

**A MANAGEMENT PROGRAM FOR
THE DINGO
(*Canis lupus dingo*)
IN THE
NORTHERN TERRITORY OF AUSTRALIA**



2006-2011



**PARKS AND WILDLIFE SERVICE
DEPARTMENT OF NATURAL RESOURCES, ENVIRONMENT AND THE ARTS**

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1. EXECUTIVE SUMMARY

1.1 Species Subject to Management

Class: Eutheria
Order: Carnivora
Family: Canidae
Species: *Canis lupus dingo*
Common names: Dingo

1.2 Responsible Authority

Parks and Wildlife Service of the Northern Territory
Department of Natural Resources, Environment and The Arts
PO Box 496
Palmerston, Northern Territory, Australia 0831
Telephone: (08) 8999 4401
Facsimile: (08) 8999 4793

1.3 Management Perspective

Dingoes have inhabited Australia for about 4000 years, long enough to become a functional part of the natural ecological system as a top order predator (Fleming *et al.* 2001). As such, dingoes are likely to control the diversity of ecological systems by limiting populations of their prey and/or subordinate competitors. Thus, the removal of dingoes has the potential to severely affect species richness and abundance further down the food chain. In view of their ecological importance, dingoes are regarded under Northern Territory legislation as native wildlife. This status affords the dingo full legal protection, making it an offence to possess, interfere with, or kill dingoes unless authorised to do so under the *Territory Parks and Wildlife Conservation Act (2000)* (TPWCA).

The dingo is an important feature of Aboriginal culture and ongoing strong cultural associations exist across the Northern Territory. Aboriginal people regard the dingo as important in the practical sense (for companionship and to hunt game) and also in the mythological sense. Ceremonies are held for dingoes, Dreaming stories relating to the dingo are maintained and passed through generations and there are numerous sites that relate to the ancestral travels of the dingo (Rose 1992).

Despite their environmental and cultural significance, dingoes (and other wild dogs) are known to have a number of negative or undesirable impacts in the Northern Territory. Dingoes are known predators of livestock and they can cause significant economic losses to pastoral production. They are also known to prey upon domestic livestock on rural blocks and they can be a menace to humans at remote tourist resorts, mine sites and national parks. Furthermore, they can have an impact on the survival of remnant populations of native fauna. Ongoing population management is required to control these impacts, but at the same time, ensure the long-term persistence of dingoes in the wild. Management of protected wildlife is possible in the Northern Territory via programs approved under the TPWCA. A further discussion of the impacts of the dingo in the Northern Territory is presented below in Section 6.

1.4 Objective

The aim of this management program is to ensure the continued existence of wild dingo

populations in Northern Territory ecosystems, strategically reducing their negative impacts as required.

This objective will be achieved by undertaking the following management measures:

1. Maintain viable wild populations of the dingo in the Northern Territory;
2. Mitigate the level of livestock predation by dingoes;
3. Reduce the threat of dingo predation where it is identified as jeopardising the survival of native fauna populations;
4. Reduce the threat to humans of dingo attack;
5. Determine the genetic status of dingoes throughout the Northern Territory and take action to minimise cross-breeding between dingoes and domestic dogs;
6. Revise and adapt the management of dingoes in the Northern Territory as new information and technologies become available;
7. Promote public awareness of the conservation issues relating to the dingo, the ecological role of the dingo and the benefits of strategic dingo management;
8. Foster cooperation with other State and Territory Governments, the Commonwealth Government and other interested parties in ensuring that dingoes persist in the long-term;
9. Ensure that dingo management complies with current Northern Territory legislation;
10. Ensure that dingo management complies with indigenous customary law and is sympathetic to traditional mythology.

1.5 Monitoring and Research

The impacts of dingo control on calf predation and the abundance of dingoes and other pest animals such as hybrid dogs, rabbits, kangaroos, cats, foxes etc. will be monitored for the duration of the program.

The following research needs addressing gaps in current knowledge will be prioritised and then carried out as resources allow:

1. Assess the genetic status of dingo populations in the Northern Territory
2. Further investigate the relationship between 1080 baiting, dingo abundance and predation of cattle
3. Evaluate the interaction between dingoes, their prey and subordinate predators
4. Determine the effect of rabbit calicivirus on dingo diet and the predation of livestock
5. The suitability of factory-manufactured baits for use in the Northern Territory
6. Support external research and development aimed at improving dingo management

1.6 Program Review

A full review of the program, as required under Section 32(2) of the Territory Parks and Wildlife Conservation Act (2000), will be carried out at the end of five years from the date of approval of the management program.

2. INTRODUCTION

2.1 The Dingo in Australia

The dingo (*Canis lupus dingo* Meyer 1793) was brought to Australia from southern Asia approximately 4000 years ago by Asian seafarers (Fleming *et al.* 2001). After their introduction, dingoes dispersed rapidly throughout the continent, aided by Aboriginal people who developed strong cultural associations with them, using dingoes for companionship and to hunt game (Corbett 1995). Wild dingo populations became established across all of mainland Australia and the species became a key functional component of the natural ecosystem (Fleming *et al.* 2001). The dingo never became established in Tasmania.

2.2 Taxonomy

Dingoes and other wild-living dogs in Australia are members of the family Canidae, belonging to the order Carnivora. The scientific name of the dingo has undergone many changes since it was first officially named in 1792 (as *Canis antarcticus*). Currently, the most commonly used scientific name is *Canis familiaris dingo* and for the domestic and wild dog it is *Canis familiaris familiaris* (Fleming *et al.* 2001). However, there is debate about the correct nomenclature. Both the dingo and the domestic dog are derived from the grey wolf (*Canis lupus*), and it is currently recommended that they be regarded as subspecies of *Canis lupus*. Thus, the recommended specific designation for the dingo is *Canis lupus dingo* and for the domestic dog it is *Canis lupus familiaris* (Fleming *et al.* 2001).

2.3 Distribution and Habitat

Prior to European settlement, dingoes occurred throughout mainland Australia, but the establishment of agriculture in Australia has significantly reduced dingo distribution (Fleming *et al.* 2001). Predation of livestock (particularly sheep) by dingoes prompted broadscale efforts to remove dingoes from areas of intensive primary production and by the late 1800s, all states and territories had enacted legislation to facilitate and administer the control of dingoes (Breckwoldt 1988). By the early 1900s, barrier fences had been constructed to exclude dingoes from sheep producing districts which, in combination with trapping, poisoning, and land clearing, resulted in dingoes becoming extinct over much of their previous range in southern Queensland, New South Wales, Victoria and South Australia (Fleming *et al.* 2001). They are now absent from the majority of New South Wales and Victoria, from the south-eastern third of South Australia, and from the south-western tip of Western Australia (Fleming *et al.* 2001, Fig. 1).

Dingoes are regarded as common throughout the remainder of mainland Australia with the exception of the arid eastern half of Western Australia and adjoining parts of South Australia and the Northern Territory where they are considered to be naturally sparse (Fig. 1). The abundance of dingoes is actually thought to have increased across much of their current range since European settlement as a result of the establishment of artificial watering points by the pastoral industry and the introduction of rabbits (Corbett 1995).

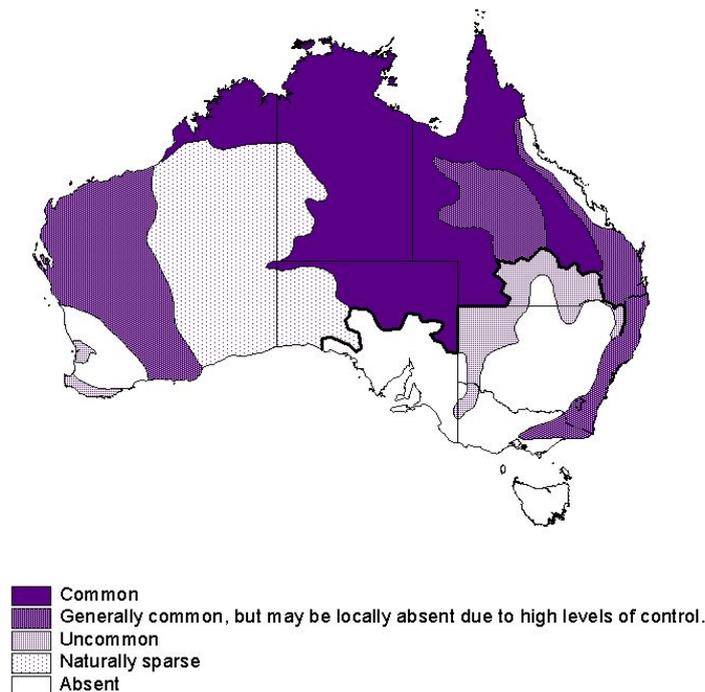


Fig. 1 Distribution of dingoes in Australia. Dog fence represented by bold black line. Reproduced from Fleming *et al.* (2001).

Dingo control measures in the Northern Territory have been far less intensive than in other States and Territories, and as a result, there has been little or no change in the distribution of dingoes in the Northern Territory. This is largely because livestock production has been restricted mainly to cattle which are less susceptible to dingo predation than sheep (Fleming and Korn 1989; Fleming *et al.* 2001).

2.4 Conservation Status

Dingoes remain common throughout the Northern Territory with the exception of the Tanami and Simpson Deserts where they are relatively sparse due to the lack of available drinking water. However, localised concentrations of dingoes do exist in this region where watering points have been introduced, such as on pastoral properties, in mining areas and near areas of human habitation.

Currently, the species is not classified as Threatened under either Territory or Commonwealth legislation. However, the dingo has recently been listed as Vulnerable on the IUCN Red List of Endangered Species due to the threat of hybridisation to the national dingo population.

2.5 Biology and Ecology

The dingo is dog-like with a relatively broad head, tapered muzzle, erect ears, short body hair and a bushy tail. The average individual stands 57 cm at the shoulder, is 123 cm long from nose to tail tip and weighs 16 kg (Fleming *et al.* 2001). The coat colour of adult dingoes is typically ginger (red to sandy) and is occasionally black-and-tan, white or black. Most dingoes have small white markings

on the chest, tail tip and feet/legs, and some have white belly markings and/or a black muzzle. All other coat colourations indicate hybridisation with domestic dogs.

Although dingoes are usually seen alone, most individuals belong to socially integrated groups whose members meet occasionally and coalesce during the breeding season to mate and rear pups (Corbett 1995). At such times, howling and scent-marking is most pronounced. Unlike domestic dogs, dingoes rarely bark. Dingoes howl over large distances to attract pack members and to repel intruders. They also communicate by scent-rubbing, and by defecating and urinating on conspicuous objects such as grass tussocks at shared sites (*e.g.* water points, trails and hunting grounds).

In their natural state, dingoes exist in discrete and stable packs comprising 3-12 individuals that occupy territories throughout the year (Corbett 1995). The home ranges of individual pack members overlap considerably but neighbouring pack territories do not (Thomson 1992; Corbett 1995). Packs have distinct male and female hierarchies with rank order determined largely by aggression, especially in males. The dominant pair are usually the only successful breeders and other pack members assist in rearing the pups. The dingo pack structure can be broken down under intensive baiting regimes, allowing successful breeding between subordinate pairs.

Territory size and individual home-range size increase as prey resources decrease. Home ranges of up to 270 km² have been recorded in central parts of the Northern Territory (Eldridge *et al.* 2003). Most dingoes remain in their natal area but some disperse, especially young males. The longest recorded dispersal distance for a tagged dingo is about 250 km (Thomson and Marsack 1992).

Pure dingoes breed once each year, determined by the female's annual oestrus cycle. Litters are usually whelped between May and July but in tropical habitats, breeding can occur at any time. Most wild females commence breeding at two years and, in packs, the dominant female tends to come into oestrus before the subordinates. However, the main method of suppressing reproduction is by infanticide, whereby all the pups of subordinate females are killed by the dominant female. Males reach full sexual maturity at 1-3 years. The gestation period is 61-69 days and the average litter size is 5 (range 1-10). Pups usually become independent at 3-6 months or, if in a pack, at 12 months when the next breeding season begins. Dens are usually located underground, usually in enlarged rabbit burrows, caves in rocky hills, under debris in dry creek beds, under large tussocks of spinifex or in hollow logs.

Dingoes eat a diverse range of foods but in the Northern Territory, the main prey are magpie geese, rodents and agile wallabies in northern tropical areas, and rabbits, rodents, lizards and red kangaroos in the south (Fleming *et al.* 2001; Eldridge *et al.* 2003). Dingoes also kill livestock, particularly cattle, and can threaten the economic viability of pastoral operations (Fleming *et al.* 2001). In the more arid parts of the Northern Territory, livestock predation appears to be dependent on the availability of native prey, and increases when native prey is scarce (*e.g.* during droughts or as a result of human disturbance to habitats). However, in the wetter, more seasonal areas there is evidence of seasonal peaks in predation, possibly related to seasonal breeding activity of dingoes, the timing of calving and control activity (Fleming *et al.* 2001). Dingoes also scavenge and steal prey from other predators.

Dingoes alter their group size and hunting strategy in order to maximise hunting success. For example, packs have greater success than solitary dingoes in hunting kangaroos and vice versa when hunting rabbits (Corbett 1995).

There is increasing scientific evidence to suggest that dingoes limit populations of their prey and subordinate predators. For example, inverse density relationships between dingoes and foxes have been observed (*e.g.* Jarman 1986). Thus, it is possible that removing dingoes will result in an increase in feral cat and fox numbers and a consequent increase in predation on small native mammals. Similarly, dingo removal may cause prey species such as the red kangaroo and the rabbit to become overabundant.

2.6 Potential Threats

2.6.1 Hybridisation with Domestic Dogs

With European settlement came the introduction of the domestic dog (*Canis lupus familiaris*). Domestic dogs quickly established feral populations, especially in areas where dingo populations had been severely reduced. Dingoes and domestic dogs readily hybridise and nowadays, the term wild dog is used to collectively describe dingoes, feral dogs and their hybrids. Continual hybridisation between domestic dogs and dingoes has led to the current situation in eastern and southern Australia where over 50 % of the wild dog population is hybrid (Newsome and Corbett 1982; Corbett 2001).

Hybridisation with domestic dogs represents a significant threat to the long-term conservation of the dingo (Corbett 2001; Wilton 2001). So far in the Northern Territory, this process has been slow because the behavioural differences between dingoes and domestic dogs make it difficult for dogs to infiltrate dingo society and breed (Corbett 1995). Nevertheless, the process is occurring, particularly at the interface between towns and surrounding bushland. Unless action is taken to manage dogs effectively in towns and communities, the long-term conservation of dingoes will be jeopardised in the Northern Territory as it is elsewhere in Australia. In eastern Australia, hybridisation rates have increased in recent years as a result of a trend for people in urban and semi-rural areas to keep pet dingoes. This has the effect of greatly increasing rates of cross-breeding as pet dingoes grow up outside the natural hierarchy of dingo society which removes the behavioural barriers that usually curb hybridisation (Corbett 2001). The resulting hybrids are often rejected by their owners or stray to the bush where their dingo genes make it easier for them to infiltrate dingo society and breed with pure dingoes.

2.6.2 Human-induced Mortality

Humans have had a major impact on dingo populations in Australia through control practices such as poisoning, trapping and shooting. In the Northern Territory, persecution has decreased over the last 30 years with improved understanding of dingo ecology and predation. Nonetheless, it is a major cause of dingo mortality.

2.6.3 Parasites and Disease

Dingoes are susceptible to all diseases that affect domestic dogs (Fleming *et al.* 2001). The majority of these diseases have little effect on the survival of adult dingoes, but exceptions include canine distemper (Paramyxovirus), hookworm (*Uncinaria stenocephala* and *Ancylostoma caninum*) and heartworm (*Dilofilaria immitis*). Pups are also killed by lungworm (*Oslerus osleri*), whipworm (*Trichurus vulpis*), hepatitis (Adenovirus), coccidiosis (*Isospora rivolta*, *Eimeria canis*), lice (*Trichodectes canis*) and ticks (*Ixodes holocyclus*, *Rhipicephalus sanguineus* and *Amblyomma triguttatum*). Sarcoptic mange (caused by *Sarcoptes scabiei*) is a widespread parasitic disease in dingo populations throughout Australia, but it is seldom debilitating. Hydatidosis (causal agent *Echinococcus granulosus*) does not cause mortality in dingoes, but causes serious illness and sometimes death in humans. It leads to the condemnation of offal from up to 90 % of slaughtered

cattle from endemic areas, resulting in devaluation of carcasses.

Dingoes could also be vectors to the rabies virus in the event of its introduction to Australia. In this situation, there would be a need to reduce dingo populations to a level which would stop the spread of the virus.

2.7 The Impact of the Dingo in the Northern Territory

Throughout Australia, dingoes and other wild dogs have significant impacts on agricultural production through predation of livestock. Sheep are the most commonly attacked livestock followed by cattle and goats (Fleming *et al.* 2001). In the Northern Territory, livestock production is limited to cattle. Cattle are most vulnerable to wild dog attack at the calf and weaner stage, although protective behaviour by the cow can be sufficient to deter attacks. Therefore, the likelihood of wild dog attack is also dependent on the health and condition of adult cattle and their capacity to protect their calves (Fleming *et al.* 2001). Furthermore, livestock predation has been found to depend on seasonal conditions, increasing when the availability of alternative prey is low (Thomson 1992; Corbett 1995). Consequently, the impact of wild dogs on cattle is highly variable and accordingly, estimates of calf and weaner predation losses in rangeland grazing areas range from 0-30% (Rankine and Donsaldson 1968; Allen and Gonzales 1998; Fleming *et al.* 2001; Eldridge *et al.* 2003). In addition, calf mortality has a variety of potential causes and due to the broadscale nature of cattle production in the Northern Territory, it is difficult to distinguish between them. The only method guaranteed to identify the level of calf predation by dingoes is to pregnancy test individual cows, then monitor the cows throughout their pregnancy and subsequently monitor the fate of the calves once they are born. Such an exercise would be beyond the capacity of a pastoralist running a broadscale operation.

Wild dogs are also implicated in the spread of disease such as hydatidosis in cattle and sheep, and heartworm and parvovirus in pet domestic dogs. Hydatidosis leads to the condemnation of offal from slaughtered abattoir cattle in affected areas and has the potential to cause significant economic losses.

There are few reliable estimates of the true economic cost of wild dogs. According to members of the Northern Territory Cattlemen's Association (NTCA), a minimum of 1500 to 2500 cattle are killed or maimed each year in the Northern Territory by wild dogs, which currently equates to an annual damage bill of more than \$2 million (J. Armstrong, President NTCA, pers. comm.). This represents approximately 0.5% of total annual production. A recent report commissioned by the Queensland Government estimated that wild dogs cost the state over \$30 million per year in stock losses, disease spread by wild dogs and control costs. Stock losses alone were estimated at over \$18 million. Northern Territory pastoralists responding to a questionnaire survey conducted by the Parks and Wildlife Service in 1995 estimated that 1.6 to 7.1% of stock losses were attributable to wild dogs (depending on district), calculated to be worth \$13.5 million at the time (Eldridge and Bryan 1995). Despite the variability in these estimates, there is little doubt that dingo predation can be a significant cause of economic loss, particularly during the early years of a drought when native prey availability is low and dingo abundance remains relatively high. Dingo predation is one of the few causes of calf mortality that can be easily controlled by the pastoralist to improve profitability. Many of the remaining causes (e.g. disease, malnutrition etc.) are highly dependent on seasonal conditions and difficult to control, particularly in variable and unpredictable climates which are typical of much of the Northern Territory. As a result, a tendency has developed among some pastoralists to control dingoes on a routine basis in an attempt to maximise profitability. There is evidence to suggest, however, that routine control can be detrimental to cattle production (e.g.

Allen and Gonzales 1998). Routine baiting can lead to local eradication of dingoes in some areas. Such areas are readily recolonised by young dispersing dogs or in some cases, hybrid dogs, resulting in higher levels of livestock predation.

There are several benefits in maintaining wild dingo populations. First, dingoes have become an important part of the natural ecological system in Australia as a top order predator. They eat a diverse range of species and they are known to keep several native species under control that could otherwise be pests, such as kangaroos and wallabies (Caughley *et al.* 1980; Edwards *et al.* 1995; Pople *et al.* 2000). They also prey upon introduced pest species such as rabbits, foxes, feral cats and feral pigs which helps to keep their numbers in check (*e.g.* Jarman 1986; Marsack and Campbell 1990; Lundie-Jenkins *et al.* 1993; Corbett 1995; O'Neill 2002; Paltridge 2002). Feral goats have never become established in the mainland Northern Territory due to the widespread distribution of dingoes.

Second, the dingo is a highly social animal. Although they are usually seen alone, most individuals belong to discrete packs that occupy and defend distinct territories year round. They usually only come together as a pack during the breeding season to mate and rear pups (Corbett 1995). Packs have highly developed male and female hierarchies and breeding is usually only successful between the dominant pair. Subordinate pack members are actively prevented from breeding by the dominant pair (Fleming *et al.* 2001). This pack structure can be broken down under intensive baiting regimes, which facilitates breeding between subordinate pairs potentially resulting in greater population growth. A lack of pack structure also means that territories are not being adequately defended which allows the spread of feral and hybrid dogs. Hybrids can breed year-round, there are no social restrictions to breeding like there is in the dingo, and they are poorer predators than pure dingoes, tending to prey more heavily on livestock.

Third, the dingo is classified as protected wildlife under the Territory Parks and Wildlife Conservation Act (2000), in recognition of its ecological importance. Cross-breeding with domestic dogs represents a significant threat to the long-term persistence of pure dingoes in Australia. In the Northern Territory, the genetic integrity of dingoes remains largely intact, affording them significant conservation value.

Fourth, strong cultural associations exist between the dingo and Aboriginal people and there is strong feeling amongst many in the Aboriginal community that dingoes should not be killed. Past management of dingoes in the Northern Territory has failed to adequately consider these associations. Dingo management in the Northern Territory must be tailored to respect the perspectives of Aboriginal people.

2.8 The History of Dingo Management in the Northern Territory

As was the case in many parts of Australia, the threat of livestock predation meant that dingoes became the enemy of pastoralists across the Northern Territory. Initially, dingo control was conducted opportunistically by individual pastoralists, although some are known to have employed people specifically to eradicate dogs from their properties. Organised control of dingoes began with the introduction of the Dingo Destruction Ordinance in July 1924 which was administered by the then Animal Industry and Agriculture Branch (Stephens 1969). Professional 'doggers' were employed to destroy dingoes on pastoral land and a bounty system was established to encourage landholders to conduct their own control. By 1969, there were six dogger positions in the Northern Territory and bounties of \$2 per scalp were being paid (Stephens 1969). Steel jaw traps and strychnine baits were the main control methods used.

The first reported broad-scale dingo control exercise occurred in 1966 when an aerial baiting campaign was conducted in the Victoria River Downs (VRD) district using strychnine baits. By the mid-1970s, sodium monofluoroacetate (1080) had replaced strychnine as the preferred poison for dingo control due to its specificity to canids and apparent safety in regard to non-target wildlife. Its popularity amongst pastoralists grew rapidly and by 1979, 80 % of all Northern Territory pastoral properties had been involved with 1080 aerial baiting programs. By this time, some sections of the community were beginning to raise concerns that dingo numbers had decreased to such low levels that they were in danger of localised extinction. A moratorium on 1080 aerial baiting was proposed but was rejected by the Northern Territory Government following representation from the pastoral industry (Honner 1983). Ultimately, the government responded by transferring responsibility for the dingo baiting program to the then Conservation Commission of the Northern Territory (CCNT) to improve operational efficiency and curtail unlimited aerial baiting. By 1983, CCNT was responsible for the dingo baiting program throughout the entire Northern Territory (Honner 1983). Poisons such as Strychnine and Lucijet became banned substances and permits to possess 1080 were available only to selected CCNT staff. Baiting was conducted only in response to pastoralists reporting stock damage and aerial baiting was discouraged unless vehicle access to the target area was not possible, or unless dingo damage was particularly heavy and widespread (R. Bryan, Parks and Wildlife Service, pers. comm. 2002).

Since that time, the responsibility for dingo management has remained with the Parks and Wildlife Service of the Northern Territory (formerly CCNT), and 1080 baiting has continued to be the principal technique employed for dingo control. Current baiting procedure uses non-refined fresh meat baits (400g beef, horse, donkey or camel meat) delivering 6 mg 1080 per bait. Baits are distributed by vehicle (and, in some cases, aircraft) to areas frequented by dingoes including water points, roads and tracks. The program restricts the number of baits laid at any one location to thirty. 1080 is recognised as the safest and most efficient way of controlling canids as they are extremely susceptible to this poison with only a very small amount required to kill a dog (0.3mg per kg). Mixed correctly, with the right sized bait, it is also reasonably 'target specific'.

Dingoes have occasionally become a nuisance outside pastoral areas. For example, they are known to prey upon domestic livestock on rural blocks and they can be a menace to tourists and staff at remote tourist resorts and national parks. Alternative methods to poison-baiting are used in these areas. These include trapping, exclusion fencing and shooting. Dingo control in these areas is the responsibility of the relevant town council or resort owner, although the Parks and Wildlife Service provides advice on strategies for control. Responsibility for dingo management in national parks under a Joint Management Agreement lies with the management partners.

Previous 1080 baiting details for the Northern Territory have been summarised in Appendices 2-4. It is clear from these data that baiting intensity varies considerably from year to year. This variability is most obvious in the southern Northern Territory where climate is relatively variable. Historically, baiting is least intensive during wet years and most intensive as conditions become drier after periods of above average rainfall.

2.9 Legislation and International Obligations relating to Dingo Management

2.9.1 Northern Territory

Territory Parks and Wildlife Conservation Act (2000)

Under the *Territory Parks and Wildlife Conservation Act (2000)* (TPWCA), the dingo is regarded as indigenous to Australia and is legally protected across all land tenures throughout the Northern Territory (Section 43). Section 66 of the TPWCA prohibits the taking, interference with, possession, control or movement of protected wildlife unless authority to do so is granted under the Act. “Interference with” protected wildlife as defined under the Act is to harm, disturb, alter the behaviour of or otherwise affect the capacity of an animal to perform its natural processes, or to damage or destroy its habitat. Deliberate feeding of protected wildlife is regarded as “interference”. The maximum penalty for breaches of these provisions is 500 penalty units (currently \$55,000) or five years imprisonment for a person, or 2,500 penalty units (currently \$275,000) for a body corporate.

Authorisation to take or interfere with a dingo, in whole or in part, is by a permit issued by the Director of the Parks and Wildlife Service (Sections 55 to 63). The maximum penalty for breaches of the provisions of a permit is 50 penalty units (currently \$5,500) or six months imprisonment for a person, or 250 penalty units (currently \$27,500) for a body corporate.

Transportation of dingoes between the Northern Territory and other States and Territories within the Commonwealth can only be undertaken with a permit issued under Sections 55 to 63 of the TPWCA.

Under Section 29 of the TPWCA, the conservation status of the dingo is classified as “Lower risk – Least concern” and it is not classified as threatened under Section 30 of the Act.

Section 122 of the TPWCA provides for traditional harvest of dingoes for food, ceremonial and religious purposes by Aboriginal people.

This management program for dingoes in the Northern Territory is in accordance with the requirements of Sections 32 to 34 of the TPWCA which state that the Parks and Wildlife Service may control wildlife under management programs approved by the Northern Territory Administrator.

The Animal Welfare Act (1999)

Under Section 17 of the *Animal Welfare Act (1999)*, a person must not administer poison to an animal or lay poison in a place with the intention of killing an animal unless authorised by a law in force in the Northern Territory.

A person guilty of an offence under the *Animal Welfare Act (1999)* is liable to a penalty not exceeding 100 penalty units (currently \$11,000) or imprisonment for 12 months. A person found guilty of an offence under this Act is liable to an additional penalty not exceeding 5 penalty units (currently \$550) for each day after the first day on which the offence continues.

Agricultural and Veterinary Chemicals (Control of Use) Act (2004)

The *Agricultural and Veterinary Chemicals (Control of Use) Act* (2004) provides for the use of agricultural and veterinary chemicals, including sodium monofluoroacetate (compound 1080), which is used in dingo management in the Northern Territory. Compound 1080 is classed under the Act as a restricted chemical product, making it illegal to possess or use the substance unless authorised under the *Agricultural and Veterinary Chemicals Regulations*. Schedule 2 of the Regulations states that the possession or use of a restricted chemical product containing 1080 is restricted to a person (a) who has successfully completed a training course in handling the product approved by the Parks and Wildlife Service; and (b) whose possession and use of the product is in accordance with the standard operating procedures for the product developed by the Service. It also states that a person may possess and use a 1080 product if under the direction of an authorised person.

Compound 1080 is classified as a Schedule 7 poison under the National Standard for the Uniform Scheduling of Drugs and Poisons. Schedule 7 poisons (the most dangerous category of poisons) require special precautions in manufacture and use and special restrictions often apply. In the Northern Territory, Schedule 7 chemical products can only be used if authorised by the Chemicals Coordinator (Department of Primary Industries, Fisheries and Mines) under the *Agricultural and Veterinary Chemicals (Control of Use) Regulations* (2004). Authorisation is issued only if the Chemicals Coordinator is satisfied that the applicant has genuine and sufficient reason to possess and use the product, is competent to handle the product and that the use of the product would not pose an unacceptable risk to the health and safety of the applicant or to the environment.

The *Agricultural and Veterinary Chemicals (Control of Use) Regulations* require records to be kept of the use of all agricultural chemical products for a minimum period of 2 years when used for the purpose of pest control.

2.9.2 Other States and Territories

Legislation relating to dingoes and other wild dogs varies between States and Territories.

Western Australia

Dingoes and hybrids are ‘declared animals’ under the *Agriculture and Related Resources Protection Act 1976* administered by Agriculture Western Australia (AGWEST). Populations must be controlled and cannot be introduced or kept in captivity except in approved institutions or under a permit which carries specific conditions. The Agriculture Protection Board (APB) is responsible for the control of dingoes and wild dogs throughout Western Australia. It is recognised that dingoes pose no threat in areas beyond the limits of pastoral or agricultural activity and APB policy restricts control activities to stocked land and its immediate environs. Domestic dogs, however, must be controlled. In municipal areas, the management of domestic dogs is covered under the *Dog Act (1976)*.

Dingoes are also covered by the *Western Australian Wildlife Conservation Act (1950)*, administered by the Department of Conservation and Land Management (CALMWA). Under this Act, they are listed as ‘unprotected fauna’. However, despite being unprotected, they are generally not subject to control in fauna reserves and National Parks without appropriate consultation between CALMWA, landholders and AGWEST.

South Australia

Dingoes and hybrids are ‘proclaimed’ pests under the *Animal and Plant Control Board (Agricultural Protection and Other Purposes) Act* (1986) in the sheep zone south of the Dog Fence. Dingoes must be controlled in this zone and they can only be kept in authorised zoos and wildlife parks.

North of the Dog Fence, the dingo is regarded as a legitimate wildlife species and although unprotected, is afforded a level of protection by the South Australian Dingo Policy which imposes restrictions on dingo control beyond a 35-kilometre baited buffer zone north of the Dog Fence.

Queensland

Dingoes and other wild dogs are declared pests under the *Rural Lands Protection Act* (1985), administered by the Land Protection Branch of the Department of Natural Resources, Mines and Energy (DNRM&E) and local governments. Managers of all land in Queensland have a legal responsibility under this Act to reduce dingo and other wild dog numbers on their land. Dingoes and hybrids can only be kept in zoos and wildlife parks, and only with ministerial approval.

The dingo is defined as both ‘wildlife’ and ‘native wildlife’ under the *Nature Conservation Act* (1992), and is a natural resource (and therefore protected) within protected areas such as national parks. Outside protected areas, the dingo is not classified as ‘indigenous to Australia’ and is not protected wildlife.

New South Wales (NSW)

The *Rural Lands Protection Act* (1998) assigns dingoes and other wild dogs the status of noxious animals and requires land owners or occupiers to suppress or destroy them, and provides for orders to enforce these provisions. Although the dingo is unprotected under the *National Parks and Wildlife Act 1974*, the wild dog policy of the National Parks and Wildlife Service protects dingoes within National Parks and nature reserves. The dingo is recognised as a native species under the *Threatened Species Conservation Act* (1995). The *Wild Dog Destruction Act* (1921) includes dingoes with its definition of wild dogs. This Act applies only to the western division of New South Wales where it requires owners or occupiers of land to control wild dogs. The Act also prohibits ownership of dingoes in this region without the written permission of the Wild Dog Destruction Board constituted under the Act. Elsewhere in NSW, dingoes can be kept as pets under the provisions of the *Companion Animals Act* (1998).

Australian Capital Territory (ACT)

Dingoes are protected under the *Nature Conservation Act* (1980). However, the control of dingoes and other wild dogs on private lands is allowed subject to a permit authorising the killing of a protected species issued by Environment ACT.

Victoria

Wild dogs, including dingoes, are declared as ‘Established Pest Animals’ under the *Catchment and Land Protection Act* (1994) and landholders have a legal obligation to prevent the spread of, and as far as possible eradicate them on land they own or occupy. The *Domestic (Feral and Nuisance) Animal Act* (1994) places responsibility on dog owners to control them at all times. Dingoes are afforded some protection on lands administered under the *National Parks Act* (1975) by a management policy.

Tasmania

Dingoes have never colonised Tasmania and the import of dingoes is banned under the *National Parks and Wildlife Act (1970)*. The control of feral and commensal dogs preying upon livestock is covered under the *Dog Control Act (1987)*.

2.9.3 Commonwealth

The dingo is regarded as a regulated native species under the *Environment Protection and Biodiversity Conservation Act (1999)*, and thus is protected in Commonwealth National Parks and reserves, World Heritage and other protected areas. However, the Act provides for dingoes to be controlled in areas where they are having a demonstrated impact on native ecological communities. The Act prohibits the export of dingoes or their parts from Australia unless carried out in accordance with a permit or authority issued under the Act. The species is not listed as threatened.

The aerial application of 1080 baits is governed by the *Civil Aviation Regulations (1988)*.

2.9.4 International

The dingo (*Canis lupus dingo*) is listed as Vulnerable to extinction in the wild on the IUCN Red List of Threatened Species. The justification for this listing is that, although populations of wild dogs remain abundant in Australia, the proportion of pure dingoes is declining through hybridisation with domestic dogs. There are currently no obligations relating to dingo management arising from this listing.

3. AIM AND OBJECTIVES

The aim of this management program is to ensure the continued existence of wild dingo populations in Northern Territory ecosystems, strategically reducing their negative impacts as required.

Objectives to achieve this aim are:

1. Maintain viable wild populations of the dingo in the Northern Territory;
2. Mitigate the level of livestock predation by dingoes;
3. Reduce the threat of dingo predation where it is identified as jeopardising the survival of native fauna populations;
4. Reduce the threat to humans of dingo attack;
5. Determine the genetic status of dingoes throughout the Northern Territory and take action to minimise cross-breeding between dingoes and domestic dogs;
6. Revise and adapt the management of dingoes in the Northern Territory as new information and technologies become available;

7. Promote public awareness of the conservation issues relating to the dingo, the ecological role of the dingo and the benefits of strategic dingo management;
8. Foster cooperation with other State and Territory Governments, the Commonwealth Government and other interested parties in ensuring that dingoes persist in the long-term;
9. Ensure that dingo management complies with current Northern Territory legislation;
10. Ensure that dingo management complies with indigenous customary law and is sympathetic to traditional mythology.

4. MANAGEMENT MEASURES

4.1 Maintain Viable Wild Dingo Populations

Dingoes will be managed with the objective of maintaining wild populations of pure dingoes throughout the entire Northern Territory. In parks, reserves and other non-agricultural land, dingo populations will not be controlled unless predator management is prescribed by management recommendations for other native fauna (*e.g.* endangered species). Limits placed on the number and location of baits laid on each property in combination with active encouragement of pastoralists to be strategic in their baiting activities will ensure the continued existence of dingoes in pastoral areas.

4.2 Mitigate Threats to Livestock by Dingoes

In pastoral areas outside municipalities, dingoes will be controlled by the Parks and Wildlife Service at the request of landholders reporting significant damage to livestock by dingoes. The principal technique for dingo control is 1080 baiting as it is the most cost-effective lethal means of reducing dingoes in remote and inaccessible areas typical of the Northern Territory (Fleming *et al.* 2001). However, landholders experiencing minor livestock damage will be encouraged to apply for a relevant permit and undertake control through the use of dog-proof fencing or shooting if these options are likely to be feasible. Aerial baiting will not be encouraged in the Northern Territory and only considered in special cases subject to the legal requirements of the Civil Aviation Safety Authority (CASA).

On Aboriginal land in use for cattle production, dingo control will also be conducted by the Parks and Wildlife Service. However, authorisation based on appropriate consultation with relevant native title holders must be given by the appropriate statutory authority (*e.g.* Central Land Council, Northern Land Council) before a control operation will be conducted.

It is not the policy or practise of the Parks and Wildlife Service to conduct dingo control in municipal areas or remote tourist resorts. Permits will be issued to town councils and resort owners to pursue alternative methods for dingo control in these areas, including trapping, exclusion fencing and shooting.

Landholders will be encouraged to adopt a strategic approach to management, with an emphasis on concentrating control in areas where, and at times when livestock are most at risk.

4.3 Mitigate Threats to the Survival of Native Fauna by Dingoes

Dingo management may occasionally be required for conservation purposes, as predation by dingoes can have an impact on the survival of remnant populations of native fauna. Endangered populations of marsupials, in particular, may require dingoes to be controlled in order for them to become re-established or survive (Johnson *et al.* 1989). However, there is some evidence to suggest that as top-order predators, the removal of dingoes may result in an increase in the abundance of otherwise subordinate predators such as cats and foxes which may pose an even greater threat to remnant fauna populations (e.g. Soulé *et al.* 1988, Crooks and Soulé 1999). Dingo control will be conducted only in cases when the dingo is definitively identified as a significant threat to the survival or re-establishment of endangered fauna populations.

On Aboriginal land, dingo management for conservation purposes must be authorised by the appropriate statutory authority (e.g. Central Land Council, Northern Land Council). The Parks and Wildlife Service will seek input and involvement of relevant native title holders and land managers in conducting control operations in these areas.

4.4 Reduce the Threat to Humans of Dingo Attack

Dingo-human interaction and dingo behaviour will be managed to reduce the threat to humans of dingo attack. Visitors to national parks will be actively discouraged from attracting or deliberately feeding dingoes. Existing legislation provides for people to be prosecuted for deliberately feeding protected wildlife. Visitors will be informed of the consequences of attracting and habituating dingoes to picnic and camping areas by means of information brochures and signage. Visitors will also be informed of correct procedures to avoid attracting dingoes. Information will be disseminated to privately-owned and operated tourist destinations, informing them of the risk of dingo attack, how aggressive dingo behaviour towards humans develops and how to prevent it, and their legal obligation not to deliberately feed dingoes. Information will also be disseminated to the wider community to raise awareness of this issue.

Waste on national parks will be managed to minimise its availability to dingoes. Where provided, rubbish bins will be enclosed and emptied regularly. Where rubbish bins are not provided, signage will instruct visitors to store rubbish so as to prevent dingo access and to remove all rubbish on departure. Open refuse tips will be located well away from picnic and camping areas and will be back-filled regularly. All refuse tips will be enclosed inside a barrier fence to block access to dingoes. Public barbecues will be washed regularly to remove residual meat scraps and fat. Operators of remote tourist resorts and mine sites will be encouraged to manage waste by the same approach.

4.5 Minimise Hybridisation between Dingoes and Domestic Dogs

Cross-breeding with domestic dogs is potentially a significant threat to the long-term persistence of dingoes in the Northern Territory. Currently, hybrid dogs appear only to occur in localised areas in the vicinity of human activity (Eldridge *et al.* 2003), but interstate trends indicate that the level of hybridisation has the potential to increase, particularly in areas where dingoes are controlled. The level of hybridisation will be regularly monitored to ensure that the genetic status of Northern Territory dingo populations is maintained. Initially, this will be achieved by opportunistically collecting and measuring the skulls of dead animals. However, as technology for determining genetic status from DNA material becomes available, it is envisaged that genetic techniques will eventually be adopted in the Northern Territory.

The Parks and Wildlife Service will support the activities of Animal Management in Rural and

Remote Indigenous Communities (AMRRIC) in their endeavour to deliver sustainable dog health programs throughout the Northern Territory. Integral to these programs will be ongoing desexing of companion dogs in indigenous communities which is regarded by AMRRIC to be a vital component in any strategy to retard the hybridisation process (S. Phelan, AMRRIC, pers. comm.). Likewise, the Parks and Wildlife Service will advise town councils and assist with the development of dog control programs in urban areas to reduce the number of stray/feral domestic dogs in the vicinity of cities and towns in the Northern Territory.

Members of the public require a permit to keep a dingo under the *Territory Parks and Wildlife Conservation Act* (2000). Such permit holders will be required to desex their animals to prevent cross-breeding with domestic dogs, unless the permit holder is an approved institution using the animals for captive breeding. The existence of 'entire' dingoes in urban areas (which lack the complex social behaviours that curb reproduction) has the potential to greatly increase cross-breeding. Many of the resultant hybrids will inevitably stray to the bush where their dingo genes make it easier for them to infiltrate wild dingo society and breed with pure dingoes (Corbett 2001).

4.6 Employ the Precautionary Principle and the Concept of Adaptive Management

The management of dingoes in the Northern Territory will be based on the precautionary principle and the concept of adaptive management. Precaution is needed as dingoes are totally protected in the Northern Territory, culturally important to Aboriginal people and there is a lot that we do not know about the ecological role of dingoes nor the impacts of current management on dingoes and other species. This management program has been developed using principles and strategies recommended by the Federal Government's Bureau of Rural Sciences. However, the research and monitoring component of the program will progressively improve our understanding of issues relating to dingo ecology and management in the Northern Territory. Similarly, new research conducted elsewhere may bear relevance to the Northern Territory. Both on-ground management and the management program will be adapted as new information becomes available.

4.7 Promote Public Awareness and Involvement

4.7.1 Community Education

The Parks and Wildlife Service will develop extension programs that encourage landholders to implement appropriate strategic dingo control consistent with the objectives of this management program. The programs will focus on the benefits to cattle production of strategic control and the advantages of maintaining wild populations of pure dingoes in the long-term. The Parks and Wildlife Service will provide a continuous flow of information to landholders to allow them to develop efficient and effective strategies for dingo management. This will be achieved primarily through direct verbal communication between field-operative staff and landholders, but relevant written information will also be distributed to landholders as required.

The public (including Aboriginal people) will be kept informed of conservation issues relating to the dingo and the need for appropriate dingo management in the Northern Territory. Particular emphasis will be given to the impacts of hybridisation between dingoes and domestic dogs on livestock predation and dingo conservation in the Northern Territory. Information will be disseminated through the print and electronic media, the provision of natural history information through handouts and later on the internet, public presentations, and the publication of scientific papers. Park rangers and staff of the Territory Wildlife Park and the Alice Springs Desert Park will play important roles in promoting public awareness, as will non-government land management organisations such as Landcare groups and Aboriginal Land Councils.

Visitors to national parks will be informed that:

- dingoes are different from domestic dogs – they are inherently aggressive and dangerous;
- it is natural for some dingoes to be lean and they do not need to be fed;
- it is illegal to deliberately feed dingoes;
- food and supplies should be stowed in vehicles or locked storage boxes to prevent dingoes gaining access;
- barbecues and cooking/eating utensils should be washed immediately after use;
- rubbish should be placed in bins immediately or stowed to prevent dingoes gaining access;
- ‘playing’ with dingoes can encourage them to bite people;
- actively discouraging dingoes from approaching humans is as important as not encouraging them;
- problem dingoes will be destroyed and inappropriate behaviour by visitors and residents (such as deliberate feeding and inappropriate rubbish storage) is the ultimate cause of their deaths.

This information will also be disseminated to privately-owned remote tourist establishments (and to the wider community) to inform them of the potential danger that dingoes pose to humans.

4.7.2 Landholder Responsibilities

Pastoral landholders are encouraged to monitor dingo activity regularly by recording where individuals and tracks are most frequently seen and where the highest levels of damage occur. Calving rates, sub-lethal calf damage and calf fatalities should also be recorded. Dingo control is to be conducted only in response to an observed increase in livestock damage and not as a routine preventative measure. As a general rule of thumb, dingo control should not be necessary until the proportion of damage calves exceeds 1-2 %. It should be conducted only where excessive damage is occurring (e.g. in the region of weaner paddocks and calving areas).

Landholders experiencing significant damage to livestock are required to contact the Parks and Wildlife Service to request baiting. Landholders will be interviewed by phone to assess the level of damage and to determine whether 1080 baiting is appropriate. Neighbouring landholders will be encouraged to synchronise baiting in order to enhance the effectiveness of the program and to minimise operational costs.

Landholders must supply the bait meat and on pastoral leases only, the landholder may be responsible for distributing the baits to agreed target areas identified in consultation with the attending Parks and Wildlife officer.

Landholders are responsible for advising neighbouring properties, communities and outstations of their intention to bait at least 5 days in advance. At the time baits are laid, signs must be displayed on all public roads throughout the baited area stating:

- (a) that 1080 baits have been laid for the purpose of dingo control and
- (b) the date they were laid.

Prior to baiting, landholders must complete and sign an indemnity form specifying the sites to be targeted, the number of baits to be laid, and declaring that baiting will be conducted according to the prescribed regulations. A pro forma is appended to the Parks and Wildlife Service Standard Operating Procedure (SOP) for using 1080 to control dingoes (and other wild dogs) in the Northern Territory.

Landholders are encouraged to provide ear tips from dingo carcasses for DNA analysis. This will help to assess the genetic status of the Northern Territory dingo population, a research priority identified in this management program.

4.8 Cooperation with Other Vertebrate Pest Management Jurisdictions

The Parks and Wildlife Service will foster cooperation between State, Territory and Commonwealth Governments, and other interested parties in ensuring that best-practice procedures are employed to manage the threat of dingoes to livestock while allowing the species to persist in the wild in the long-term. The Parks and Wildlife Service will assign an officer to represent the Northern Territory on the national Vertebrate Pest Committee.

4.9 Compliance with Current Northern Territory Legislation

4.9.1 Authorisation to Possess and Use 1080

Sodium monofluoroacetate (Compound 1080) is a Schedule 7 (S7) Restricted Chemical Product under the *Agricultural and Veterinary Chemicals (Control of Use) Act & Regulations* (2004). Its possession and use is restricted to persons authorised by the Chemicals Coordinator, Department of Primary Industries, Fisheries and Mines (DPIFM).

DPIFM issue a blanket authorisation to the Parks and Wildlife Service allowing its officers to use 1080 for the purpose of dingo control according to the Service's Standard Operating Procedure for Using 1080 to Control Dingoes (and Other Wild Dogs) in the Northern Territory. The authorisation is renewable annually upon receipt of a summary report from Service detailing 1080 usage for the previous year.

4.9.2 Training and Accreditation

The Parks and Wildlife Service will continue to offer a Dingo Control training program to officers involved in the use of 1080. These officers must also possess Certificate III ChemCert accreditation.

4.9.3 Permits

Taking, keeping and inter-state movement of dingoes is controlled by permits issued under the *Territory Parks and Wildlife Conservation Act 2000*. Conditions are included on permits, and permits will be cancelled by the Director, Biodiversity Conservation, if those conditions are breached.

4.9.4 Animal Welfare

The Parks and Wildlife Service will fulfil its obligations for dingo welfare as provided for under the *Territory Parks and Wildlife Conservation Act 2000* and the *Animal Welfare Act 1999*.

Research undertaken on dingoes in the Northern Territory will be subject to the approval of the Charles Darwin University Animal Ethics Committee.

4.10 Compliance with Aboriginal Customary Law and Mythology

An ongoing process of consultation and communication with Aboriginal land owners and managers will occur for the duration of the program. Historically, the management of dingoes in the Northern

Territory has disregarded the Aboriginal cultural sensitivities associated with the dingo. There are numerous documented sacred sites and “Dreaming” stories that relate to custodial and kinship relationships between dingoes and Aboriginal people and the killing of dingoes may have led to negative social and cultural repercussions (Paul Josif, Northern Land Council, pers. comm.). The Parks and Wildlife Service will consult with the relevant statutory authorities (e.g. Central Land Council, Northern Land Council) to develop a solution to this situation that is acceptable to all land owners. A possible option is to establish “dingo conservation zones” based primarily on the location of known dingo sacred sites and “Dreaming” trails. Other factors which might be considered are the genetic status (or level of hybridisation) of dingoes in the area, land tenure and land use. Dingo baiting would be restricted to areas outside these dingo conservation zones.

5. MONITORING AND RESEARCH

5.1 Monitoring

5.1.1 Operational Monitoring

Records will be maintained by the Parks and Wildlife Service, describing for each year the number of properties treated with 1080 baits for the purpose of dingo control, the total number of baits laid, the total number of targets, the total amount of poison used, and the costs associated with management. Ideally, operational monitoring should be used to assess the efficiency of the management program. However, this would require some measure of the number or proportion of dingoes killed per unit effort which, with existing levels of resourcing, is not possible over the typically vast area of a Northern Territory pastoral property. The lag time between bait ingestion and the onset of symptoms means that victims of 1080 baiting are rarely found.

5.1.2 Performance Monitoring

Pastoralists will be encouraged to conduct their own performance monitoring by routinely recording calving rate and the number of calves or weaners showing signs of damage (*i.e.* scarring, missing tissue). Comparing these rates before and after dingo management enables landholders to assess the effectiveness of their management actions which can be used as a basis for future management.

Follow-up interviews with a sample of pastoralists will be conducted after each baiting season to monitor the effectiveness of the management program on a regional basis. Interviews will be conducted verbally by Parks and Wildlife Service staff involved in the program and will include questions relating to the impacts of baiting not only on calf predation, but also on the abundance of dingoes and other pest animals such as hybrid dogs, rabbits, kangaroos, cats, foxes etc. The results of these interviews along with the findings of ongoing scientific research will be used to make improvements to the program as required.

Specific management measures will be monitored as per the milestone matrix in Appendix 1.

5.2 Research

Research needs will be prioritised and then carried out as resources allow. The following research priorities address gaps in current knowledge.

5.2.1 Evaluating the Interaction Between Dingoes, Their Prey and Subordinate Predators

There is a growing body of evidence to support the notion that the removal of the dingo from terrestrial ecosystems in Australia by human interference such as baiting, trapping and shooting can significantly affect ecosystem function. As top order predators, dingoes are likely to control the diversity of an ecological system by limiting populations of their prey and/or subordinate competitors. Thus, the removal of dingoes has the potential to severely affect species richness and abundance further down the food chain. For example, dingo removal may allow subordinate predator populations (e.g. feral cats and foxes) to increase and prey populations (e.g. red kangaroos, feral pigs and rabbits) may become overabundant and lead to overgrazing. There is considerable observational evidence throughout Australia that this phenomenon is indeed taking place but to date, it is backed by only a small body of scientific evidence.

The Australian Research Council has recently committed funding to increase the scientific understanding of trophic regulation by dingoes in Australia. The Parks and Wildlife Service is in full support of this project and will assist with the research where possible.

5.2.2 The Relationship Between 1080 Baiting, Dingo Abundance and Predation of Cattle

Currently in the Northern Territory, the relationship between dingo density and cattle predation, and the effects of 1080 baiting on this relationship are not well-documented. A recent study in central Australia has shown that during flush seasons, when alternative prey such as rabbits and red kangaroos are readily available, dingoes have little impact on cattle (Eldridge *et al.* 2003). Circumstantial evidence from elsewhere in Australia suggests that there are benefits in reducing the intensity of dingo management, and undertaking control measures only when and where necessary instead of on a routine basis. It is thought that this allows the managed population of dingoes to redevelop their natural system of male and female hierarchies which effectively limits both population growth and the process of hybridisation. It also allows dingoes to hunt cooperatively for preferred foods like kangaroo and rabbit.

The Parks and Wildlife Service will endeavour to further investigate this relationship in an effort to refine dingo management in the Northern Territory. The Parks and Wildlife Service will also support initiatives undertaken by research institutions, other land management agencies and indigenous organisations that aim to further investigate this relationship.

5.2.3 Genetic Assessment of Dingo Populations in the Northern Territory

Hybridisation with domestic dogs represents a significant threat to the long-term conservation of dingoes. For example, in the wild dog population of Australia's south-eastern highlands, the proportion of pure dingoes (based on skull morphometrics) has declined to approximately 17 % (Jones 1990). In the Northern Territory, hybridisation has occurred to a much lesser extent and pure dingoes remain common (Eldridge *et al.* 2003). However, if the issue of cross-breeding is not addressed, a decline in the proportion of pure dingoes in Northern Territory wild dog populations is inevitable.

The current genetic status of dingoes in the Northern Territory needs to be determined and compared with the results of previous taxonomic research to assess the threat of hybridisation to the long-term conservation of pure dingoes. Live dingoes cannot be accurately differentiated from hybrids in the field using physical characteristics such as coat colour. Genetic differentiation is also difficult, as dingoes and domestic dogs are closely related and there is little variation in their genetic material. Recently, however, researchers at the University of New South Wales have developed a relatively reliable method of using DNA material from skin or blood samples to assess

dingo purity (Wilton 2001). With further development, the technique could potentially be applied to scat and hair samples.

The Parks and Wildlife Service will develop a sampling program with the objective of collecting tissue samples from a representative group of Northern Territory dingoes. Samples will be analysed using the above technique (when perfected) to assess the current genetic status of dingoes in the Northern Territory. The Parks and Wildlife Service may implement additional management measures to protect wild populations of pure dingoes if hybridisation is identified as a threat to the survival of those pure dingo populations.

5.2.4 The Effect of Rabbit Calicivirus on Dingo Diet and the Predation of Livestock

The establishment of Rabbit Calicivirus (RCV) in central Australia caused rabbit density in the region to decline by 85 % (Edwards *et al.* 2002). Research will be conducted to build on previous dietary studies and determine how reduced rabbit availability has affected the diet of dingoes. All previous research has been carried out during periods of high rainfall, and there is a need for further research when conditions become drier. Particular emphasis will be placed on identifying post-RCV changes in the level of livestock predation.

5.2.5 The Suitability of Factory Manufactured Baits for Use in the Northern Territory

A manufactured 1080 bait product known as ‘Doggone’ has recently been registered for use in the Northern Territory. ‘Doggone’ is a shelf-stable (storable) meat-meal based product that is packaged with exactly the required lethal 1080 dose for wild dogs. Currently, the PWSNT Standard Operating Procedure for Using 1080 to Control Dingoes (and Other Wild Dogs) in the Northern Territory does not provide for its use. Fresh meat baits have been shown in the past to be significantly more effective in the Northern Territory than manufactured baits (Eldridge *et al.* 2000). However, manufactured baits require very little preparation and are therefore considerably easier and safer for users. As new products become available, it is important to test their suitability to Northern Territory conditions, and their potential to improve control programs where 1080 baiting is required. The Parks and Wildlife Service will evaluate the efficacy of the ‘Doggone’ product under local conditions.

5.2.6 Support of External Research and Development

PWSNT will support external research and development programs aimed at making wild dog control more humane and more effective, including the development of alternative toxicants.

6. REVIEW OF PROGRAM

A full review of the program, as required under Section 32(2) of the Territory Parks and Wildlife Conservation Act (2000), will be carried out at the end of five years from the date of approval of the management program (see Appendix 1). The progress of the management program will be reported as part of this review. The report will include, but not be limited to:

1. Changes to dingo management;
2. Any change in conservation status of the dingo in the Northern Territory;
3. Summaries of the results of the monitoring and research programs;

4. The number of properties baited, the number of targets baited and the total amount of poison used per year in the life of this program.

7. ACKNOWLEDGEMENTS

A draft of this program was circulated for public comment in 2004/5. The Parks and Wildlife Advisory Council of the Northern Territory made specific recommendations in regards to a later draft of the program in 2005 (Appendix 5).

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Appendix 1. Milestone matrix for the management program.

Milestone		Action Officer	Year				
			2006/7	2007/8	2008/9	2009/10	2010/11
1.	Evaluate management outcomes: <ul style="list-style-type: none"> Assess current status of wild dingo populations. Assess predation levels on livestock and native fauna. Assess the threat to humans posed by wild dogs on national parks and rural and remote communities. 	Senior Scientist, (Pest Management)	Annually				
2.	Assess genetic status of dingoes in the Northern Territory.	Scientific Officer (Pest Animal Management)			Dec 08		
3.	Monitor genetic status of Northern Territory dingoes through collection of skin/blood samples and skull measurement.	Scientific Officer (Pest Animal Management).	Ongoing				Dec 10
4.	Maintain support of AMRRIC dog health programs to slow the rate of hybridization between domestic dogs and dingoes around indigenous communities and outstations.	Scientific Officer (Pest Animal Management).	Ongoing				Dec 10
5.	Establish and maintain flow of information to stakeholders and the wider community.	Scientific Officer (Pest Animal Management); Regional Senior Wildlife Officers, W/life Operations.	Ongoing				Dec10
6.	Conduct further research to investigate the impacts of 1080 baiting, particularly during dry periods.	Scientific Officer (Pest Animal Management).					Dec 10
7.	Maintain Parks and Wildlife Service representation on the national Vertebrate Pest Committee.	Senior Scientist, (Pest Animal Management).	Ongoing				
8.	Report baiting statistics including the number of properties baited, the number of baits laid, the amount of poison used and total costs.	Regional Senior Wildlife Operations Officers	Annually				
9.	Conduct random landholder interviews to evaluate performance outcomes.	Regional Senior Wildlife Operations Officers	Annually				
10.	Monitor compliance with current Northern Territory legislation, policy and training requirements.	Regional Senior Wildlife Operations Officers	Ongoing				Dec 10
11.	Integrate the Aboriginal totemic and spiritual significance of the dingo into the management program in a manner acceptable to indigenous stakeholders.	Senior Scientist, (Fe Pest Animal Management).	Ongoing				
12.	Review of program.	Principal Scientist, Biodiversity Conservation					Dec 10

Appendix 2. Dingo baiting records from the Alice Springs region, 1983-2003.

Year	Number of Properties	Number of baits
1983	8	3776
1984	17	6039
1985	25	13758
1986	27	22159
1987	38	27204
1988	32	22337
1989	26	19373
1990	29	19039
1991	42	29056
1992	42	26249
1993	59	60953
1994	47	42243
1995	48	32088
1996	57	36213
1997	54	42925
1998	43	28594
1999	66	42250
2000	56	45080
2001	28	19125
2002	76	62951
2003	70	62329

Appendix 3. Dingo baiting records from the Katherine region, August 2002 – December 2003.

Year	Number of Properties	Number of baits
2002	29	25761
2003	62	40269

Appendix 4. Dingo baiting records from the Darwin region, 1983 - 2003.

Year	Number of Properties	Number of baits
1983	4	790
1984	12	3974
1985	16 (7 rural)	2564
1986	12 (3 rural)	3085
1987	15 (2 rural)	2583
1988	19 (3 rural)	2833
1989	36 (19 rural)	6209
1990	32 (12 rural)	6559
1991	25 (4 rural)	7850
1992	27 (5 rural)	5435
1993	26 (7 rural)	6643
1994	34 (12 rural)	4177
1995	37 (9 rural)	8617
1996	44 (10 rural)	8932
1997	36 (8 rural)	7430
1998	22 (6 rural)	4317
1999	29 (4 rural)	5418
2000	36 (5 rural)	9772
2001	27 (8 rural)	7519
2002	42 (5 rural)	9389
2003	31 (6 rural)	5401

Appendix 5. Characteristics of 1080

Properties

The chemical name for 1080 is sodium monofluoroacetate. It occurs naturally in several Australian native plants but it is also manufactured commercially as a pesticide. It is a white powder that is highly soluble in water and generally odourless and tasteless to humans. When mixed with water, the solution is colourless, although commercial manufacturers add purple dye to the powder to enable the solution to be easily identified. It is broken down by high temperature (>110°C) and naturally occurring bacteria and fungi. It therefore does not cause a build-up of toxic residues in soil, water or plants. Nevertheless, in dry areas, 1080 baits can form a dry outer skin that protects the 1080 inside the bait from degradation. Tests have shown that baits in this form can remain toxic for over 12 months after being laid. 1080 is registered as a Schedule 7 poison which means that its use is restricted to authorised Government officers.

Sensitivity of Animals to 1080

1080 is a broad-spectrum poison that interferes with an animal's ability to produce energy from food. Thus, poisoned animals are not able to meet their energy needs. There is a lag time between the ingestion of 1080 and the appearance of signs of poisoning. In mammals, this lag is between 0.5 and 20 hours. There is wide variation in the sensitivity of different animal groups (families) to 1080. Canids (dogs and foxes) are among the most sensitive, herbivores and birds are less sensitive, and reptiles, fish and amphibians are relatively insensitive to 1080. The Lethal Dose 50 (LD₅₀) is the most common measure of toxicity. This equates to the amount of toxin (mg) per kg body mass required to kill 50% of test animals. Following is a list of LD₅₀ values for some common species, illustrating that dogs and foxes are very susceptible.

Species	LD ₅₀ (mg/kg body mass)	Average adult body mass (kg)	Amount for LD ₅₀ (mg)
Dog	0.11	14.5	1.6
Fox	0.12	6.5	0.78
Cat	0.35	4.4	1.54
Rabbit	0.4	1.6	0.64
Cattle	0.4	450	180
Pig	1.02	55	56.1
Human	2	80	160
Wedge-tailed eagle	9.1	4.85	44.14
Crow	12.8	0.38	4.86

First Aid in the Case of Accidental 1080 Poisoning

Dingo baits contain 6 mg of 1080 and are relatively safe to humans. However, they are lethal to pet and working dogs. Early symptoms of 1080 poisoning in dogs include disorientation, restlessness, hyperactivity, aggression, running around in circles, howling and barking. Symptoms of advanced 1080 toxicosis include rapid and laboured breathing, tremors and muscle spasms, and convulsions. There is limited treatment for 1080 poisoning in dogs as there is no known antidote. However, there are a range of treatments that will aid recovery but early action is vital. Every precaution must be taken to prevent domestic dogs from coming into contact with poison baits. Dogs should be tied up while baits are being prepared and baits should not be laid within a dog's normal roaming distance. Only early action will save a poisoned dog. Poisoned dogs should be made to vomit immediately. This can be done by placing one or two crystals of washing soda or half a teaspoon of salt down the dog's throat. The dog should then be taken to a vet immediately.

Appendix 6. Comments on the draft plan made by the Parks and Wildlife Advisory Council of the Northern Territory and the place where the issues were addressed in the revised plan.

Comment	Where addressed in plan
Need for a precautionary approach to baiting while scientific basis for decision making is improved	Section 3.6
Need to incorporate indigenous perspectives on dingo management issues	Sections 2, 3.10
Need to improve scientific knowledge on: <ul style="list-style-type: none"> • ecological role of dingoes • role of intactness of dingo packs in slowing hybridisation • impacts of baiting on non-target species, cattle losses and other feral animals 	Section 4.2.3 Section 4.2.1 Section 4.2.2
Need to develop better and more accurate data on impacts of dingoes on stock	Section 4.1.2
Biological and ecological information needs to be at the beginning of the document	Sections 2.1-2.8
Objectives and Management Measures should be presented in order of importance, with conservation objectives and measures listed before impact management objectives and measures.	Sections 3 and 4.