National Multi-species Recovery Plan
for the

Partridge Pigeon [eastern subspecies] *Geophaps smithii smithii*;

Crested Shrike-tit [northern (sub)species] *Falcunculus (frontatus) whitei*;

Masked Owl [north Australian mainland subspecies] *Tyto novaehollandiae kimberli*; and

Masked Owl [Tiwi Islands subspecies] *Tyto novaehollandiae melvillensis*,

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Cover photo
Northern Shrike-tit, Yinberrie Hills, Northern Territory (photo: Don Franklin)

CONTENTS

SUMMARY

This Recovery Plan describes the status and ecology of, and management requirements for, four threatened bird taxa, the Tiwi masked owl *Tyto novaehollandiae melvillensis*, the north Australian mainland subspecies of masked owl *T. n. kimberli*, the northern (crested) shrike-tit *Falcunculus (frontatus) whitei* and the eastern subspecies of partridge pigeon *Geophaps smithii smithii*. All four taxa are restricted to northern Australia, and occur predominantly in eucalypt open forests and savanna woodlands. There are some important commonalities and important differences in ecology and conservation issues among the four taxa. Knowledge of three of the taxa (the two masked owl subspecies and the northern shrike-tit) is rudimentary, and inadequate to define in any detail priorities for recovery management. The partridge pigeon has probably declined substantially, most likely because of altered fire regimes. Over a broad-scale, it may also be detrimentally affected by the spread of exotic pasture plants, predation by feral cats, and the impacts upon vegetation of grazing by livestock and feral stock. It is possible that masked owls have also been affected by these factors that have pervasively altered north Australian landscapes: in particular, they may have suffered resource depletion through broad-scale decline of native mammals and decrease in the number of large hollow-bearing trees (although there is little direct supportive evidence of the latter). There is no convincing evidence of historic change in the status of northern shrike-tit, but it is conceivable that it too has been affected by landscape-scale change due to the effects of altered fire regimes and pastoralism. In addition to these responses to pervasive change, all taxa may suffer local losses through current and proposed vegetation clearance and land-use intensification.

This Recovery Plan describes a series of actions aimed at enhancing the status of all four taxa (and a broad range of co-occurring native plants and animals). These actions comprise the establishment of a coordinating body that assists with the enhanced management and recovery of north Australian threatened species; clearly targeted research and surveys that aim to increase the current limited knowledge base to a level adequate for appropriately informed management; and the immediate implementation of specific management actions. These latter include actions to improve fire management, to minimise risks and/or impacts associated with intensification of land-use, and to improve regulation relating to the use of invasive exotic pasture plants.

PART A: SPECIES INFORMATION AND GENERAL REQUIREMENTS

Introduction

This recovery plan considers four bird taxa largely restricted to open forests and woodlands of tropical northern Australia. This multi-species plan recognises some commonalities in threats facing these taxa, and in management responses, but there are clearly also very distinct differences among the taxa.

Packaging these taxa together in one Recovery Plan is one approach to seeking to improve conservation management in northern Australia. It is recognised that other approaches may also have been suitable for the taxa considered here: for example single species recovery plans for the partridge pigeon (including also the subspecies *blaauwi* from north-western Australia, not considered here), for the crested shrike-tit (including the subspecies *frontatus* and *leucogaster* from south-eastern and south-western Australia respectively) and for masked owl (including the subspecies *novaehollandiae* and *castanops* from southern and eastern Australia). Such plans may have had more internal homogeneity, but at the expense of a less clear focus on regional conservation issues that affect a range of bird taxa. Another alternative may have been for an even more inclusive multi-species plan for northern Australian threatened birds more generally, but such may have proven too unwieldy.

Descriptions

The northern shrike-tit forms part of the highly distinctive crested shrike-tit superspecies. The shrike-tit is an arboreal, medium sized bird, with striking black and white markings, and black crest, on the head, with the body green above and yellow below. The bill is conspicuously deep, strong and hooked. The northern shrike-tit is notably smaller than the two other shrike-tit subspecies.

The partridge pigeon is a terrestrial, generally dull-coloured dumpy medium-small pigeon (weight *ca*. 200g), with the most distinctive feature being a patch of brightly-coloured bare skin around the eye. This is red in the eastern subspecies *G. smithii smithii* and yellow in the western subspecies *G. s. blaauwi*. Both subspecies also have a prominent white patch on the underwing that is conspicuous when the bird is in flight.

The masked owl is a large (males *ca* 600 g., females *ca*. 1 kg.) owl with prominent heart-shaped facial disc, with plumage highly patterned by speckling, and generally darker on the back and paler below. Compared to two other species of *Tyto* owls in northern Australia, the grass owl *T. capensis* and barn owl *T. alba*, its legs are conspicuously well feathered and its claws and feet large and strong. The northern Australian subspecies *T. novaehollandiae kimberli* and *T. n. melvillensis* are smaller than other Australian subspecies.

Taxonomy

The taxonomic status of the northern shrike-tit has been unstable since its discovery. The most recent treatment is that of Schodde and Mason (1999) who recognised it as a distinct species *Falcunculus whitei* Campbell, 1910. Other recent accounts (e.g. Christidis and Boles 1994; Johnstone 2001; Higgins and Peter 2002) have retained the marginally more traditional view that it is a well-marked (and geographically isolated) subspecies of the crested shrike-tit *F. frontatus*. Its specific or subspecific categorisation is a line-ball call, reflected here in the use of the equivocating *Falcunculus (frontatus) whitei*.

There are two well-marked subspecies of partridge pigeon *Geophaps smithii* (Jardine and Selby, 1830), conventionally labelled the western *G. s. blaauwi* and eastern *G. s. smithii* subspecies. The taxonomic status of these subspecies and the species as a whole is well-established. Although there has been some uncertainty about the generic relationship of the partridge pigeon (e.g. Christidis and Boles 1994), the current nomenclature is now widely accepted.

The masked owl *Tyto novaehollandiae* (Stephens, 1826) is a well-defined species, with a highly fragmented distribution including south-western Australia, Tasmania, south-eastern and eastern Australia, north-eastern Queensland, the monsoonal tropics of the north of the Northern Territory and Kimberley, and southern New Guinea (Higgins 1999). Populations on islands off New Guinea (e.g. Tanimbar, Buru and Manus) have sometimes been included within *T. novaehollandiae*, but are now generally recognised as specifically distinct (Higgins 1999). Within Australia, four or five subspecies are recognised: *T. n. novaehollandiae* from south-western Australia and south-eastern Australia as far north as south-eastern Queensland; *T .n. castanops* from Tasmania; *T .n. kimberli* from mainland northern Australia; and *T. n. melvillensis* from the Tiwi Islands, Northern Territory: some sources (e.g. Mason 1983; Schodde and Mason 1997) treat populations on Cape York Peninsula as another subspecies *T. n. galei*, distinct from *T. n. kimberli*, but this treatment is contested (Higgins 1999). There are few specimens of *T. n. melvillensis*, but the most substantial recent treatment (Schodde and Mason 1997) maintains its recognition as a validly distinct subspecies.

Conservation Status

As at March 2004,

the northern shrike-tit *Falcunculus (frontatus) whitei* is listed as:

- *Vulnerable* in Australia, under the *EPBCA*;
- *Data Deficient* in the Northern Territory, under regulations of the *Territory Parks and Wildlife Act 2000*;
- *Fauna that is rare or likely to become extinct* in Western Australia, under the *Wildlife Conservation Act 1950*, in the Wildlife Conservation (Specially Protected Fauna) Notice 2003.

It was classified as *Endangered* in the Action Plan for Australian Birds (Garnett and Crowley 2000).

the eastern subspecies of partridge pigeon *Geophaps smithii smithii* is listed as:

- *Vulnerable* in Australia, under the *EPBCA*;
- *Near Threatened* in the Northern Territory, under regulations of the *Territory Parks and Wildlife Act 2000*.

It was classified as *Near Threatened* in the Action Plan for Australian Birds (Garnett and Crowley 2000). Johnstone and Storr (1998) regarded this subspecies as "Extinct" in Western Australia.

the Tiwi Islands subspecies of masked owl *Tyto novaehollandiae melvillensis* is listed as:

- *Vulnerable* in Australia, under the *EPBCA*;
- *Endangered* in the Northern Territory, under regulations of the *Territory Parks and Wildlife Act 2000* (by the IUCN criteria C2a - population size estimated at <2500 mature individuals, an inferred or projected population decline, and at least 95% of mature individuals within one subpopulation);

It was classified as *Endangered* in the Action Plan for Australian Birds (Garnett and Crowley 2000).

the north Australian mainland subspecies of masked owl *Tyto novaehollandiae kimberli* is listed as:

- *Vulnerable* in Australia, under the *EPBCA*;
- *Near Threatened* in the Northern Territory, under regulations of the *Territory Parks and Wildlife Act 2000*;
- *Vulnerable* in Queensland, under the *Queensland Nature Conservation Act 1992*;

It was classified as *Near Threatened* in the Action Plan for Australian Birds (Garnett and Crowley 2000).

In each case, the NT status is based on evaluations made in 2003, using the IUCN Red List Categories version 3.1. (IUCN 2001). The national status typically follows assessments made prior to 2000.

Affected interests

The primary affected interests for all four taxa are the Australian and State/Territory conservation agencies, and particularly that of the Northern Territory, in which the bulk of the range for all four taxa occurs.

The ranges of all four taxa fall largely on pastoral leasehold lands and Aboriginal freehold lands, with smaller areas included within military training areas (managed by the Department of Defence), and conservation reserves (including Kakadu NP, co-managed by Parks Australia North). The eastern subspecies of partridge pigeon occurs in the peri-urban area around Darwin, where there is increasing land development for horticulture and rural residential estates.

None of the species is commercially exploited.

On Melville Island, the Tiwi Masked Owl occurs in sites in or around a developing major forestry venture that replaces native vegetation with short-rotation exotic plantation species (Woinarski *et al*. 2003ab). To a degree uncertain because of limited sampling, some or all or the taxa occur on lands devoted primarily to mining.

One such instance is the presence of partridge pigeons on the uranium leases of Ranger and Jabiluka enclosed within Kakadu NP.

Role and interests of indigenous people

As noted in the above section, much of the range of all four taxa occurs on Aboriginal lands. Although masked owls are known and named within many Aboriginal cultures (e.g. Puruntatameri *et al*. 2001), no special significance has been attributed to them across the published ethnobiological literature. There has been no published information on any indigenous knowledge of, or significance attributed to, the northern shrike-tit.

In contrast, the partridge pigeon is well-known by Aboriginal groups on whose land it occurs: it is a conspicuous, locally abundant, distinctive, ground-dwelling, moderately large, diurnal bird, offering a reasonable food resource. The best documentation of this interest is in Kakadu NP, where partridge pigeons (known as *Raagu* in Gagudju language; or "red-eye pigeon" colloquially) is regarded as an indicator of seasons and burning regimes. In Kakadu NP, Fraser *et al*. (2003) used a cross-cultural study to examine the response of partridge pigeons to fire regimes, and suggested that traditional fine-scale landscape burning by Aboriginal people provided the most suitable habitat for this species. On the Tiwi Islands, Northern Territory, Tiwi Aboriginal people know the partridge pigeon as *Mapulinka*, "the same Tiwi name as the Emerald Dove, (although) these pigeons are recognised as quite distinct. The flesh of these birds can be eaten after roasting. In the past they were hunted with wooden implements and traps, more recent hunting involves shot-guns or using a slingshot, the latter being used mostly by children" (Puruntatameri *et al*. 2001).

Benefits to other species

The four taxa considered here share similarities mostly in the habitat and geographic range occupied, but contrast conspicuously in their ecology and resource requirements. The main collateral benefit of improved management for these four taxa will be for the biodiversity in tropical eucalypt forests and savanna woodlands generally. This may be particularly so where fire management is improved.

The partridge pigeon may be an exemplar of a large suite of granivorous birds that have declined, and continue to decline, across much of northern Australia (Franklin 1999; Garnett and Crowley 2000; Woinarski and Catterall 2004). It is likely that land management actions implemented to improve habitat suitability (and/or reduce predation by feral cats) for partridge pigeons would also benefit many other co-occurring granivorous birds, particularly including chestnut-backed button-quail *Turnix catanota*, masked finch *Poephila personata*, long-tailed finch *P. acuticauda*, the endangered gouldian finch *Erythrura gouldiae* and hooded parrot *Psephotus dissimilis*. Such action would probably also benefit a range of northern Australian terrestrial small and medium-sized mammal species, whose decline has coincided with that of the partridge pigeon and has probably likewise been associated, at least in part, with changed fire regimes (Woinarski *et al.* 2001, 2004; Pardon *et al*. 2003).

Management to enhance habitat suitability for masked owls may benefit the many other hollow-dependent species in northern Australia (Taylor *et al*. 2003), including red-tailed black-cockatoo *Calyptorhynchus banksii*, sulphur-crested cockatoo *Cacatua galerita*, dollarbird *Eurystomus orientalis*, common brushtailed possum *Trichosurus vulpecula* and black-footed tree-rat *Mesembriomys gouldii*.

Social and economic impacts

There are no clearcut and tightly defined social and economic impacts associated with this Recovery Plan. Much of the distribution of these four taxa is on Aboriginal land. Research on, and management of, these species may provide some limited contributions to these local economies. Fraser *et al*. (2003) demonstrated that there may be much scope for Aboriginal involvement in recovery actions for the partridge pigeons, and that traditional Aboriginal fire management may be important for this species.

At least two (partridge pigeon and Tiwi masked owl) of the four taxa have some distributional overlap or convergence with large mining or forestry operations. Conservation management for the species may come at some costs to these ventures, but such costs are generally likely to be low because the disturbances are generally not on lands that provide high quality habitat to these species. A possible exception is for the Tiwi masked owl and partridge pigeon on Melville Island, where forestry development is occurring on lands with high suitability for these taxa.

PART B: DISTRIBUTION AND HABITAT

Distribution

The four taxa considered here are restricted to open forests and savanna woodlands of northern Australia.

The most circumscribed distribution is that of the Tiwi masked owl, which is known only from the paired Tiwi islands of Bathurst (1693 km^2) and Melville (5788 km^2) (Fig. 1). Woinarski *et al*. (2003a) provided some more detailed information on its range on these islands, noting it to be reasonably widespread on both islands, particularly in the higher rainfall areas of north-west Melville Island, where eucalypt forests are tallest and there are many small patches of monsoon rainforest.

The distribution of the mainland north Australian masked owl subspecies *T. n. kimberli* is very imperfectly known, with remarkably few records across its broad range (Fig. 2). Based on compilation of records from 1998-2002, the New Atlas of Australian Birds (Barrett *et al*. 2003) reported it from only one $1/4^o$ grid cell (from a total of about 130) in northern Western Australia, two (of a total of about 320) in the Top End of the Northern Territory, one on the Barkly Tableland, and five in northern Queensland. The circumscription of this distribution is confused by (i) a number of dubious or at least unconfirmed records away from its main range (Higgins 1999), such as on the south-west of Cape York Peninsula and in semi-arid Northern Territory; and (ii) whether or not the northeast Cape York Peninsula population is recognised as subspecifically distinct. Curiously, the most authoritative recent source (Higgins 1999) does not include the Kimberley within its mapped range. Recognising the shortcomings in survey information, the current range can be considered to include the north and north-west coastal Kimberley, from Cambridge Gulf south-west to Yampi Sound, including Augustus Island (Johnstone and Storr 1998); the Top End of the Northern Territory, including Cobourg Peninsula, extending south to around Katherine (Storr 1977), with a handful of isolated records from further south, including Jasper Gorge (the Victoria River District), McArthur River station, and Avon Downs (Barkly Tablelands) (Storr 1977; Higgins 1999; Barrett *et al*. 2003); north-eastern Queensland, including a few early records from north-eastern Cape York Peninsula (Archer-Watson Rivers) (the putative subspecies *T. n. galei*), with a broader distribution centred on Townsville (extending as far north as Mt Molloy and as far south-east as an early twentieth century record at Coomooboolaroo: Barnard 1925) (Higgins 1999; Barrett *et al*. 2003). There is little information on trends in population or range, but there have been no recent records near the historic inland central Queensland record (Woinarski and Catterall 2004), and the subspecies is thought to have declined in the Wet Tropics (Nielsen 1996).

The eastern subspecies of partridge pigeon *G. s. smithii* is now largely restricted to the north-west Top End of the Northern Territory, in an area bounded from the Yinberrie Hills (about 50 km N of Katherine) in the South Litchfield NP in the west, Kakadu NP in the east and the Tiwi Islands in the north, with smaller scattered populations elsewhere in the Top End (Fig. 3). Its range formerly extended into lower rainfall areas as far south-east as the McArthur River near Borroloola and as far west as the extreme east Kimberley (Keep River drainage) (Storr 1977; Higgins and Davies 1996; Fraser 2000b). Storr (1977) noted that there were "no recent records from the Keep, Victoria, lower Daly, Katherine, King, Roper and McArthur drainages".

Earlier claims of the distribution extending to Queensland (Laura-Cooktown area) are in error (Higgins and Davies 1996), although persistent in the literature (e.g. Johnstone and Storr 1998).

The distribution of the northern shrike-tit is very imprecisely known, largely because of the sparsity of records. In a review of its status, Robinson and Woinarski (1992) could locate only 26 records (from 22 sites) of this taxon. There have been a trickle of records since (e.g. Robinson *et al*. 1992; Franklin *et al*. 1997; Higgins and Peter 2002). The new Atlas of Australian birds (Barrett *et al*. 2003) reported northern shrike-tits from three 1/4^{o} grid cells in northern Western Australia and five in the Top End of the Northern Territory. Recognising the limitations imposed by these records, the current range is considered to include much of the Top End of the Northern Territory and Kimberley extending from the McArthur River in the far south-east (although with no records from that region since 1914) to near Derby in the west Kimberley (Fig. 4). Most recent records are from south and west of Katherine and near Derby. There are no records from the relatively well-surveyed high rainfall areas around Darwin, the Cobourg Peninsula and Tiwi Islands, suggesting that it is probably absent from the taller forests in this area.

Habitat critical to the survival of the species

The limited amount of ecological information available prevents any tight definition of critical habitat for these taxa. The Tiwi masked owl appears to be most abundant in tall eucalypt open forests, in which tree hollows are relatively plentiful (Woinarski *et al*. 2003a). There are too few records of the northern Australian mainland subspecies of masked owl to characterise habitat, but it too is dependent on tree hollows.

Within its preferred open forests with grassy understorey, the partridge pigeon may require an intricately burnt mosaic (Fraser *et al*. 2003).

No clear habitat preference has been described for the northern shrike-tit: it has been reported in a wide range of eucalypt open forests and woodlands, and, less commonly, in a woodlands dominated by *Terminalia* and *Melaleuca* species (Robinson and Woinarski 1992; Holmes and Noske 1990; Higgins and Peter 2002).

Mapping of habitat critical to the survival of the species

Not applicable.

Important populations

For the Tiwi masked owl, the (probably single panmictic) population on the Tiwi Islands is, by default, an important population.

For the north Australian mainland subspecies of masked owl, no particular (sub-)population is unarguably peerlessly significant. However, the isolated population on north-eastern Cape York Peninsula may be considered important, because it is possibly morphologically distinctive (perhaps to subspecific level).

For the eastern subspecies of partridge pigeons, the Tiwi Island population may be significant because it may be unusually abundant there, and because its isolation on these islands may provide it some refuge from at least some threatening processes operating on the mainland. The population within Kakadu NP may be important because it is a high profile species there, and a focal species for the implementation of fire management.

For the northern shrike-tit, sites near Derby in the west Kimberley and in an area around 100 km west and south of Katherine have produced most records of this bird over the last few decades, suggesting that they may be unusually abundant in these locations.

PART C: KNOWN AND POTENTIAL THREATS

Biology and ecology relevant to threatening processes

Masked Owls

For the masked owl (both subspecies), the main ecological features relevant to management are (i) a large home range (and hence low population density); (ii) requirements for large trees with large hollows for nesting; and (iii) diet largely comprising mammals.

There are no data on population density nor home range size for either *T. n. kimberli* or *T. n. melvillensis*, but the subspecies *T. n. novaehollandiae* in coastal south-eastern Australia occupies home ranges of about 5-10 km^2 (Kavanagh and Murray 1996). This may suggest that large areas of intact forest are needed to support viable populations, although *T. n. kimberli* is known to hunt over cleared areas and sugar cane plantations (Garnett and Crowley 2000).

There are no substantial data to suggest that large hollow-earing trees are limiting in northern Australia. However, one study in tall eucalypt forests and woodlands near Darwin (Pittman 2003) found that the population of common brushtail possums *Trichosurus vulpecula* and black-footed tree-rats *Mesembriomys gouldii* was near a carrying capacity imposed by hollow availability, and that possums monopolised hollows particularly in woodland fragments. Trends to increased frequency, intensity and scale of fires over the last 50 or so years, and in part more recently magnified by invasion of exotic pasture grasses, have probably resulted in declines in the number of the largest eucalypt trees, especially where these were extensively hollowed (Williams *et al*. 1999, 2003).

There is some evidence for a broad-scale decline in native small and medium-sized mammals across much of northern Australia over the last century (Winter and Allison 1980; Woinarski *et al*. 2001; Sattler and Creighton 2002; Pardon *et al*. 2003). If so, this may have reduced food availability for masked owls. More acutely, in parts of the Queensland range (particularly around horticultural areas) the broad-scale application of the rodenticide Klerat may have led directly to mortality of masked owls (Nielsen 1996; Young and De Lai 1997), although the link is unproven (Garnett and Crowley 2000). This pesticide is now banned (Garnett and Crowley 2000).

Partridge Pigeon

Many granivorous birds are known to have declined extensively across northern Australia (Franklin 1999), largely because this resource has been affected by vegetation change caused by altered fire regimes, grazing by livestock and incursions by exotic weed species (particularly pasture grasses). For granivorous animals, the most critical resource changes appear to be related to spatial heterogeneity, with seed resources most likely to be available year-round if the consumer can access a broader range of variability (such as that created or enhanced by fine-scale burning) (Fraser 2000ab; Fraser *et al*. 2003; Woinarski *et al*. in press, *a*). Seed availability is also affected by changes in phenology, vegetation structure and floristic composition, with each of these capable of being affected by imposed fire regimes, grazing and the occurrence of exotic plants (Crowley and Garnett 1999, 2001; Woinarski *et al*. in press, *a*).

For the partridge pigeon, the effects of changed fire regimes, invasion by exotic grasses, and prevalence of livestock and feral stock are compounded: not only do these factors change the abundance, timing and spatial pattern of food resources, but they may also directly affect reproductive output. The partridge pigeon nests on the ground, typically with simple scrape nests placed within or around clumps of grass. The nesting period is in the early dry season, a time when fires are prevalent, and the cured grass is highly flammable. Increased frequency or extent of fires in this season is likely to result in increased mortality of eggs and/or young.

But partridge pigeons are also disadvantaged by the absence of fire. Where unburnt, the very dense tall grass layer characteristic of open forests in northern Australia makes movement for ground-feeding vertebrates difficult, and reduces accessibility to food resources (Woinarski 1990).

Given these complex and partly contradictory responses to fire, the best fire regime for partridge pigeons appears to be one of fine-scale patchiness, where burnt and unburnt areas are juxtaposed at the scale of an individual pigeon's home-range (Fraser 2000; Fraser *et al*. 2003).

Partridge pigeons spend almost all of their time on the ground, not only for foraging and nesting but also for roosting at night. This renders them particularly susceptible to introduced predators (dogs and cats), and it is highly likely that populations have suffered increased predation since the arrival of at least cats in northern Australia over the last 150 years. This predation impact may be compounded where fire regimes are now characterised by more extensive intense fires, that result in the absence of ground-layer vegetation over large areas. In the only study of such a situation in northern Australian open forests, Oakwood (2000) found that predation upon the ground-feeding northern quolls *Dasyurus hallucatus* was greatly increased in the months following extensive fire. Such impacts are likely to be more extreme for the partridge pigeon, given its night-time roosting on the ground, unprotected by such shelters as hollow logs or rock crevices used by northern quolls.

Recent studies in the Top End of the Northern Territory have documented the rapid spread of exotic pasture grasses away from their points of introduction into native open forests and woodlands, even including conservation reserves (e.g. Kean and Price 2003). These grasses replace native species (hence affecting food resources available for granivores such as partridge pigeons), but perhaps even more importantly they greatly increase the fuel load, typically leading to fire intensities about an order of magnitude greater than that typical with native grass understories (Rossiter *et al*. 2003).

These more catastrophic fires are likely to create a less heterogeneous understorey, with far more extensive uniform burnt areas, thereby reducing reproduction and survivorship of partridge pigeons.

In contrast to this generally dismal recent environmental change, partridge pigeons may derive some, perhaps minor, benefit from the invasion of cane toads (*Bufo marinus*) into their north Australian range. Cane toads are likely to reduce the numbers of goannas, snakes, quolls and some other predators, and hence reduce the total predation pressure on partridge pigeons. While this may represent some benefit to this particular threatened species, the detrimental impacts of cane toads on Australian fauna overall far outweigh such benefits, and a broad range of measures are in place or proposed to mitigate the spread of toads.

Northern Shrike-tit

Other than a few notes based on brief observations (e.g. Sedgwick 1988; Holmes and Noske 1990; Robinson *et al*. 1992; Franklin *et al*. 1997), there is almost nothing known of the ecology of the northern shrike-tit. The crested shrike-tits of south-eastern Australia characteristically forage for invertebrates in and under the decorticating bark of eucalypt trees (Higgins and Peter 2002), but this microhabitat is not available in the eucalypt forests and savanna woodlands of northern Australia. Instead, the northern shrike-tit appears to forage, for invertebrates, mostly in foliage, branches, the trunk and bark across a range of eucalypt and other tree species. There are no data to suggest that the availability of foliage invertebrates has changed in northern Australia over the last century. The scarcity of records of northern shrike-tits suggests that populations are at very low density. Notes accompanying the brief observational records suggest that the species typically occurs in small groups (2-5 individuals), with these probably occupying a large home range (Robinson and Woinarski 1992). In other subspecies of crested shrike-tit, this large home range has led to it being particularly susceptible to habitat fragmentation, and unlikely to survive in smaller remnants (Higgins and Peter 2002). Nests are placed high in tree foliage (Higgins and Peter 2002), and are probably unaffected by all but the most intense of fires.

Identification of threats

All four taxa are affected by broad-scale environmental changes, fueled by altered fire regimes, grazing by livestock and feral animals, and invasion of native woodlands by exotic plants, particularly introduced pasture grasses. The relative impacts and intensity of these factors vary across northern Australia, in relation to land use, land ownership, human population density and availability of management resources (e.g. Yibarbuk *et al*. 2001; Bowman *et al*. 2001; Woinarski and Ash 2002). In almost all parts of northern Australia, the very limited current management resources available are insufficient to halt this broad-scale degradation (e.g. Sattler and Creighton 2002).

These pervasive environmental changes affect the four taxa in various ways. Food resources have changed in abundance and/or year-round availability. For example, a decline in small mammals may have contributed to a decline in the abundance of masked owls; changes in grass species composition may have increased the seasonal nadir in seed availability characteristic of the wet-dry tropics (Crowley and Garnett 1999, 2001; Woinarski *et al*. in press), and hence contributed to a decline in the abundance of partridge pigeons.

In addition to these broad-scale threats, localised more acute factors affect some populations of some of these taxa. Increasing levels of land clearing may reduce the extent of suitable habitat for at least some of these four taxa on the Tiwi Islands, Darwin-Daly area, central Queensland, and possible east and south-west Kimberley.

Feral cats may prey on the almost entirely terrestrial partridge pigeon.

Populations and Areas under threat

With the exception of acute changes associated with (i) land-clearing, particularly on the Tiwi Islands (affecting the Tiwi masked owl *T. n. melvillensis* and the partridge pigeon *G. s. smithii*), around Darwin and the Daly catchment (affecting *T. n. kimberli*, *G. s. smithii* and possibly *F. (frontatus) whitei*), and in north-eastern Queensland (affecting *T. n. kimberli*), and (ii) possible poisoning through local use of the rodenticide Klerat (affecting *T. n. kimberli*), most factors threatening these four taxa are pervasive and insidious. These broad-scale factors leading to environmental change (through altered fire regimes, invasion by weeds and grazing by livestock and feral stock) affect all four taxa across their entire range.

PART D: RECOVERY OBJECTIVES, CRITERIA, ACTIONS AND COSTS

1. **Enhance communication about the status of these taxa, through the establishment and operation of a Recovery Team, or some other appropriate forum, of interested stakeholders**

Objective
To better communicate information about these taxa amongst interested stakeholders, and coordinate the implementation of recovery planning.

Because the factors affecting these taxa operate predominantly across tenures and jurisdictions, effective management and recovery can only happen through coordination and integration of actions across very large areas. Note that this argument applies as validly for a range of other plant, mammal and bird species (at least) across northern Australia (e.g. Woinarski 2004), so there may be merit in widening a "Recovery Team" to an ongoing forum on biodiversity conservation management and priorities for northern Australia as a whole.

Criteria
- formation and operation of a Recovery Team and/or ongoing forum that includes representation of stakeholder groups;
- high levels of awareness of the threatened status of these taxa amongst stakeholder groups, and substantial involvement of those groups in recovery management.

Action 1.1. Establish and operate a Recovery Team or regular forum or alliance to assist in the coordination of management actions.

The most effective and efficient procedure to implement recovery would be to establish an ongoing coordination group that considers priorities for threatened species actions across northern Australia, that promotes and oversees relevant research, that communicates appropriately to all stakeholders, that monitors trends in status and responses to management actions, and that integrates recovery management. There is no such body at present, although there is some such coordination (albeit mostly for different issues) through the Tropical Savannas Management Cooperative Research Centre, and there are parallels with the North Australian Fire Management group (which holds annual workshops) and the North Australian Indigenous Land and Sea Management Alliance (NAILSMA).

cost ($000)

activity	**2004**	**2005**	**2006**	**2007**	**2008**
operate Recovery Team, alliance or regular forum	30	20	20	20	20

2. **Undertake research studies necessary to more clearly establish the status of these taxa, the impacts of putative threats, and to prioritise recovery management actions.**

Objective
To increase, to a level adequate for informed and effective management, knowledge of the total population, population trends, distribution, habitat suitability, susceptibility to threatening processes, and prioritisation for actions for each of the four taxa.

For each taxon considered the available information on population size, distribution, trends in status, habitat requirements and response to putative threatening processes is fragmentary and insufficient to guide prioritisation of management responses with confidence.

Criterion
- Knowledge gained will be sufficient to substantially refine management priorities and guidelines

Action 2.1. Assess population size, distribution and habitat requirements for the masked owl subspecies T. n. kimberli *and* T. n. melvillensis.

Playback of calls has recently been used successfully to census for *T. n. melvillensis* on the Tiwi Islands (Woinarski *et al*. 2003), and is likely to be similarly effective for *T. n. kimberli* on the north Australian mainland. There has been no previous broad-scale sampling for these taxa using such survey methods, and this action proposes to sample systematically for masked owls across northern Australia in order to clarify habitat preference, population size, distribution, and relationship of these characteristics to land use, fire regimes and other possible impacts.

cost ($000)

activity	2004	2005	2006	2007	2008
broad-scale survey and identification of environmental relationships for masked owls across northern Australia	5	40	10	0	0

Action 2.2. Assess population size, distribution and habitat requirements for the northern shrike-tit

The northern shrike-tit is a notoriously difficult bird to locate and survey, and there has been no ecological research focusing on this bird. The research actions considered appropriate are (i) a 12-month intensive autecological study of one known population; then (ii) with this knowledge, undertake a broad-scale survey to define its range, habitat associations, population, and response to land management.

cost ($000)

activity	2004	2005	2006	2007	2008
targeted ecological study of at least one known population of northern shrike-tit	0	60	10	0	0
broad-scale survey of distribution, abundance, habitat and response to management for northern shrike-tit	0	10	70	20	0

Action 2.3. Undertake targeted studies to (i) examine the extent of distributional contraction of partridge pigeons, and (ii) evaluate the relative significance of putative threatening processes (invasion of exotic pasture grasses, predation by feral cats, fire regimes).

The partridge pigeon is thought to have contracted substantially in distribution, but there has been no intensive recent searches for the species in that part of its historic range for which there have been no recent records (notably the Gulf Falls and Uplands and Gulf Coastal bioregions: McArthur River area). The study proposed would work collaboratively with Aboriginal landholders in this area to survey for this species, to chronicle the history of its decline (if any), and to identify probable causes for that decline.

The other component of this program involves targeted ecological studies to quantify the relative individual and compounded impacts of putative threatening processes.

cost ($000)

activity	2004	2005	2006	2007	2008
undertake a collaborative survey across the historic known range of partridge pigeons, in order to assess, with more confidence, the extent of decline, its timing and its possible causes	0	50	25	0	0
undertake a targeted study to examine the relative impacts of threatening processes possibly affecting partridge pigeons	0	35	35	35	0

Action 2.4. Examine impacts of land clearing on all four taxa, particularly on the Tiwi Islands, and the Darwin-Daly region (and, for masked owl, the response to historic clearing in north-eastern Queensland); and use the resulting knowledge to develop guidelines for habitat protection, corridor configuration etc. for all taxa for landscapes subject to increasingly intensive development.

cost ($000)

activity	2004	2005	2006	2007	2008
undertake focused study on response of all four taxa to habitat fragmentation, and develop guidelines for habitat protection in landscapes exposed to more intensive use	0	50	50	10	0

Action 2.5. Develop appropriate monitoring programs for all taxa, to provide effective and accurate measures of trends in status.

cost ($000)

activity	2004	2005	2006	2007	2008
trial, refine and implement specific monitoring programs for all four taxa, with particular reference to measuring the efficacy of management actions undertaken for these taxa	0	80	50	50	50

3. Manage populations (or threats to those populations) of each of the four taxa such that their conservation status becomes secure (not threatened)

Objective
To implement management that results in substantial benefit to populations of these four taxa.

Criteria
- Threatening processes are ameliorated, and management implemented to benefit each species;
- All relevant stakeholders are aware of appropriate management guidelines, and where practicable, implement these;
- Conservation status of all four taxa is improved, to not threatened status.

As described above, knowledge of these taxa is inadequate to prescribe ideal recovery management. The actions proposed under 1 and 2 above will redress this limitation; and, until those actions provide results, it would be inappropriate to define management actions in detail. Nonetheless, some broad management guidelines are possible to identify now, and these can be applied and iteratively refined with further knowledge from the studies described, and by adaptive management based on measurement of the response (of the bird taxa or the threats themselves) to such imposed management.

Action 3.1. Maintain and enhance habitat suitability, through fire management
For each of the four taxa, the preferred fire regime is not known with any certainty. However, it is likely that frequent, extensive, high intensity fires reduce habitat suitability and may result in increased direct mortality. Small fires that promote a mix of burnt patches and patches unburnt for various ages are more likely to increase habitat suitability. Most conservation reserves in northern Australia, and many Aboriginal lands, are now being managed to attempt to implement such fine-scale regimes and minimise risks of extensive destructive fires. As such, fire management specifically for these four taxa should be capable of being insinuated into existing management planning that applies more broadly for conservation reserves and Aboriginal lands in much of northern Australia. Given that such improved fire management aims to benefit many species (and other values) as well as these four taxa, it is somewhat artificial to isolate any costing for this action within a broader fire management framework. As has been done with some fire-sensitive plant species (notably such as the northern cypress-pine *Callitris intratropica*: Bowman and Panton 1993), the partridge pigeon may represent a flagship animal species for some land managers or management agencies, whereby its trends in abundance may measure more broadly the efficacy of their landscape fire management.

cost ($000)

activity	**2004**	**2005**	**2006**	**2007**	**2008**
implement fire management programs to improve habitat suitability for these taxa	30	30	30	30	30

Action 3.2 Minimise impacts of acute land-use factors
There is some risk of at least localised detriment to all four taxa from current and proposed land clearing activities associated with horticultural development, plantation forestry, and rural residential expansion.

This action recognises that risks to these taxa may be minimised by the development and application of general guidelines for maintaining habitat suitability and regional populations for each taxon.

cost ($000)

activity	**2004**	**2005**	**2006**	**2007**	**2008**
develop and apply general guidelines for minimising risks to these four taxa of an increased intensification of land use	20	10	10	10	10

Action 3.3. Minimise impacts of spread of exotic pasture plants
Exotic grasses deliberately introduced for pastoralism are transforming the north Australian landscape. While such grasses are providing economic benefits, they are also imposing substantial biodiversity (and other) costs.

This situation is currently without effective or balanced regulation. This action proposes to develop an appropriate protocol for the consideration of use of exotic pasture plants; and to prioritise and cost ameliorative management responses to the current outbreak of exotic pasture grasses. Of the taxa considered in this Plan, this action will particularly benefit partridge pigeons, but its benefit will flow to many other native plants and animals not considered directly in this Plan.

cost ($000)

activity	**2004**	**2005**	**2006**	**2007**	**2008**
develop and implement a protocol governing the use of exotic pasture plants in northern Australia	20	50	0	0	0
cost and prioritise ameliorative management responses to current outbreaks of exotic pasture plants	0	15	15	0	0

Total costs for all described Actions

cost ($000)

	2004	**2005**	**2006**	**2007**	**2008**	**Total**
Total	105	445	325	175	110	1160

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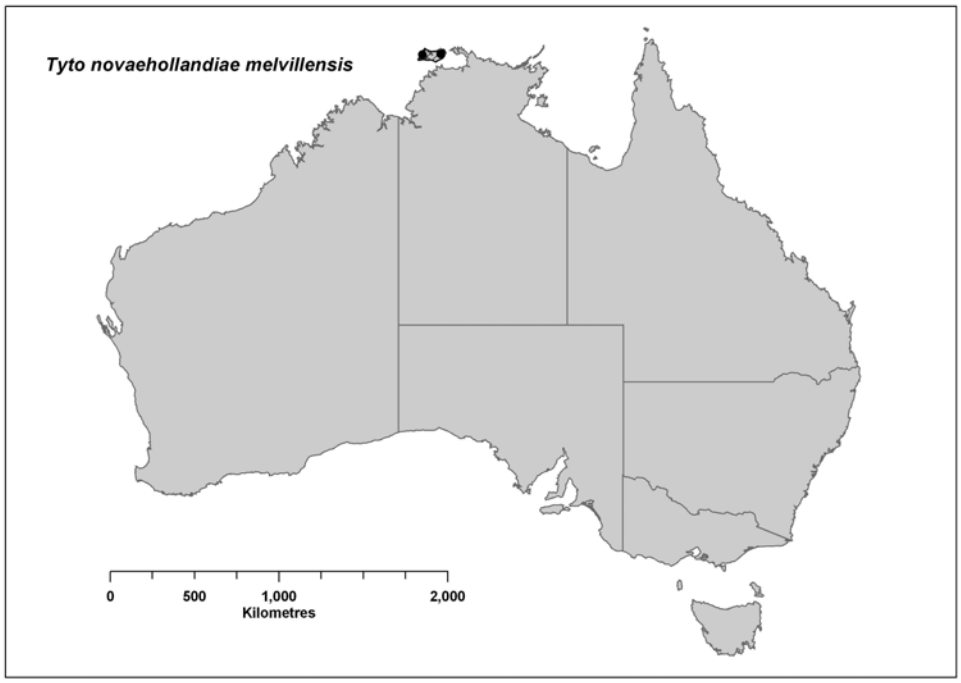
Abbreviations

EPBCA	*Environment Protection and Biodiversity Conservation Act 1999*
IUCN	International Union for the Conservation of Nature
NP	National Park
NT	Northern Territory
WA	Western Australia



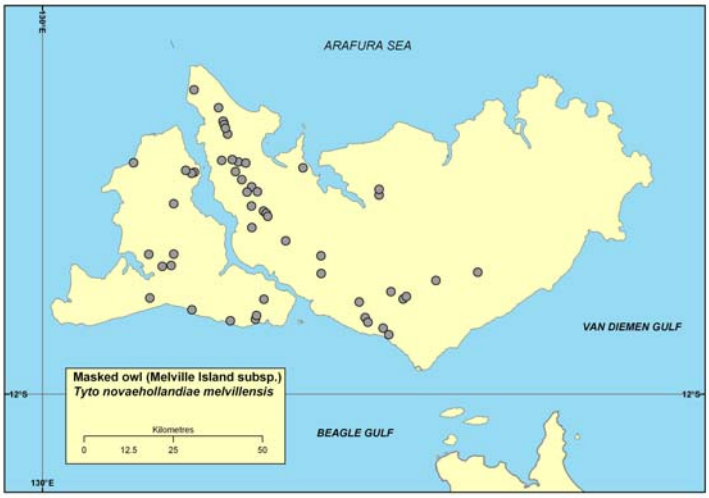


Figure 1. (a) [top] Distribution of the Tiwi masked owl *Tyto novaehollandiae melvillensis*. Dots indicate records from the New Atlas of Australian Birds (Barrett *et al*. 2003), covering observations over the period 1998-2002.

(b) [bottom]. Distribution on the Tiwi Islands, from survey records of the NT Department of Infrastructure Planning and Environment (Woinarski *et al*. 2003a).

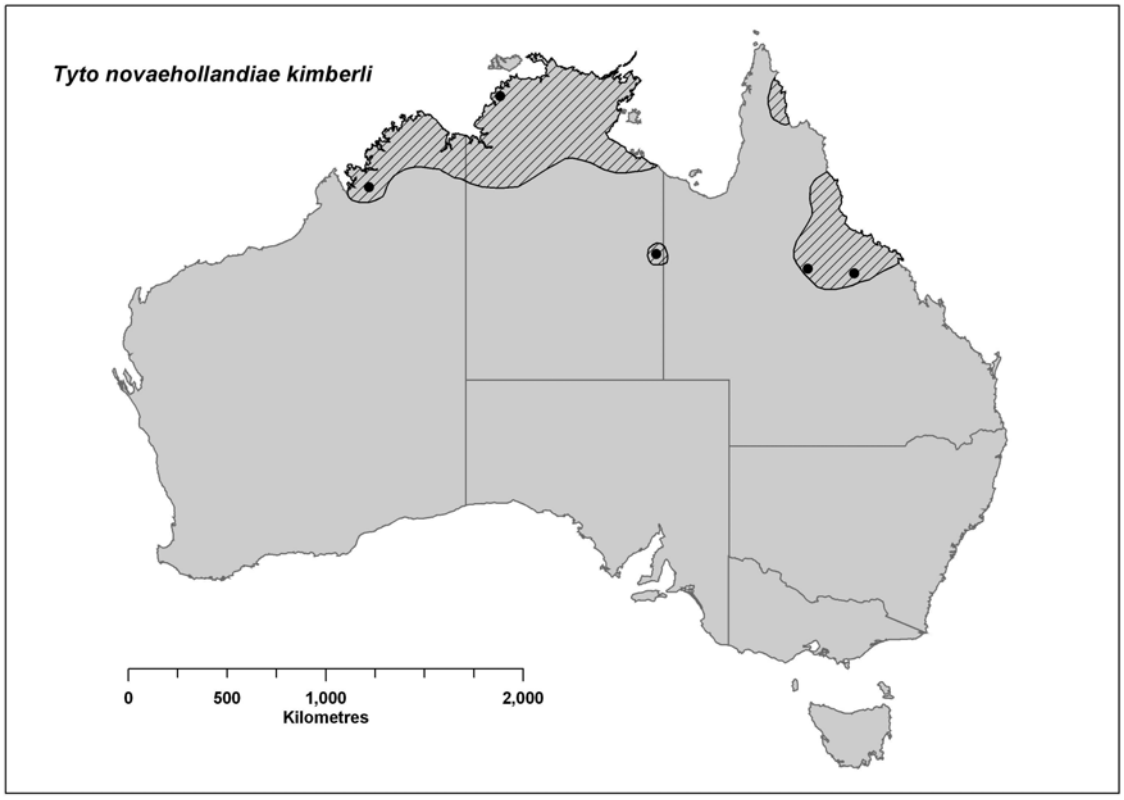


Figure 2. Distribution of the north Australian mainland subspecies of masked owl *Tyto novaehollandiae kimberli*. Dots indicate records from the New Atlas of Australian Birds (Barrett *et al*. 2003), covering observations over the period 1998-2002.

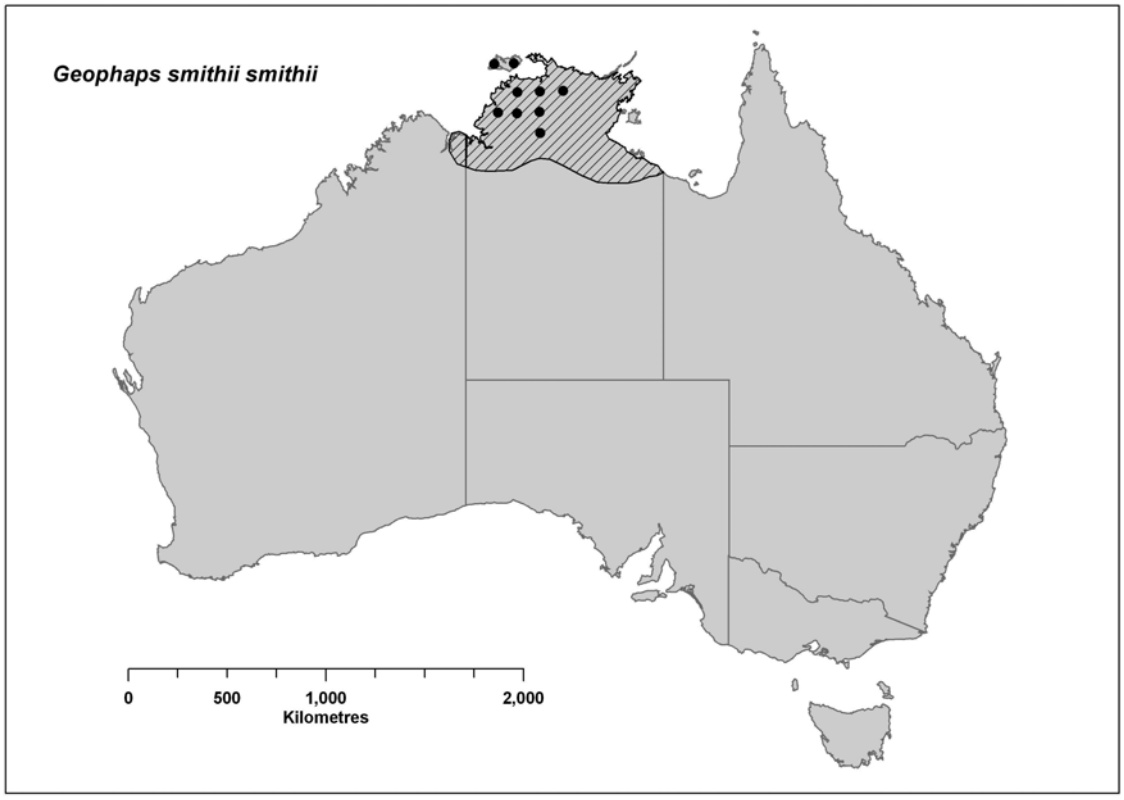


Figure 3. Distribution of the eastern subspecies of partridge pigeon *Geophaps smithii smithii*. Dots indicate records from the New Atlas of Australian Birds (Barrett *et al*. 2003), covering observations over the period 1998-2002.

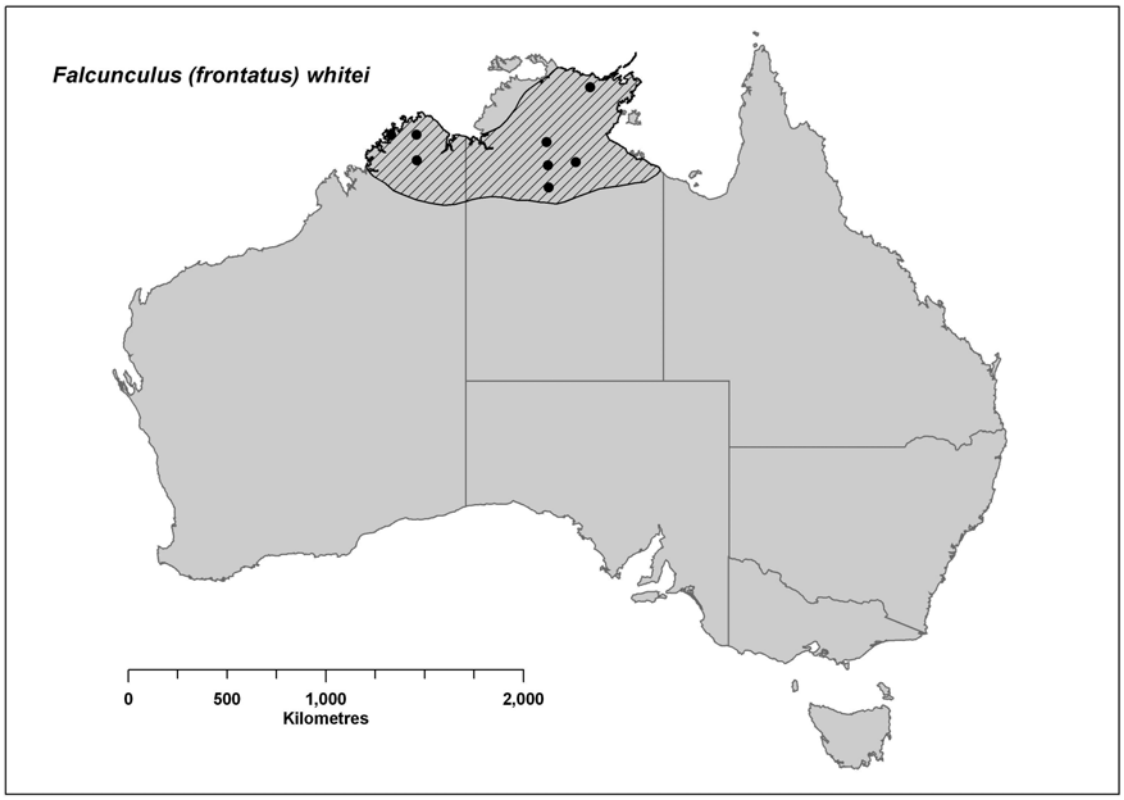


Figure 4. Distribution of the northern (crested) shrike-tit *Falcunculus (frontatus) whitei*. Dots indicate records from the New Atlas of Australian Birds (Barrett *et al*. 2003), covering observations over the period 1998-2002.