DEVILS OF THE ALPINE PROJECT: FIELD MONITORING PROGRAM

Chris Coupland & Wade Anthony

Devils at Cradle – Tasmanian Devil Sanctuary, 3950 Cradle Mountain Road, Cradle Mountain, Tasmania 7306. Email: devilsatcradle@bigpond.com.

INTRODUCTION

Devil Facial Tumour Disease (DFTD) is a debilitating and fatal cancer that affects Tasmanian devils across 59% of the land mass of Tasmania and has caused the death of about 50% of devil individuals in affected areas (DPIW 2007). The disease is characterised by the development of ulcerated tumours around the jaws and head of individual devils. As the tumour grows affected devils become weakened and can become so debilitated that they starve to death within a period of months.

One theory suggests that DFTD started from a chance mutation in one individual ("the rotten apple") in the far northeast of the State in Mount William National Park. The first reported case of DFTD was witnessed by Christo Baars, a wildlife photographer working in the area in 1996. The tumours are believed to be directly transmissible between two individuals through an "allograft" or transplant of tumour cells during challenging or mating behaviour (DPIW 2007; Pearse & Swift 2006). The successful allograft may rely on a lack of genetic diversity in the devil population (Siddle *et al.* 2007). The very low heterozygosity or genetic variability among individuals within populations and variability among populations (http://ec.europa.eu/research/biosociety/library/glossarylist.en.cfm 2007) may be the result of "genetic bottlenecking" or an "island effect".

DFTD can affect all age classes of devils, however, mature age animals show the more serious gross facial and mouth tumours: these age classes having greater opportunity to have face-to-face interactions. As the age structure of affected populations change, younger devils are now showing the disease. The disease has been observed in juvenile devils, younger than two years (DPIW 2007).

Currently DFTD is not found in the western third of the State (Hawkins *et al.* 2006) and Narawntapu (formally Asbestos Ranges) National Park on the central north coast (DPIW 2007). It is believed that these areas are naturally isolated from the spread of disease because of natural vegetation, habitat and topographical boundaries preventing interaction and the spread of disease into these regions. This is further supported by recent evidence from Menna Jones (as cited in Hawkins *et al.* 2006) that the western population is a separate gene pool. The western population may also be free of DFTD due to its very low natural density, which may not facilitate the spread of the disease.

DFTD was first observed in the Cradle Mountain area in November 2004 (W. Anthony pers. comm.). Prior to January 2006, only two individuals with the condition had been

documented by Parks and Wildlife field staff at Cradle Mountain (both observed by W. Anthony). Prior to the commencement of this study, it was postulated that the population in the Cradle region may have declined by 20-30% (N. Mooney pers. comm.). To the west and north of Cradle Mountain lie boundaries of less preferred wet/rain forest. It is believed that the decrease in gene flow may provide enough genetic differentiation to limit the spread of DFTD (Hawkins *et al.* 2006).

The purpose of the *Devils of the Alpine - Field Monitoring Program (DOA-FMP)* study is to monitor the Tasmanian devil population in the Cradle Valley area and to provide a long-term surveillance tool to assess the impact of the arrival of DFTD into this population. The field techniques used are similar to those applied to other carnivore monitoring projects in remote areas of the world.

SIMILAR PROJECTS

Remote sensing cameras have been used throughout the world as a valuable tool in wildlife research and game management. Several long term projects including snow leopards, wolverines, tigers and polar bears utilise similar technology as the DOA-FMP. The equipment is relatively cheap, durable and accurate and is well suited for remote and/or alpine applications.

Remote sensing cameras are an unobtrusive mechanism that can be used to monitor elusive species such as devils. In other studies, the cameras have been used in conjunction with a trapping regime that can make devils either potentially trap shy or increase their confidence. This has potential in giving a pronounced bias to the results over a long term.

By using solely camera traps in the *DOA-FMP*, the devils very quickly become conditioned to their presence providing an accurate picture of the health and dynamics of the Cradle Mountain population.

Whilst similar surveys have been conducted at Cradle Mountain in the past, this continuous long term program is unique in that it will allow daily, ongoing and long-term monitoring supporting the possible release of captive bred animals into the wild.

DPIW and the University of Tasmania have also undertaken various spasmodic devil research programs in the Cradle Mountain Area since Menna Jones' studies in the 1990s.

DEVILS OF THE ALPINE PROJECT

Devils@Cradle, a locally owned devil sanctuary is conducting a devil research and conservation project called 'Devils of the Alpine' (DOA). With the assistance of the Cradle Mountain Parks and Wildlife Service (PWS) and Wildlife Management Branch – Devil Facial Tumour Disease Project team (of the Department of Primary Industries & Water), the field monitoring program (FMP) aims to provide a greater understanding of the current and long term population dynamics and DFTD emergence within the Cradle Mountain area.

The short term objective is to increase the number of field monitoring cameras through sponsorship, grants and donations so that we can continue to expand the scope of the study area. The scope of the study area is intended to cover from Daisy Dell through to the Black Bluff Range including the Vale of Belvoir and Reynolds Falls Conservation Areas, the commercial area of the Cradle Valley and into the Cradle Mountain National Park (approximately 75 square kilometres). We aim to present the results of the DOA-FMP results as a quarterly update on the Devils@Cradle website.

The long term objective of our program is to use the data to inform any decision regarding release of captive bred animals into suitable wild locations. Such areas will be selected on the basis of the presence of DFTD risk in the surrounding wild devil population. Released animals could be monitored through radio tracking devices and assist in the breeding diversity of low density areas in the wild.

METHODS

The Field Monitoring Program (FMP) was conducted using remote sensing, passive infra-red digital cameras. The cameras currently used are Camtrakker™ manufactured in the United States for wildlife and game monitoring purposes and are available online from www.camtrakker.com.

The camera traps were erected strategically in the study area in a zone located by observing and following the natural paths (game trails) that devils have created over many generations. These paths generally converge as the home ranges overlap and are marked by a common latrine site. A slightly open area was selected to try and limit the number of "false records" or digital images taken of moving leaves, branches, etc. A GPS reading was taken to identify the location of the camera trap.

The cameras were mounted on a 900 mm treated pine post driven 300 mm into the ground and fixed to the post using industrial rubber "bungy cords" or "ocky straps". A 600 mm square marine ply "roof" was screwed to the top of each post, providing some protection from rain and frost to the lens window (Figure 1).

To act as an attractant, "bait boxes" (Figure 1) were constructed from 500 mm lengths of 100 mm PVC plumbing pipe enclosed at both ends. A separate screw cap was used at one end and drilled through with air holes to allow the scent to escape. The bait boxes were filled with wallaby offal and dug into the ground leaving only the top exposed. These were positioned 3 m from the camera to record with the best clarity and detail a digital image of devils visiting the camera traps.

A "drag" was conducted with a carcass to scent the game trails in the general vicinity of the camera traps.

Cameras were armed using the "arming" mode on the device that separates the sensor from the camera to any movement at ground level over the bait box; this was determined using the red light installed into the unit. Cameras were set (as per the instructions) using

slide switches mounted within the protective casing of the unit to function only at night and to the most sensitive frequency of operation of one shot every 30 seconds when triggered by movement.

Figure 1. Setting camera trap 1 – Devils@Cradle 2007.
Inset 1 – Camtrakker Digital 6.0 Unit. Inset 2 – Photo taken 21st July 2006 – Devils@Cradle.

Camera traps were checked periodically during which time the memory card was changed and reset. The digital images logged in sequential order on the memory card were checked back at the Devils@Cradle facility where the images were documented and relevant information added to the data set.

During the program cameras were moved frequently between permanently set stations throughout the study area to avoid developing dependence and bias to the results by the local population on the free feeding.

A data base of all animals observed has been kept in both hard copy through a proforma (Figure 2) and electronically (JPEG format). Each individual once identified was given a number e.g. 06-001 (06 determines the year in which the animal was first identified and 001 the individual's identification code). Each digital image was stored in computer files

according to identity codes for easy access. Within each file each digital image was stored in order of date and time, providing a record of activity. The digital images were examined for signs of facial lesions suggestive of or typical of DFTD.

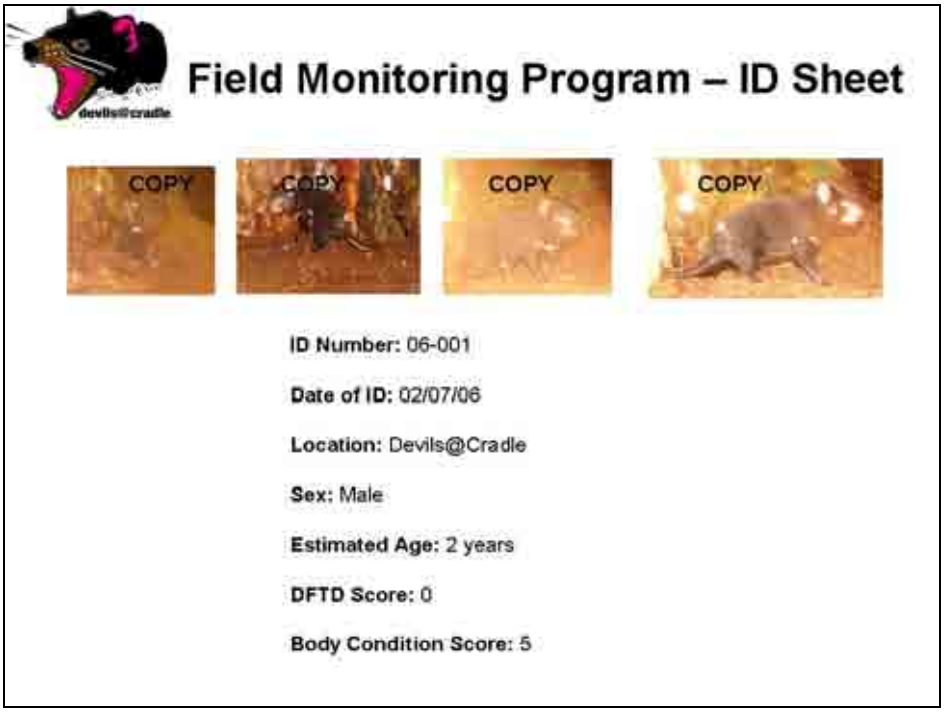

Figure 2. An example of a Completed Identification Proforma. Devils@Cradle 2006.

The documentation for the program occurred in several ways. Data gathered in the study area was formatted and recorded within a spreadsheet data base.

Accumulated totals were produced, displayed and used for interpretation at the Devils@Cradle facility. These accumulative totals for devils, spotted-tailed quolls and eastern quolls are also displayed on the Devils@Cradle website (ww.devilsatcradle.com/ devilsofthealpine.htm) and updated quarterly for public viewing. The formatted results are also forwarded onto the DPIW – DFTD Project Team for assessment and feedback.

SCOPE OF THE STUDY AREA

Tasmanian devils are a gregarious species and have already been attracted to the Devils@Cradle facility stimulated by the vocalising of the captive population. It was believed the *"Cradle View"* property offered an excellent opportunity for undertaking this

type of study as it lies near the interface between the eastern and western devil populations. Permission has been gained to utilise a large area of land both Private and Crown for the purpose of this study. Access to the surrounding Conservation areas of the Cradle Mountain National Park, Vale of Belvoir Conservation area and Reynolds Falls Recreation area has been approved by the PWS (Figure 3).

Figure 3. Satellite image of general area surrounding Devils@Cradle and various trap sites on private land on Belvoir Road.

While this report is confined to the immediate area of Cradle Mountain, the scope for this study is quite extensive. This surveillance area will allow for a comprehensive study into current numbers, their movements, habits, range, life spans and the presence of DFTD in the Cradle Mountain region.

RESULTS

Table 1 shows the accumulative results for the first 12 months of the *Devils of the Alpine – Field Monitoring Program (DOA-FMP)*. Results shown are from the 1st July 2006 to the 1st July 2007, with the time period broken into 3-month intervals. By the end of June

2007, a possible 77 individual devils had been identified within the study area; based on distinctive characteristic features, age, body size and coat colouration. There were 35 males, 34 females and 8 juveniles; the juveniles could not be confidently sexed as the sexual dimorphism was not predominant enough to be identified through the photographic method. Over the 12 month period 1758 individual photographs were taken of devils, 4 individuals showed visible facial lesions consistent with DFTD; an occurrence of 6.5% of the observed population. A previously unobserved DFTD positive animal was subsequently killed by a vehicle (Figure 4) on Belvoir Road which transects the Middlesex Station. This animal was identified as 06-028 (Figure 4).

Table 1. Summarised accumulative results for the DOA-FMP.

Devil	**# Indiv**	**# DFTD**	**% DFTD positive**	**M**	**F**	**J**	**# cameras**	**# images**	**Notes**
Jul 06 - Oct 06	26	3	11.5	16	10	0	2	696	
Nov 06 - Jan 07	38	4	10.5	18	14	8	2	1243	1 DFTD road kill
Jan07 - Mar 07	59	4	6.8	27	26	14	4	1606	
Mar 07 - May 07	67	4	6.0	30	30	7	4	1667	
May 06 - Jul 07	77	4	5.2	35	34	8	4	1758	
S-t quoll	**# Indiv**			**M**	**F**	**J**	**# cameras**	**# images**	**Notes**
Jul 06 - Oct 06	1			1	0	0	2	14	
Nov 06 - Jan 07	2			1	1	0	2	24	
Jan07 - Mar 07	5			3	2	0	4	128	
Mar 07 - May 07	6			3	2	1	4	140	1 road kill juvenile
May 06 - Jul 07	7			4	2	1	4	243	
Eastern quoll	**# Indiv**			**M**	**F**	**J**	**# cameras**	**# images**	**Notes**
Jul 06 - Oct 06	?						2	92	
Nov 06 - Jan 07	?						2	101	
Jan07 - Mar 07	?						4	101	
Mar 07 - May 07	c. 10						4	103	
May 06 - Jul 07	c. 10						4	104	

The *DOA-FMP* also produced a substantial data set on the presence of spotted-tailed quoll (*Dasyurus maculatus*) in the study area. By July 1st 2007, 7 individual quolls had been identified within the study area (4 males, 2 females and 1 juvenile) with 243 images taken of the 7 individuals. One individual juvenile was killed by a vehicle also on Cradle Mountain Road within the study area.

Figure 4. Adult Tasmanian devil with a large DFTD lesion killed by vehicle within study area January 07. Devils@Cradle 2007.

Approximately 10 eastern quolls (*Dasyurus viverrinus*) individuals are shown in Table 1. Due to the difficulties in identification, the number of individual eastern quolls in the study area was not accurately determined as for the other large dasyurids. One hundred and four photographs were taken within the 12 month study period: neither the spotted-tailed quolls nor eastern quolls within this study showed any signs of DFTD lesions.

Table 1 shows the number of digital images taken and number of individual devil's identified throughout the study period. The rate of identification of new individuals throughout the study period was most rapid at the start of the study and declined over the second 6 months.

Despite the increase in the number of individual devils identified in the study area, the number observed with DFTD facial lesions did not increase (Figure 5). As a proportion of the devil population attracted to the camera traps, the number of DFTD-affected devils – as assessed by camera images – actually decreased over the 12-month period (Figure 5). Individual devils 06-17, 06-18 and 06-22 (Figure 6) were positively identified on numerous occasions throughout the study period until January 2007. Devil 06-17 was first

identified at 1.00 am on the 3rd August 06 and was last seen at 12:12 am on the 1st of September. Individual 06-18 (Figures 6 and 9) was first observed 13th August 2006 at 1:03 am and last observed 18th November 2006 at 11:40 pm. Individual 06-22 was observed on the 30th August 2006 at 10:26 am for the first time and was last observed 13th November 2006. After January 2007, with the observation of the road kill devil identified through the *DOA-FMP* study (06-028), no new DFTD-affected individuals were recorded within the study area.

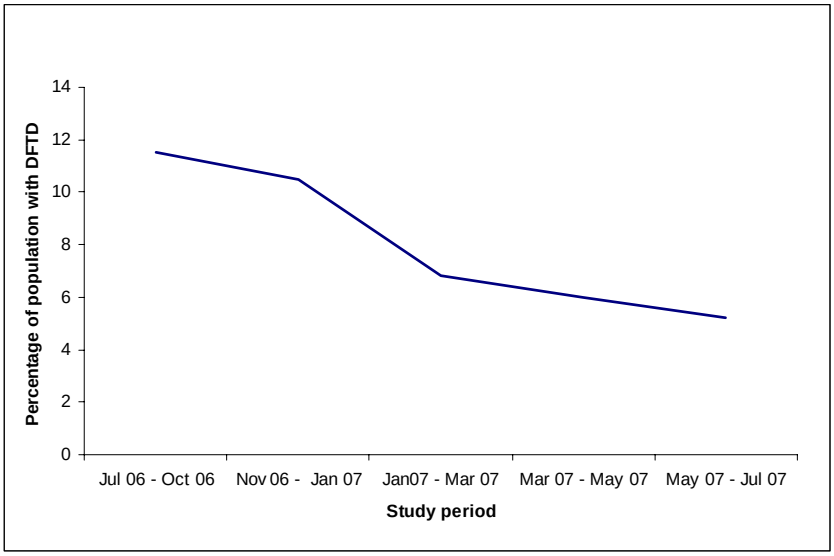

Figure 5. Occurrence of DFTD within the observed population.

Figure 6. The four individuals recorded by the DOA-FMP with DFTD.

Of the 1758 digital images taken of 77 individual devils; Figure 7 shows the only recorded contact between two devils (06-22 is identified as the individual on the right).

Figure 7. Only digital image showing close contact between devils: the devil on the right is 06-22, the last individual identified in the study area with DFTD facial lesions [17/10/2006 at 2:54 am].

Figure 8 represents the recorded number of males, females and juvenile devils within the study period. No juveniles were observed in the first study interval. An overall sex ratio of 1.03 males for every female was calculated. Figure 8 also shows the ratio of male, female and juvenile spotted-tailed quoll identified in the study area. There were twice the numbers of male quolls identified within the study area as females.

Figure 9 shows devil 06-18 and the progression of DFTD in that individual. One hundred and ninety six digital images have been taken of individual 06-18 on three separate occasions (13th August, 14th August, and 18th November 2006); a male estimated to be 4 years of age. When first observed in August this animal appeared to have a large ulcerated tumour developing on right side of his face (the image alone was not sufficient to definitively diagnose DFTD). When this devil was photographed again on the 18th November 2006 the tumour appeared to have expanded from the cheek and whisker beds of the right hand side of the face across to involve the left and the neck; a massive increase in the observed development of the tumour in 3 months. No further images of 06-18 were taken after 18th November 2006.

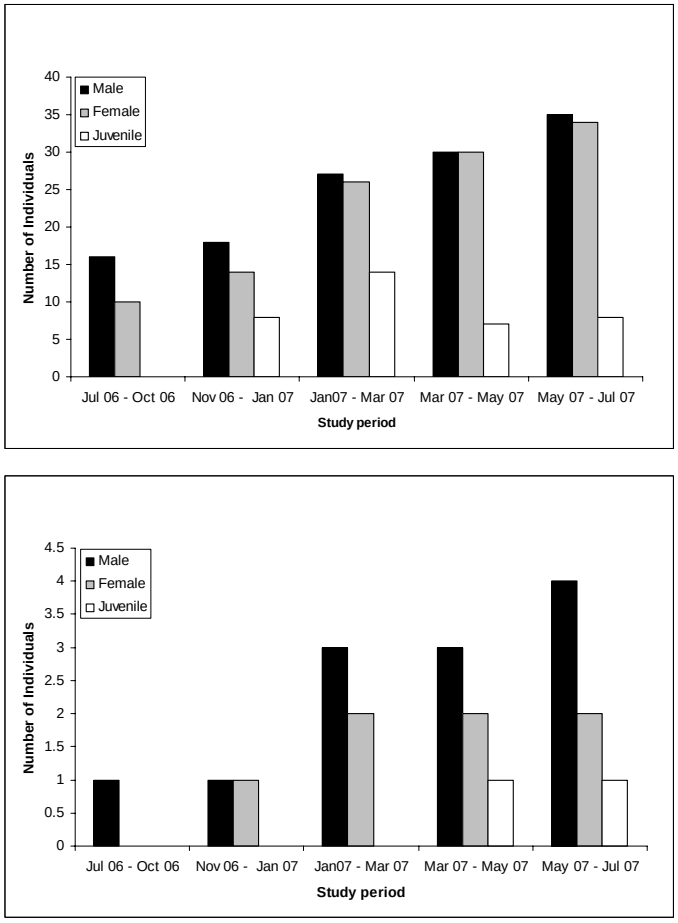

Figure 8. Sex ratio of Tasmanian devils (top) identified within the Cradle Mountain region and the sex ratio of spotted-tailed quolls (bottom) in the Cradle Mountain population.

DISCUSSION

The Department of Primary Industry and Water records indicate that in excess of 2000 devils were trapped from 1964 to 1995 and there is no record of DFTD-like lesions in any animal in that time frame (DPIW 2007). Both of these findings suggest that DFTD has only recently emerged within the Tasmanian devil population. There is currently no recorded evidence of immunity or resistance known to the disease in any of the study sites where the disease is present (Hawkins *et al.* 2006).

Figure 9. Progression of DFTD in devil 06-18.

In 1990 Menna Jones as cited in Hawkins *et al.* (2006) trapped and examined 126 individual devils within the Cradle Mountain area and found no record of DFTD. Furthermore, *The Cradle Mountain Lodge*™ and other commercial operations have been conducting spotlighting tours and wildlife based tours for approximately ten years. Despite the considerable publicity surrounding DFTD, the first case was only observed in the Cradle Mountain area in November 2004 (W. Anthony pers. comm.).

Popular public opinion suggests that DFTD is caused or facilitated by the use of certain chemicals and human induced land management. DFTD appears to be a transmissible disease with diseased devils detected in national parks, the World Heritage Area, agricultural and forestry areas. The known disease-free areas currently appear in the western areas of the State (Hawkins *et al.* 2006).

West of Cradle Mountain, the environment changes rapidly to different ecosystems. Large stretches of wet/rain forest are present, which is the least preferred habitat of the species. It was hoped that this rapid change in habitat type from east to west may prevent gene flow and interaction between eastern and western devils. This is supported by results from

a number of studies cited in Hawkins *et al.* (2006) that there are two distinct genetic groups and if transmission occurs through physical contact this differentiation may act to slow the transmission or make the western population genetically immune to the disease (Hawkins *et al.* 2006).

It is believed by DPIW that DFTD has now been identified 25 km west of Cradle Mountain and its detection in the *DOA-FMP* study site in the Pencil Pine region (W. Anthony pers. comm.) indicates its emergence in a lower density devil population (Figure 10).

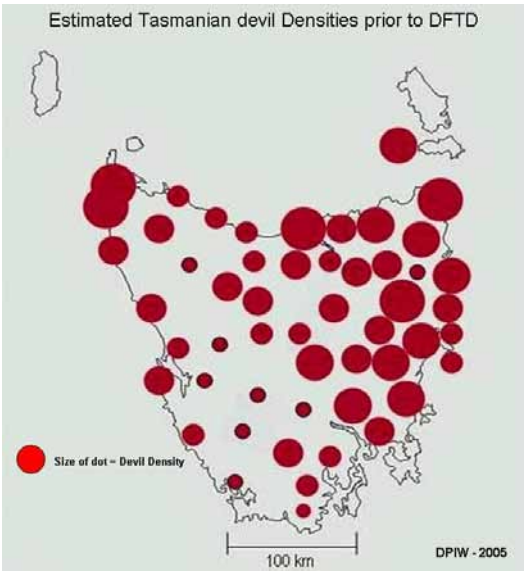

Figure 10. Tasmanian devil density prior to Devil Facial Tumour Disease – (DPIW 2005).

Results presented in the current paper support some of those presented in Hawkins *et al.* (2006). DPIW devil field research suggests that DFTD lesions are usually observable in individual devils within six months of the disease being first detected within a population (Hawkins *et al.* 2006). Hamade (2004, cited in Hawkins *et al.* (2006)) postulates "Where tumour growth varies little between individuals if there is a peak in transmission. This could occur if biting is the key transmission route, since it is more common in the mating season. All animals infected the previous year might have died by June, with newly infected animal's not yet manifesting signs".

The *DOA-FMP* has attempted to identify all devils resident in the study area. The apparent absence of any increase in the number of DFTD-affected individuals after the first DFTD affected devil was recorded in the area (November 2004) is particularly

noteworthy. The low number of DFTD affected devils seen in the study site in a 12 month period may indicate a change in the resident devils' capacity to resist this tumour establishing in the Cradle Mountain area. Another explanation for the low number of observed DFTD-affected devils in this population, somewhat borne out by this devil dataset, may be attributed to reduced devil-to-devil contact. Most of our results support those made by Hamede 2004 (as cited in Hawkins *et al.* 2006) that the greatest rate of disease attrition will be by June, our results show that the lowest recorded rate of DFTD observation was in June 2007. Devil 06-18 contradicts other findings in the study (Figure 10; this animal was first observed with DFTD lesions in August and was later observed in November 2006 with obvious progression and expansion of the tumour. With no further observations of this individual, it is likely the animal died well before June 2007. An average rate of decline identified in the DPIW studies as a result of DFTD is 50%. (DPIW 2007; Hawkins *et al.* 2006).

Cradle Mountain was an area where DFTD was late to emerge (Hawkins *et al.* 2006); the first observation of DFTD in the area was made in late 2004 (W. Anthony pers. comm.; Hawkins *et al.* 2006). This study observed a maximum occurrence of obviously affected devils of 13.1%; considerably lower than the 20-30% rate expected. Devils@Cradle plans to continue the *DOA-FMP* long term. Although there are limitations on the ability of camera images to detect all animals with facial tumours, if the current trends reported in this paper continue, then it may be the first indication of some genetic resistance within a local devil population.

It is currently unclear whether the transmission of DFTD is density-dependent. Disease reports are confined to populations considered higher density. In the north-east where the disease is active local devil populations have declined by 75-80% the recorded occurrence of DFTD remains high (Hawkins *et al.* 2006), much greater than the recorded occurrence in the Cradle Mountain region. The Cradle Mountain population appears, from our study (figure 10) to be a medium-density population, which may explain the lower than expected occurrence of DFTD-affected animals.

Hawkins *et al.* (2006) suggests that even a casual observer at a distance of 20 m would be able to detect more than a third of the cases (of DFTD) that a trained researcher would "visually diagnose".

The Camtrakker system provides high resolution images sufficient for the diagnosis of DFTD. Two of the cases of DFTD determined by this study were sent to the DPIW for confirmation. The Camtrakker units are designed for larger mammals such as deer. The passive infra red sensor is designed to detect body heat in motion. Initially we had to experiment with the positioning, height of the camera above the ground to increase sensitivity of the sensor. Despite these adjustments on occasions the cameras were observed not to fire despite and animal in the correct range. Consequently the images obtained may not reflect the full extent of dasyurid activity at the camera trap sites.

One battery unit malfunctioned, and failed to reach and maintain full charge for a period during the study. The result of this malfunction was that the unit still functioned but was far less sensitive than a working unit; a new battery was sent from the US. Having this camera partially inactive may have affected image resolution and interpretation during the period of January to March 2007.

Despite been unobtrusive passive infra-red cameras, there is some evidence that the animals became increasingly trap shy. One expects in all studies to have a greatest rate of detection and identification at the beginning of the study. With eastern quolls we ceased obtaining images quite early in the period of the study. We chose not to utilise carrion frequently as part of this study in order to minimise the development of dependence, risk of spread of DFTD through the devil population at a greater rate than natural, thus biasing the study and putting the population in the region at risk. By simply using a bait box as an attractant it appears that the eastern quolls "learned" that there is little gain to be had and move on quickly. Through the second year of study we will look at using carcasses more frequently, on a random basis to maintain animal activity around the bait stations.

To date there is no evidence of population recovery at any DFTD-affected location and reports of DFTD now cover more than half the extent of the occurrence of the devil's known range. Field studies across the state suggest the disease is spreading westwards and southwards (Hawkins *et al.* 2006).

The *Devils of the Alpine – Field Monitoring Program* has only been in operation for 12 months and provides a baseline for the current population. The program will be in a unique position to monitor the impact of DFTD on the devils in the Cradle Mountain region. If the current trends continue then the *DOA-FMP* will be able to record any differences in the response of a devil population in a region close to the interface between eastern and western devils cohorts. Hopefully the *DOA-FMP* will be in a position to detect any evidence of innate resistance to DFTD present in the population.

As we prepared this paper we collected another 3 months worth of data and have still not observed another DFTD positive animal. If there is a reduction in density of devils within the Cradle Mountain region, it will be important to keep track of the prevalence of introduced predators. Anecdotally (W. Anthony pers. comm.) the presence of feral cats (*Felis catus*) is on the increase within both the private land and areas protected for biodiversity conservation areas (W. Anthony, pers. comm.). Parks and Wildlife is also trying to counteract the presence of at least one dog pack within the general Cradle Mountain /Walls of Jerusalem Area (W. Anthony pers. comm.; *The Advocate*, 16th August 2006, page 3). The presence of the *Devils of the Alpine* passive infra-red camera systems has not yet detected any indication of either introduced species within the study area.

The red fox (*Vulpes vulpes*) is a massive threat to the fauna of Tasmania. Currently there is a co-ordinated effort to eradicate the individuals that are thought to be free living within the State (DPIW 2007). The DPIW has hard evidence to indicate the presence of a small

number of red fox within the State (DPIW 2007). As devils decline one would expect such oppurtunistic species such as fox to expand their range and potentially move into a number of areas that are less densely populated. The *DOA-FMP* has not detected any fox activity within the study area.

Quolls and devils have overlapping ranges. Spotted-tailed quolls are far more territorial than devils and therefore one would expect less overlap of their ranges and therefore fewer individuals identified within the study area. Currently we have identified 7 spotted-tail quoll individuals and approximately 10 eastern quoll individuals within the study area.

No sign of lesions on individuals of either species of quoll have been observed. The current research (reviewed in Hawkins *et al.* 2006) suggests that the actual disease source of DFTD is the tumour cell. Live cells are transferred from an affected devil to another through biting. This has been termed an 'allograft' infection (i.e. a graft between two individuals who are of the same species but have genetic differences www.choa.org/default.aspx 2007), however, it is now apparent that the close genetic relationship between all eastern devils is allowing these tumour cells to be acting more like homografts (i.e. a graft from an genetically identical animal) (Siddle *et al.* 2007). It is unlikely due to the genetic differentiation between the *Sarcophilus* genus, which contains the only the devil and the *Dasyurus* genus, which contains both species of quolls that tumour cells of DFTD will act as a xenograft (i.e. tissues or cells that can successfully transfer from one species to another species (www.convatec.com/en_AU/tips/dictionary/wound_care.htm 2007).

Currently we have noted the presence of what appears to be a healthy population of spotted-tailed quolls and as the study period continued we have identified more individuals. It is unusual that we have identified far more males than females, but it may indicate that we are on the edge of at least four animal's territories. Eastern quolls on the other hand have reduced in the frequency over the observation period. Currently we believe this is due to trap shyness or an indicator of their natural range or congregations in suitable habitat rather than a decline in population. From Wade Anthony's personal experience living and working in the Cradle Mountain region for the last six years, eastern quolls are not generally observed in the winter months and the frequency of observation increases over the summer months. There is currently no concern for the eastern quoll population in the region. An observable increase in spotted-tailed quoll numbers may indicate a decline in devils. If devils do decline it appears from anecdotal evidence that there may be an increase in quoll numbers as they either expand their range or increase in numbers to fill the vacant niche. It is currently arguable, within the observed devil population, a true decline has not been observed. We may have observed the normal dynamics, seasonality and rates of attrition that is natural for the area and species.

ACKNOWLEDGEMENTS

The authors would like to thank the ongoing support of the Parks and Wildlife Service – Cradle Mountain, the Cradle Mountain Tourism Association, Inc. and the DPIW –

Wildlife Management Branch; the numerous and generous public donations received that financially support the Devils of the Alpine – Field Monitoring Program; the staff at Devils@Cradle Tasmanian devil sanctuary for their support and commitment; John Wright for permission to incorporate his private property into the study area; and Dr David Obendorf for his advice, helpful suggestions and his valuable time taken to review this study.

REFERENCES

Department of Primary Industries & Water (DPIW) (2007). www.tassiedevil.com.au.

Hawkins, C.E., Baars, C., Hesterman, H., Hocking, G.J., Jones, M.E., Lazenby, B.,Mann, D., Mooney, N., Pemberton, D., Pyecroft, S., Restani, M. & Wiersma, J. (2006). Emerging disease and population decline of an island endemic, the Tasmanian devil *Sarcophilus harrisii*. *Biological Conservation* 131(2): 307-324.

Pearse, A.M. & Swift, K. (2006). Transmission of devil facial tumour disease. *Nature* 439: 549.

Siddle, H. V., Kriess, A., Eldridge, M.D.B., Noonan, E., Clarke, C.J., Pyecroft, S., Woods, G.M. & Belov, K. (2007). Transmission of a fatal clonal tumour by biting occurs due to depleted MHC diversity in a threatened carnivorous marsupial. *Proceedings of the National Academy of Science* 104(41): 16221-16226.