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# DINGOES, DOMESTIC DOGS, OR HYBRIDS? GENETICS OF PERI-URBAN WILD DOGS IN NE AUSTRALIA

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## ABSTRACT (SUMMARY)

Wild dogs are common residents in peri-urban areas of north-eastern Australia. Improved knowledge of the ancestry of wild dogs can assist in determining management priorities, such as targeting source populations, in such areas. We studied the genetics of wild dogs from peri-urban and more regional areas in NE Australia to determine the degree of hybridisation of dog populations. Tissue or hair samples from free-ranging dogs captured through control and research programs were collected and DNA extracted. Seventeen microsatellite loci were examined. Each sample was classified as domestic dog, pure dingo, probable dingo, or hybrid through comparison of allelic data to known dingo/domestic dog reference samples (using the Average 3Q score). Total (pooled) results from all regions show that hybrid wild dogs dominate and less than 36% were of dingo/ probable dingo ancestry. Very few (~1%) were domestic dogs. Spatial and regional differences in dingo hybridisation also suggest trends of increased hybridisation with increased urbanisation. This paper presents the initial findings of the study into peri-urban wild dog genetics, and discusses how such information can assist in developing best practice management strategies and guidelines for implementing control in peri-urban areas.

## INTRODUCTION

Wild dog impacts are increasingly being felt by producers and residents of towns and suburbs throughout the more populated areas of north-eastern Australia. Wild dogs in these areas can have substantial impacts on fragmented conservation estates and a number of primary industries including grazing, dairy and intensive livestock industries. In various forums, pest managers have consistently identified the need to improve our understanding of wild dog ecology and develop control tools for managing peri-urban wild dogs. Genetics of wild dog populations has been studied generally, but limited information is available from the peri-urban areas. This paper presents the initial findings of the study into peri-urban wild dog genetics specifically relating to the heritage (hybridisation) of wild dogs. The proportion of dingoes (*Canis lupus dingo*), domestic dogs (*Canis lupus familiaris*) or their hybrids are examined from wild dog populations in north-eastern Australia, and the implications for wild dog management are discussed.

## METHODS

Tissue samples were collected from wild dogs euthanized from control or research programs conducted within and adjacent to peri-urban areas, and from historical samples collected in more rural areas. The allelic data pertaining to reference samples of known dingoes and domestics were used to assign wild dog samples to status (i.e. 'purity' group) based on the Average 3Q score (following Elledge et al 2008). We categorised samples

into either 1) domestic dogs; 2) hybrid dingoes of varying percentage dingo genetics or 3) dingoes (Table 1).

We use the purity component to test one hypothesis of high relevance to management of wild dogs in peri-urban areas:

H<sub>0</sub>: Peri-urban wild dogs are largely the wild descendants of neglected domestic dogs and hence management should focus around improved control of domestic and stray dogs.

H<sub>1</sub>: Peri-urban wild dogs are mostly free-ranging descendants of dingoes necessitating broader strategic and coordinated management of free-ranging wild dog populations.

## RESULTS

The hybridisation of wild dog samples collected (n = 904) is shown by collection region in Table 2. From all samples and regions (pooled), the majority (64%) of wild dogs were classified as hybrid wild dogs, with individuals displaying some, but varying, levels of dingo genetics (from <50% to >75% dingo) as calculated from Average 3Q (Table 1). The mean percentages of 'pure dingo' and 'probable dingo' were 22 and 13% respectively, pooling these indicates that just over one-third of samples tested (35%) could be considered dingoes. Importantly, very few domestic dogs were present in the sample (1% overall). The virtual absence of domestic dogs means that we can safely reject the null hypothesis, and accept that management of wild dog populations should focus on managing free-ranging wild dog populations rather than domestic or stray dogs.

Preliminary spatial analyses show the percentage of hybridisation within wild dog populations is greater with closer proximity to settled or populated areas, particularly in south-eastern Queensland. Conversely, wild dog populations in more regional, rural or remote areas appear to show a greater than average percentage of dingo (Table 1 and unpublished data).

## DISCUSSION

Our data indicate that wild dog populations in north-eastern Australia consist of dingoes, hybrid dingo/domestic dogs, and, to a very limited extent, (feral) domestic dogs. Wild dog populations, particularly those in close proximity to areas of dense human habitation or use in south-east Queensland, show extensive levels of hybridisation. This supports previous research using both morphological (e.g. [Newsome and Corbett 1985](#); [Woodall \*et al.\* 1996](#)) and genetic ([Stephens 2011](#)) assessments of hybridisation in wild dog populations. Hybridisation levels in our study (64% in NE Australia) are very similar to those found by Stephens (2011) (67% for Queensland), but are much greater than reported by [Woodall \*et al.\* \(1996\)](#), who classified 50% and 95% of animals as dingoes for south-east and central Queensland respectively. Although the time since European occupation and human population density (and hence, domestic dog density) are probably the most dominant factors that influence, other factors that influence interbreeding, including the social organisation and behaviour of dingoes, and free-ranging behaviour of domestic dogs, are also important ([Elledge \*et al.\* 2006](#)).

**Table 1.** Dingo hybridisation (%) of wild dog samples by region using Average 3Q

Region (n)	Dingo	Prob Dingo	>75% Dingo	65-75% Dingo	50-65% Dingo	<50% Dingo	Domestic dog
Blackall (10)	40	30	20	0	10	0	0
Blackbutt (18)	33	11	17	0	39	0	0
Bollon (4)	50	0	0	50	0	0	0
Bunya mountains (3)	33	33	0	33	0	0	0
Charleville (7)	86	0	0	0	14	0	0
Injune (11)	55	9	27	9	0	0	0
Kilcoy/Toogoolawah (43)	33	16	19	14	16	2	0
North Burnett/Childers (5)	40	20	20	0	20	0	0
Roma (18)	44	17	22	11	6	0	0
St George (4)	0	0	0	50	25	25	0
Warroo (22)	41	9	23	14	9	5	0
Brisbane/Logan (104)	14	8	13	17	28	20	0
Darling/Southern Downs (14)	7	7	14	36	14	21	0
Gatton/Lockyer (5)	20	0	60	20	0	0	0
Gold Coast (90)	9	9	13	24	29	16	0
Gympie (5)	20	0	0	60	20	0	0
Mackay (16)	44	13	13	19	13	0	0
Moreton Bay (148)	20	13	18	26	18	5	1
Mt Mee (141)	18	28	7	17	21	9	0
North Qld (94)	21	13	17	27	16	4	2
North Coast NSW (15)	0	7	0	33	47	13	0
Sunshine Coast (28)	39	7	4	14	29	7	0
Townsville (22)	18	27	9	27	9	9	0
Unknown (77)	22	5	9	21	25	14	4
<i>Mean (904)</i>	<i>22</i>	<i>13</i>	<i>13</i>	<i>21</i>	<i>21</i>	<i>9</i>	<i>1</i>

The virtual absence of domestic dogs demonstrates that wild dogs are generally free-living dingo-hybrids or dingoes, rather than escaped or roaming domestic dogs. For peri-urban pest managers, this indicates that both short and longer-term efforts to reduce the deleterious impacts of wild dogs should focus on managing free-ranging wild dog populations rather than domestic or stray dogs. This would be of particular importance for local governments, where resources are allocated to managing both wild dogs and escaped domestic or 'feral' dogs.

In Queensland, dingoes are protected within protected areas and state forests under the *Nature Conservation Act 1992* and *Forestry Act 1959* (DNPSR 2015), although wild dogs can be managed to mitigate threats to wildlife, impacts on neighbouring enterprises, and hybridisation with dingoes (DNPSR 2015). The introgression of domestic dog genes threaten the conservation of dingo populations (Elledge *et al.* 2006), but field identification (and selective removal) of hybrids from conservation lands is problematic (Claridge *et al.* 2014). They have no legal protection outside these areas, and landholders are obliged to manage wild dogs on their land. Hence, while our data and approach could contribute to determining key areas of high dingo genetic purity for conservation purposes, they would have little impact on management practices outside conservation areas, where wild dog impacts remain widespread and demand intervention.

Studies to date suggests little effect of hybridisation on the reproductive output, movement ecology, social organisation and feeding ecology of wild dogs but there may be consequences from increasing hybridisation that have yet to be realised ([Claridge \*et al.\* 2014](#)). Our data is being used to investigate the influence of genetics on disease or pathogen presence, and breeding ecology, to explore differences in these parameters as a function of hybridisation. Further analysis will be completed to assess the geographic distribution of dingoes and their hybrids in the sampled regions. Finally, probably the most important component of our genetic research is the assessment of gene flow. Such information is of high value to help understand the implications of control practices, for example by helping to designate control units.

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