

# Urban Dingoes (*Canis lupus dingo* and Hybrids) and Human Hydatid Disease (*Echinococcus granulosus*) in Queensland, Australia

Ben Allen

The School of Animal Studies, The University of Queensland, Gatton Campus, Queensland, Australia

**ABSTRACT:** Urban dingoes are known to occur along most of the Australian eastern seaboard but are particularly common in Queensland coastal cities and towns. Urban dingoes cause significant damage to domestic pets and livestock and present four serious threats to human health and safety: attacks on humans, attacks on domestic animals, zoonotic disease transmission to humans, and the psychological and emotional trauma to affected residents. I have begun to monitor urban dingoes in three metropolitan and regional Queensland coastal cities using GPS datalogging collars to determine habitat use by dingoes in urban communities, assess their reliance on bushland areas, and evaluate their potential role in the epidemiology of zoonotic diseases, including human hydatid disease (caused by the parasitic tapeworm *Echinococcus granulosus*). Similar to urban predators on other continents (e.g., red foxes and coyotes), I found urban dingoes to have smaller home ranges than their rural counterparts, exhibit flexible habitat requirements in a resource-rich urban environment, and potentially have a pivotal role in the transmission of *E. granulosus* to humans in built-up areas. Some challenges of urban predator and zoonotic disease management are discussed.

**KEY WORDS:** *Canis lupus dingo*, dingo, disease, *Echinococcus granulosus*, hydatid disease, urban, zoonosis

Proc. 22<sup>nd</sup> Vertebr. Pest Conf. (R. M. Timm and J. M. O'Brien, Eds.)  
Published at Univ. of Calif., Davis. 2006. Pp. 334-338.

## INTRODUCTION

Dingoes (*Canis lupus dingo*) in Australia traditionally have been viewed as a cause of livestock predation problems in rural areas. However, in recent years dingoes have emerged as a human health and safety issue in residential communities. The common occurrence of both pure and hybrid dingoes in many urban areas is largely unknown to most people; consequently, urban dingo ecology is a new and emerging field in Australia.

Urban dingoes present many risks to human health and safety and cause significant, yet often difficult to quantify, economic impacts (Rural Management Partners 2004). Four potential threats to public health in urban areas can be gleaned from the Rural Management Partners (2004) report; these are:

- 1) Direct attack on people, especially children, resulting in injury or death;
- 2) Direct attack on companion animals and/or domestic livestock, resulting in injury or death;
- 3) A potential source of zoonotic disease infection, especially hydatid tapeworms, through contamination of school grounds, municipal parks, and bushland reserves by dingo feces containing hydatid eggs; and
- 4) Psychological and emotional trauma to affected residents caused by the loss of domestic animals and public amenity, or caused by the fear of dingo attacks on people or pets, and the financial loss to people relocating due to fear of dingoes.

The frequency of these events has increased in the last decade across coastal Queensland (Rural Management Partners 2004), but no studies have as yet been conducted to determine exactly why. It is potentially attributable to the historical changes in available control practices for dingoes and other wild dogs in coastal Queensland. In 1996, new guidelines for the use of 1080 baits in semi-urban areas of Queensland increased the minimum buffer

area for the distribution of baits from 1 km to 2 km away from any human dwelling (NRM 2006). This effectively prevents the use of 1080 baiting in urban areas. Also, new national firearms legislation introduced in 1997 dramatically reduced the opportunities for many landholders to legally shoot dingoes on their properties (ACT JCS 2001, Baker and McPhedran 2004). In addition to these changes, much of the urban and semi-urban bushland previously managed as "Forestry Reserve" has been converted to "National Park" in an ongoing process over the last several years. While it has not been thoroughly investigated, it is likely that with the change in management regimes came a reduced effort in controlling dingoes and other wild dogs on large tracts of urban bushland. These changes combined with the rapid expansion of human occupation of coastal fringe areas to greatly increase the frequency of reported urban dingo problems.

While agencies responsible for vertebrate pests aim to reduce these threats, the management of urban dingoes is complicated by the uncertain and changing legislative and taxonomic status between states, and by the often uninformed views of outspoken local residents. It is also complicated by a general lack of knowledge of urban dingo ecology (density, origin, foraging, movements and spatial use), parasite burden, social behavior, and the lack of efficient or permitted control methods to capture or destroy dingoes in urban areas. Identifying resources critical for sustaining dingo populations and their diseases in urban areas is essential for effective management. The crucial need for basic research on urban dingoes is apparent when many Queensland coastal shire and city councils already invest considerable funds controlling dingoes and vainly seek advice from the literature and government pest management agencies.

It is assumed by most managers that urban dingoes maintain large home ranges and use urban areas to exploit

food resources at night, while sheltering in critical bushland areas by day. Also, because of the daily reports of negative and/or aggressive human-dingo interactions received by various shire and city councils, the disease potential of urban dingoes is often overlooked. One earlier study has shown urban dingoes in north Queensland to carry multiple zoonotic diseases; this study concluded that of all the zoonotic parasites and pathogens identified in the survey, *Echinococcus granulosus* was “the most important [parasite] from the point of view of public health” (Brown and Copeman 2003:1). Hydatid-positive dingoes and wild dogs have been identified in south-east Queensland before (Baldock *et al.* 1985), and where such infected animals and humans come in contact (including urban areas), the risk of infection can increase (Chrieki 2002, Jenkins and MacPherson 2003). So, while dingoes contribute to many human health and safety risks in urban communities, further baseline information is required to better understand their ecology in these areas, in an effort to efficiently manage the risks associated with their presence.

The purpose of this research is to undertake a preliminary study of the spatial ecology and disease potential of urban dingoes in three affected shires in coastal Queensland. Besides the above, no other studies have been conducted on urban dingoes in Queensland; hence this project represents one of the initial studies of urban dingoes in Australia.

The specific aims of this project are to:

- 1) Determine the home range, habitat use, and fine-scale movement patterns of dingoes in urban areas;
- 2) Assess their reliance on natural bushland fragments for critical refuge; and
- 3) Evaluate their potential role in the transmission of zoonotic diseases, notably *Echinococcus granulosus*.

At present, this project is currently in progress and the observations and results discussed in this paper are preliminary findings only. No major or complex analysis is presented here, nor has been attempted as yet.

## METHODS

### Study Areas

Three coastal Queensland cities— Townsville City, located in northern Queensland, and Maroochy Shire and Pine Rivers Shire, both located in south-east Queensland (Figure 1)— were selected because of their chronic issues with urban dingoes. The two south-east Queensland shires form part of the greater Brisbane area. Maroochy Shire is coastal lowland with a warm-to-hot, humid climate. The area has diverse habitats, but the majority of non-urban areas contain fragments of tall Eucalypt forest, riparian rainforest, or cultivated farms dominated by sugar cane production. (To date, research has only been conducted in Maroochy Shire. For this reason, all methods, results, and discussion will omit information from the other two study sites.)

### GPS and VHF Tracking

To date, 6 dingoes of various ages (3 female, 3 male) have been captured using soft-catch “Jake” traps. All appeared to be in healthy condition. All dingoes were

also caught within 200 m of residential homes and were fitted with GPS/VHF datalogging collars with automatic release units manufactured by Sirtrack, New Zealand. Each collar weighed approximately 470 g— less than 5% of the bodyweight of the smallest dingo used in this study so far, and collars remained on the animals for approximately 4 weeks. Of the 6 animals studied to date, only 5 collars have been retrieved, the other still being on a dingo at present.

The GPS dataloggers were programmed to record locations hourly throughout the day (0900 to 1700 hrs) and each 5 minutes from dusk until dawn (1700 to 0900), with a programmed potential to yield 200 locations per day. At this programmed “duty cycle”, battery life was limited to approximately 24 days, or ~4,000 successful GPS locations. Day is here defined as 0900 to 1700; dusk as 1700 to 2100; night as 2100 to 0500; and dawn as 0500 to 0900. All locations presented in this paper have been retrieved from the GPS dataloggers, and VHF was used only occasionally to locate the animal and to recover the collar once it had fallen off the animal.

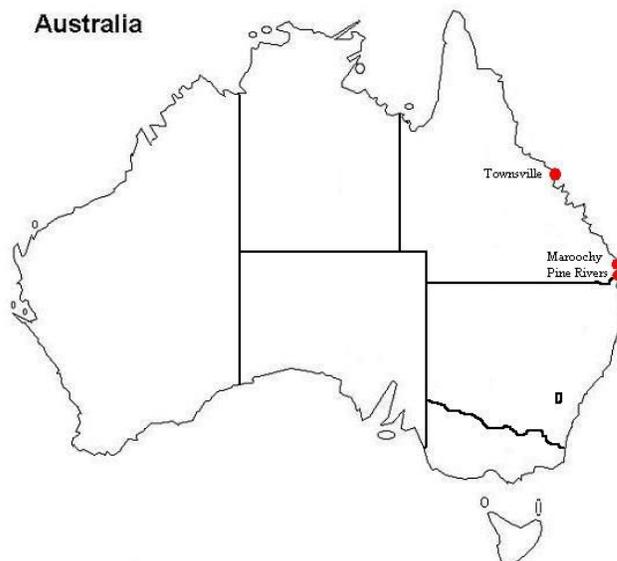


Figure 1. The three shires in Queensland, Australia where the project is being conducted.

### Disease Monitoring

For each dingo used in the study, a hair and fecal sample was taken at capture, as well as 6-10 ml of blood, from which serum was extracted and stored for future testing. Animals were searched for external parasites, specifically ticks, fleas, and mange (*Sarcoptes scabiei*). Laboratory tests for multiple diseases, parasites, and pathogens will be performed at a future date.

### Data Analysis

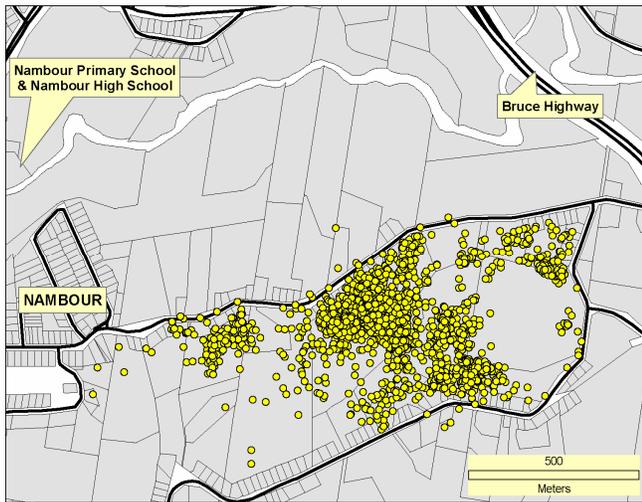
While this paper reports only initial observations from a current study in progress, some spatial analysis has been performed using ArcGIS Desktop v9.1 (ESRI, Redlands, CA, USA). This software provides clear comparisons and interpretation of large and complex spatial datasets (such as those obtained from tracking the fine-scale movements of wildlife with GPS, or other XY type data)

with the input of reliable digital cadastral maps and georeferenced aerial photography and other habitat information. Collar data were imported into ArcGIS Desktop v9.1 and were analyzed and projected using GDA 1994 MGA Zone 56 and the Geocentric Datum of Australia 1994. Using this software, GPS locations retrieved from the collars have been overlaid on Digital Cadastral Databases (DCDB) and aerial photography provided by both state and local government agencies. Aerial imagery was captured during September 2005 (1 month prior to the beginning of the study), and DCDB information is current and is regularly maintained by local government agencies. No major differences between current habitat and photo-captured habitat were discernable.

## RESULTS AND DISCUSSION

### GPS and VHF Tracking

Of the potential 200 locations per day recorded by the GPS collar, the mean number of successful locations was 171 (or 85.5%) of attempted locations per day. A brief analysis of the locations suggested that dense vegetation was the cause for not achieving the 200 potential locations. Each collar performed exceptionally well and no 'equipment failure' was experienced. Approximately 3,600–4,000 locations were recorded for each animal in 22–24 days. The results for one dingo are discussed below (Figure 2), which is representative of what was found for all the collared dingoes so far.



**Figure 2.** The movements of one urban dingo near Nambour, Queensland in January 2006. Each dot represents a GPS point taken at 5-min intervals ( $n = 3,409$ ) and was obtained from a datalogging collar fitted to the animal.

All collars were retrieved less than 700 m from where the dingo was captured, and results show that animals had been caught toward the centre of their home range rather than its boundary. However, differentiating between the "centre" and "boundary" is difficult, given that the home range sizes for each animal were very small, between 0.8 km<sup>2</sup> and 8.1 km<sup>2</sup>. Also, urban dingoes did not appear to

avoid the sites where they were captured, and one collared dingo was seen on many subsequent occasions with several other pack members revisiting the trap site where it was caught.

These preliminary results indicate that the home range sizes of urban dingoes are much smaller than their rural counterparts, which have been recorded at 44.5 km<sup>2</sup> to 113.2 km<sup>2</sup> (Thomson 1992, Corbett 1995). This suggests that where resourceful habitats are found (and most habitats in urban areas appear resourceful), the density of urban dingo populations may be very high. For example, in the smallest home range recorded for one dingo, at least 8 other individuals were sighted together, and a total of 16 individuals were captured in the same location over 11 weeks. This site was approximately 1.5 km from the centre of town, in a small bushland fragment that is almost completely surrounded by houses (Figure 2). Urban dingoes were commonly located within close proximity of school grounds, picnic areas, beaches, golf courses, and other public areas. Urban dingoes were also commonly located in back yards, nature strips, corridors, and forested fragments. At almost all times, urban dingoes were within <500 m from houses and regularly spent a considerable amount of time within 100 m of houses.

There also appears little difference between day, dawn, night, and dusk habitat use and activity patterns, as animals appear not to forage and seek refuge in separate places. Despite this, core areas are easily identifiable. However, it may not be that 'core areas' are habitats frequently visited, but rather that those other areas outside 'core areas' are habitats intentionally avoided. For example, the locations identified for the dingo in Figure 2 clearly show an unused space where locations were not recorded. This space was later determined to be a large and open manicured lawn— a "habitat" where one would expect dingoes to spend little time.

While all home ranges contained some bushland areas, 4 of the 5 dingoes spent most of their time outside of these areas. This result is not expected to be an artifact of compromised GPS capability in dense areas, because the one dingo that did have a core area in a bushland area was in an extremely dense, tall rainforest— much thicker than the vegetation within any of the other 4 home ranges. The habitats utilized as core areas by 4 of the 5 dingoes were either sugar cane fields or tall grass, even when a variety of other habitats were available. Because of the extent of sugar cane and tall grass mixed within a matrix of suburbs and development, the potential for human-dingo interactions in urban areas is very high. For all 5 dingoes, a dense understory refuge appeared the most critical habitat in core areas.

Urban dingoes can clearly survive, and indeed thrive, in areas with little natural bushland. Disturbed areas (e.g., agricultural cropping or grassy areas) also clearly provide resourceful habitats for urban dingo populations. While a dense understory appears to be critical to maintaining urban dingo populations, based on personal observations, it is likely that the selection of these habitats is due to their abundant prey availability, and not solely the vegetation density of the understory.

## Disease Information

No disease tests have, as yet, been completed on the few samples that have been obtained during the study. Ticks (*Ixodes* sp.) were found on all animals, but fleas and mange have not yet been found. A concurrent survey of the incidence and burden of *E. granulosus* in dingoes in south-east Queensland has found hydatid infections in 40% of dingoes, with burdens of up to 86,500 adult worms (D. Jenkins, pers. commun.). Animals infected with such heavy burdens of *E. granulosus* should be of serious concern in regard to human health in urban areas (Jenkins and Morris 1991). The animals being tested in that study were obtained from routine culling operations by shire council officers, and they were caught at the same sites as collared individuals in this study. This strongly suggests that the known hydatid-positive individuals tested in the concurrent project were associates of the collared animals used in this project. Rural dingo populations in eastern Australia can have up to 100% prevalence of hydatids, which requires the maintenance of regular predator-prey interaction between canids and viable intermediate hosts (Jenkins 2006). Therefore, the lower, but still serious, incidence of hydatids in urban dingoes is probably more reflective of their diet than their susceptibility to infection.

Other urban canids, such as foxes (*Vulpes vulpes*) and feral domestic dogs (*Canis familiaris*), can also become infected with *E. granulosus* (Jenkins and Craig 1992, Fleming *et al.* 2001). However, for a canid to become infected, and therefore potentially infectious, the canid needs to regularly ingest viable cyst material from an intermediate host such as a sheep or a kangaroo (Thompson and Lymbery 1995, Jenkins 2006). The prevalence of hydatid cysts in intermediate hosts in urban areas of south-east Queensland has not been investigated. Therefore, foxes and free-roaming domestic dogs would require a regular diet of viable cyst material from infected intermediate hosts to become major reservoirs of *E. granulosus* in urban areas. This is unlikely, given that there are ample alternative foods for canids in urban areas, and the knowledge that foxes and domestic dog populations have low incidences of hydatids to begin with (Baldock *et al.* 1985, Jenkins and Craig 1992).

**Table 1. Diseases and parasites of concern to managers of urban dingo populations.**

Common Name	Causative Agent
Roundworms	<i>Capillaria</i> sp.
Hookworms	<i>Ancylostoma caninum</i>
Tapeworms	<i>Echinococcus granulosus</i> , <i>Spirometra</i> sp.
Leptospirosis	<i>Leptospira interrogans</i>
Cryptosporidium	<i>Cryptosporium</i> sp.
Salmonella	<i>Salmonella</i> spp.
Campylobacter	<i>Campylobacter</i> sp.
Coccidia	<i>Isospora</i> sp.
Giardia	<i>Giardia</i> sp.
Lyme Disease	<i>Borellia burgdorferi</i>
Lyssavirus	(A rabies strain)
Parvovirus	Canine parvovirus type 2
Canine distemper	<i>Morbillivirus</i> sp.
<i>Neospora caninum</i>	<i>Neospora caninum</i>

The diet of urban dingoes, foxes, and free-roaming domestic dogs has not been investigated, but it may be that urban dingoes consume more macropods than other urban canids, and this may be the reason for the lower incidence of hydatids in urban foxes and domestic dogs. The knowledge of urban canid diets and the transmission of *E. granulosus* in urban areas are very limited, and these topics need further attention to better understand and quantify the risks. While hydatids remain one of the most important dingo related zoonoses in urban areas, other canid-borne diseases are also of concern; these are included in Table 1.

It is not known whether all of these diseases and parasites are common or even present in urban dingo populations in Queensland, but testing for these should become an integral part of dingo disease surveillance in the future. While not all the above diseases and parasites (in Table 1) are zoonotic, a high incidence or burden of them in urban dingo populations would be hazardous to humans or their pets living in affected urban areas.

## CONCLUSION

Urban dingoes are common in many residential communities on Australia's eastern seaboard, particularly Queensland. Urban dingoes are known to carry multiple zoonotic diseases (including *E. granulosus*) and occupy small home ranges in built-up areas containing a high level of disturbed environments. Urban dingoes are known to commonly attack pets and domestic livestock and to often act aggressively towards humans of all ages. Dingoes living in close association with humans have attacked people before. These preliminary findings indicate that dingoes are in high population densities in urban areas, at least in south-east Queensland, and can carry heavy burdens of some serious zoonotic diseases. As a result, urban dingo populations can contribute to an elevated risk to human health and safety to a greater degree than in rural areas. The ecology of urban dingoes should be a priority for future research by agencies responsible for human health and vertebrate pest management.

## ACKNOWLEDGEMENTS

I express sincere thanks to Maroochy Shire Council, Pine Rivers Shire Council, Townsville City Council, and the Queensland National Parks and Wildlife Service for allowing unlimited access and flexibility to all areas during this ongoing study. I also appreciate the contribution of Dr. Lee Allen (Queensland Department of Natural Resources and Mines), Dr. Dave Jenkins (Hydatid Control Campaign), and Dr. Luke Leung (The University of Queensland) for their enduring advice on the project. Finally, I am indebted to Mark Goulet from FeralsOut for his tireless trapping efforts and expertise in assisting this project, which would not be possible without the generous funding from the Queensland Health Department and Maroochy Shire Council. This project was conducted under approval from the Queensland Department of Natural Resources, Mines, and Water's Animal Ethics Committee (approval number PAEC 050504).

## LITERATURE CITED

ACT JCS. 2001. Review of the Firearms Act (1996). Australian Capital Territory Department of Justice and Community Safety, Canberra, Australia.

- BAKER J., AND S. MCPHEDRAN. 2004. Inside or outside the law? Tightening legislation and the principles of firearm ownership. *In: Proceedings of the symposium Crime in Australia: International Connections*, 29-30 November, Melbourne. Australian Institute of Criminology. <http://www.aic.gov.au/conferences/2004/baker.html>.
- BALDOCK, F. C., R. C. A. THOMPSON, L. M. KUMARATILAKE, AND J. SHIELD. 1985. *Echinococcus granulosus* in farm dogs and dingoes in south eastern Queensland. *Austral. Vet. J.* 62:335-337.
- BROWN, B., AND D. B. COPEMAN. 2003. Zoonotic importance of parasites in wild dogs caught in the vicinity of Townsville. *Austral. Vet. J.* 81(11):700-702.
- CHRIEKI, M. 2002. Echinococcosis - an emerging parasite in the immigrant population. *Amer. Fam. Physician* 66(5): 817-820.
- CORBETT, L. K. 1995. *The Dingo in Australia and Asia*. The University of New South Wales Press, Sydney, Australia. 200 pp.
- FLEMING, P., L. CORBETT, R. HARDEN, AND P. THOMSON. 2001. *Managing the Impacts of Dingoes and Other Wild Dogs*. Bureau of Rural Sciences, Canberra, Australia. 186 pp.
- JENKINS, D. J. 2006. *Echinococcus granulosus* in Australia, widespread and doing well! *Parasitol. Int.* 55:S203-S206.
- JENKINS D. J., AND N. A. CRAIG. 1992. The role of foxes *Vulpes vulpes* in the epidemiology of *Echinococcus granulosus* in urban environments. *The Med. J. Austral.* 157:754-756.
- JENKINS D. J., AND C. N. L. MACPHERSON. 2003. Transmission ecology of *Echinococcus* in wild-life in Australia and Africa. *Parasitol.* 127(Suppl.):S63-S72.
- JENKINS, D. J., AND B. MORRIS. 1991. Unusually heavy infections of *Echinococcus granulosus* in wild dogs in south-eastern Australia. *Austral. Vet. J.* 68:36-37.
- NRM. 2006. NRM facts: sodium fluoroacetate (1080). Pest series. Land Protection, Dept. of Natural Resources and Mines, Queensland Government. <http://www.nrm.qld.gov.au/factsheets/pdf/pest/pa5.pdf>.
- RURAL MANAGEMENT PARTNERS. 2003. Economic assessment of the impact of dingoes/wild dogs in Queensland. Report to Dept. of Natural Resources, Project LP02/03NRM. October 2003. Milton, Queensland, Australia. 55 pp.
- THOMPSON, R. C. A., AND A. J. E. LYMBERY (EDITORS). 1995. *Echinococcus and Hydatid Disease*. CABI Publishing, Wallingford, U.K. 480 pp.
- THOMSON, P. C. 1992. The behavioural ecology of dingoes in north-western Australia. IV. Social and spatial organisation, and movements. *Wildl. Res.* 19:543-563.