The Whistler

Thematic Issue - Threatened Species in the Hunter Region

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Threatened Species
Distribution Maps
Speckled Warbler
Varied Sittella

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- *To encourage and further the study and conservation of Australian birds and their habitat*
- *To encourage bird observing as a leisure-time activity*

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Front cover: Blue-billed Duck *Oxyura australis* - Photo: Dan Herbert
Back cover: Spotted Harrier *Circus assimilis* - Photo: Dan Herbert

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The *Whistler* - Editorial

This volume of *The Whistler* is dedicated to the "Threatened Species" of the Hunter Region. It is the first occasion that a volume of *The Whistler* has had an exclusive theme. The topic is a compelling subject central to the avian conservation priorities of the region. Mick Roderick and Alan Stuart are congratulated on their initiative, enthusiasm and drive which has nurtured the growth of an idea into an invaluable resource.

Their keynote paper "The Status of Threatened Bird Species in the Hunter Region" summarises the legislation protecting the "Threatened Species" of the region as well as providing information on the current status of each individual species. While their paper provides the current definitive statement on this complex subject, the situation is fluid. Indeed during the preparation of their manuscript a number of additional species were listed as "Threatened" under the *Threatened Species Conservation Act 1995* (NSW) and the degree of threat to some already listed was increased. The expectation is that this trend will continue and it has been foreshadowed that additional species may be listed in the future. The pressure on critical habitats like the mature woodland remnants on the floor of the central Hunter Valley, estuaries and coastal areas are such that it is anticipated the level of threat to many species will increase in the future.

In summarising the status of each Threatened Species Roderick and Stuart draw heavily on the observations of members of the Hunter Bird Observers Club (HBOC), which are recorded in the Hunter Region Annual Bird Report series. It is the first time that the information in the 17 reports of this series has been integrated to provide an overview of the status of a group of species.

The Birds Australia (BA) Atlas database provides an even more comprehensive source of information on the distribution of the Threatened Species in the Hunter Region, capturing not only the observations of HBOC members, but also the records of others in the community interested in the birds of our region. The second paper in this volume of *The Whistler* supports the keynote paper by providing detailed distribution maps for many Threatened Species and highlighting the areas where each species is most abundant. Inspection of these maps indicates a wide range of situations, including those of species like the Varied Sittella *Daphoenositta chrysoptera* and Speckled Warbler *Chthonicola sagittata*, which, while uncommon, remain well distributed and reasonably numerous, through to those of species with a very limited distribution like the Rufous Scrub-bird *Atrichornis rufescens.*

Travelling through the Hunter Region the impression might superficially be gained that there are vast areas of relatively unspoiled habitat. However, for species of birds which have specialised habitat requirements this apparent wealth of opportunity is frequently an illusion. Unfortunately reserves of mineral resources like coal often occur in areas of remnant woodland essential to our threatened woodland species leading to the destruction and fragmentation of critical habitat. The export of coal requires port facilities which can only be located in the Hunter Estuary, the most important area for threatened migratory shorebirds in NSW. In this instance the conflict is obvious and largely unavoidable. Hopefully the knowledge contained in this volume of *The Whistler* will contribute to striking the best possible balance between environmental needs of threatened birds and development.

In other instances industrial and residential developments are also occurring in mature remnant woodland on the floor of the central Hunter Valley, exacerbating the crisis concerning the protection of the threatened woodland species like the potentially critically endangered Regent Honeyeater *Anthochaera phrygia*. In this case it is not essential that these developments are located in the habitat of Threatened Species. The zoning of these developments would appear to be based either on environmental ignorance, or blatant disregard for the intent of the environmental legislation. Hopefully this volume of *The Whistler* removes ignorance as an excuse for future environmentally irresponsible land zoning and planning decisions.

A careful perusal of the Threatened Species paper demonstrates how superficial our knowledge is of the threats to individual species and appropriate management strategies for their conservation. There are exceptions, notably the study by Simon Ferrier, carried out almost thirty years ago on the Rufous Scrub-bird. His PhD thesis (University of New England, Armidale 1984) titled "The Status of the Rufous Scrub-bird *Atrichornis rufescens*; Habitat, Geographical Variation and Abundance" provides a comprehensive basis for the informed management of this species in its restricted and specialised habitat. Interestingly, Ferrier uses his results to predict fluctuations in Rufous Scrub-bird going back into pre-history, concluding that as a consequence of natural climate change there were periods when the species was less numerous than at the time of European settlement. Since settlement, land clearing, logging and fire regimes have resulted in a decline in abundance, which he suggests could, if unchecked, result in extinction by 2030. Ferrier makes the important point that priority should be given to conservation effort addressing anthropogenic as opposed to natural threats. Fortunately in the case of the Rufous Scrub-bird appropriate action has been taken and much of its remaining habitat is on conservation lands, which have been recently designated Important Bird Areas (IBA) in which the Rufous Scrub-bird, the trigger species for IBA nomination, will be monitored.

An even more optimistic example of detailed investigation resulting in positive conservation outcomes is provided by Gould's Petrel *Pterodroma leucoptera* where effective management of its breeding islands has been so successful that the listed level of threat has been decreased. Such examples are rare and we need in-depth studies on the other species, where our knowledge is less comprehensive, and often scant.

This leads us to the third paper in this volume of *The Whistler,* which demonstrates the impact of changes in grazing regimes on Speckled Warbler numbers in an area of woodland. This example demonstrates the delicate balance between actions which are beneficial and detrimental to a species. The implications for land management are that practices like grazing and hazard-reduction burning when applied cautiously and carefully monitored may be beneficial to some Threatened Species.

We hope that this volume of *The Whistler* demonstrates to HBOC members the value of their contribution to the knowledge and conservation of the birds of our region. Your ongoing contribution to HBOC's projects together with the recording of your recreational bird observations is pivotal to the future of our birds.

HBOC acknowledges with gratitude the sponsorship of this volume by Port Waratah Coal Services. Their generosity assists our ability to publish high quality publications which provide information important to the conservation of birds and the sustainable management of their habitats.

Mike Newman and Harold Tarrant
Joint Editors

The status of threatened bird species in the Hunter Region

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Many bird species listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as "threatened") under the *Threatened Species Conservation Act 1995* (NSW) have been recorded within the Hunter Region. The majority are resident or regular migrants. Some species are vagrants, and some seabirds regularly present are not reliant on the Region for survival. The authors have reviewed the regional status of all species, with particular focus on the residents and regular visitors. The conservation status for each species is given, including where relevant the status under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) and the International Union for Conservation of Nature (IUCN) review. Recent records for the Region are compared with previous periods, local threats are reviewed and the outlook for each species is discussed.

INTRODUCTION

The *Threatened Species Conservation* (TSC) *Act 1995* is the primary legislation for the protection of threatened flora and fauna species in NSW. The NSW Scientific Committee is the key group responsible for the review of the conservation status of threatened species, including the listing of those species. More than 100 bird species are listed as threatened under the TSC Act, and the Scientific Committee supports the listing of additional species.

The local status of bird species classified as threatened under the TSC Act is reviewed in this paper, as a benchmark for assessing future changes in status. The term "threatened" refers to species classified as Vulnerable, Endangered, Critically Endangered or Presumed Extinct in NSW. In certain circumstances, these classifications may be applied to a sub-species or to a local population.

Seventy-four species or sub-species listed as threatened under the TSC Act have been recorded in the Region. The majority (49 species) are resident or regular visitors. Ten seabird species or sub-species regularly present are not reliant on the Region for their survival. A further 15 species are rare visitors/vagrants. This paper reviews the local status of all those species and sub-species, with a prime focus on birds that are resident or regular visitors.

The status under two other important conservation indicators is also presented, for species where this is relevant. The two measures of conservation status are:

- The *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* is the equivalent threatened species legislation at the Commonwealth level.

- A measure of conservation status that can also be applied at sub-species level was developed by the International Union for Conservation of Nature (IUCN 2009). Some species and sub-species that occur in the Region have IUCN conservation ratings.

Because habitats change with time and birds respond accordingly, locations where species occur may change and some species will prosper overall whilst others decline. This review represents our understanding about threatened species in the Hunter Region as at the end of June 2010. In time, the status and future outlooks for the species discussed may change.

GENERAL COMMENTS

Three information sources were used extensively for this paper. Discussion about prior local records relies extensively on Hunter Bird Observers Club (HBOC) data as published in the Annual Bird Reports (ABRs) for the Hunter Region, which thus far span the years 1993-2009 (Stuart 1994-2010). Discussion about the range/distribution for species uses Volumes 1-7 of the Handbook of Australian,

New Zealand and Antarctic Birds (HANZAB) and The New Atlas of Australian Birds ("Atlas") (Barrett *et al.* 2003) as the main references. To avoid repetition, these three sources are not specifically cited within the body of the paper. Readers can discern the relevant issue of HANZAB or the Annual Bird Report from the context of the discussion for the particular species.

We are aware that databases managed by other organisations contain additional records for the Hunter Region. These may have allowed further insights. Two difficulties confronted us – in some cases, access to the database was not readily available and in other cases the vetting process for records was considered to have been less rigorous than desirable. All HBOC records are subjected to scrutiny by a Records Appraisal Committee, comprising seven experienced local observers, before they are accepted into the Club's database.

The geographical extent of the Hunter Region is defined in the Hunter Bird Observers Club ABRs and illustrated in the following paper in this volume of *The Whistler* (Newman *et al.* 2010).

Where systematically collected data were available for analysis, this allowed graphs to be generated that very effectively highlight changes. Unfortunately, for only a few of the threatened species was this possible. There is a clear opportunity for bird watchers to undertake much more systematic surveying and record management for threatened species in the Region.

The following acronyms have been used:
ABR: Annual Bird Report
BA: Birds Australia
DECCW: NSW Department of Environment, Climate Change and Water
EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999*
GDR: Great Dividing Range
HANZAB: Handbook of Australian, New Zealand and Antarctic Birds
HBOC: Hunter Bird Observers Club
HCRCMA: Hunter-Central Rivers Catchment Management Authority
HEZ: Hunter Economic Zone
HWCA: Hunter Wetlands Centre Australia
IUCN: International Union for Conservation of Nature
LGA: Local Government Area
NP: National Park
NPWS: National Parks and Wildlife Service
NR: Nature Reserve
NSW: New South Wales
SCA: State Conservation Area
SEPP: State Environmental Planning Policy
SF: State Forest
SP: State Park
TSC Act: *Threatened Species Conservation Act 1995* (NSW)
WWW: Walka Water Works

DISCUSSION

Key Threats Summarised

Unique threats for species are discussed later in the paper. Some threats apply generically to one or more guilds of species, and these are summarised below. In instances where there are additional specific threats, these are discussed in the individual species accounts.

Waterbirds: Many of these species are nomadic in Australia, responding to local changes in rainfall. Coastal wetlands are a crucial resource during times of inland drought. A key threat is the draining of coastal wetlands for residential and industrial development and mosquito control. Insalination from rising seawater levels as a result of climate change would also impact some coastal wetlands. Removal of water from inland rivers for irrigation and other purposes degrades habitat quality. This threat has been exacerbated by the prolonged recent droughts.

Migratory Shorebirds: The major threat is loss of foraging and roosting habitat within the East Asian-Australasian Flyway from reclamation of areas of potential habitat for residential and industrial development. Disturbance due to human activities (food gathering, recreational) and animals is another key threat, especially when birds are trying to increase their energy reserves for migration. An additional threat is incursion of mangroves into foraging and roosting areas due to changing tidal prism, and this is likely to be exacerbated by future climate change. The above threats are manifested both externally and regionally. A specific issue for the Region is development (both past and planned) within the Hunter Estuary. Although programs to restore foraging and roosting habitat are making progress, there is heavy reliance on using unproven offset areas to replace proven habitat that is consumed by development.

Beach-nesting Birds: Threats include loss of coastal nesting habitat due to expanding residential developments, predation of eggs and chicks, and

disturbance at nesting and roosting areas through beach-combing, fishing, dog-walking, horse-riding, 4WD vehicles. Parent birds often leave the nest when approached, exposing their chicks/eggs to risks of loss of thermal control and accidental destruction. Hydrological changes to estuaries and other water bodies may modify important areas of habitat, or affect the availability of food. Some species nest in locations that are vulnerable to flooding and king tides; these threats could become exacerbated by future climate change. A specific issue for the Region is the near relentless 4WD vehicular traffic along beaches, particularly Newcastle Bight and the Redhead-Blacksmiths coastline, deterring birds from foraging at the water's edge and disturbing them when roosting.

Rainforest Birds: Loss of habitat due to logging and clearing is the main threat for rainforest species; another is weed invasion. Climate change is a potential threat to high altitude rainforest birds, which could become trapped in "islands" that are geographically isolated from other patches of suitable habitat.

Nocturnal Birds: Logging and clearing of forests is a key threat for the large owls, and habitat degradation whereby older trees with suitable nesting/roosting hollows are logged or destroyed by fire or storms.

Woodland Birds: Threats include habitat loss and fragmentation as a result of agriculture, forestry, mining and residential development, as well as habitat degradation. The latter occurs through loss of tree hollows and key habitat trees, lack of regeneration of the eucalypt over-storey due to over-grazing and over-frequent fires, removal of fallen timber for firewood, loss of ground litter from compaction and overgrazing. Most of the lowland habitat on the floor of the Hunter Valley has been cleared historically for agriculture and housing and it is within the forested remnants that the highest concentrations of threatened woodland species occur. Many of the remnants are under threat of being cleared or further fragmented as activities such as coal mines and industrial/ residential subdivisions occur. The security of habitat for threatened woodland birds is a major concern for bird conservation in the Region.

Birds of Prey: Threats include degradation and loss of habitat, and decline in numbers of prey species, in part associated with habitat issues and in part with the introduction of calicivirus (*Lagovirus* spp.) for rabbit control.

Species Accounts

In preparing this paper, the authors' main focus has been on birds which are resident in the Region or which visit regularly. The status of other NSW listed species for which there are records for the Region is briefly discussed.

Residents and Regular Visitors

Emu *Dromaius novaehollandiae*

Conservation Status

The population in the NSW North Coast BioRegion (which includes Port Stephens and Manning River/Great Lakes) is gazetted as an Endangered Population (N.B. the populations of Emu in the west of the Region are not considered to be threatened, albeit their numbers are not high).

Discussion

The Emu population within Port Stephens and Great Lakes/Manning Valley most likely is extinct. The authors are unaware of any records since 1928 when some birds were at Myall Lakes (Enwright 1928). Neither of the BA Atlas projects recorded Emu in these areas, and nor has HBOC.

Suitable habitat appears to exist, such as in parts of Myall Lakes and Khappinghat National Parks. The absence of records seems to be due to other factors (such as persecution [historically] and predation).

Magpie Goose *Anseranas semipalmata*

Conservation Status

NSW: Vulnerable

Discussion

Once common in NSW, the Magpie Goose had suffered serious declines in south-eastern Australia by the early 1900s (Nye *et al.* 2007) such that the species became locally extinct. In 1987, HWCA re-introduced the species to Shortland. The birds began breeding in 1992 and by 1993 there was also evidence of breeding at Seaham. Aside from these two sites, the species is occasionally recorded at Kooragang/Ash Island and Hexham Swamp NR (with a breeding record there in December 2008) and from the northern part of the Region (e.g. Cundletown and Taree).

The population around Shortland is between 80 and 100 birds and appears to be stable. It is likely that birds descending from this population disperse into other parts of the Region on occasion, although the core breeding areas remain near Shortland and Seaham. Magpie Geese at the HWCA are fed daily and although not all birds attend every day, it is likely that this is inhibiting them from dispersing. Notwithstanding, the re-

introduction program has been successful in that a formerly locally extinct species now breeds in several locations in the Region. However, many of the factors that contributed to its original decline (such as inappropriate hydrological management of wetland areas) have not been reversed and it is unlikely that the local population will return to its original size and extent of range.

Freckled Duck *Stictonetta naevosa*
Conservation Status
NSW: Vulnerable
Discussion
The Freckled Duck occurs predominantly within permanent freshwater swamps west of the GDR. During dry periods, the species moves coastward and it is during these times that it has been most often recorded in the Hunter. The core breeding range of the species is in the Bulloo and Lake Eyre basins and the Murray-Darling system. No breeding records are known from the Hunter Region.

Freckled Ducks have occurred at a number of sites within the Region and these records have been noted consistently in recent years. It is therefore reasonable to suggest that the Region is a drought refuge for the species when conditions are not favourable in its preferred habitat. However, birds have only ever been present in small numbers. A captive-breeding program has been established at the HWCA site and has been successful in rearing young birds.

The majority of local habitat for the Freckled Duck occurs in areas where some level of conservation protection exists and there is no immediate cause for concern for this species within the Region.

Blue-billed Duck *Oxyura australis*
Conservation Status
NSW: Vulnerable IUCN: Near Threatened
Discussion
The Blue-billed Duck occurs in permanent wetlands and swamps deep enough for it to feed by diving. In NSW the Blue-billed Duck is most common in the southern Murray-Darling Basin area. It is usually during drier periods inland that birds move to coastal areas.

Local sightings seem consistent with the Region being a drought refuge. The species is usually recorded from a small number of key locations such as WWW, Leneghans Flat and Kooragang Island. Of these, WWW appears to be the most consistent area. Since 2002, most records have been of less than five birds, although during winter 2009 up to ten birds were present. There are breeding records at WWW in the 1970s (S. Hamonet pers. comm.) but none more recently.

With new coal-handling facilities being developed that will impact ponds on Kooragang Island, this site may become unsuitable for the species. It is unclear how this will affect the local status.

Wompoo Fruit-Dove *Ptilinopus magnificus*
Conservation Status
NSW: Vulnerable
Discussion
The Wompoo Fruit-Dove inhabits rainforest and wet sclerophyll forests where it is locally nomadic, as it follows fruiting trees and vines. It formerly occurred in the Illawarra, but in recent times the population in the Hunter Region appears to be the southernmost in Australia with only vagrant birds occurring farther south.

In the Region this species is most often recorded within the Barrington Tops/Gloucester Tops, particularly at rainforests on the lower elevated slopes. Infrequent records have been from littoral rainforests around Harrington, Saltwater NP and Seal Rocks whilst birds have been recorded occasionally in suburban areas such as Bolwarra and Eleebana, presumably in transit. Although no breeding records are known from the Region, the population is considered to be resident. The vast majority of preferred habitat for this species occurs in conservation reserves. The regional population, albeit small, seems relatively secure, although the full extent of possible impacts from climate change is yet to be realised.

Gould's Petrel *Pterodroma leucoptera*
Conservation Status
NSW: Vulnerable Commonwealth: Endangered
IUCN: Vulnerable
Discussion
Worldwide, the nominate sub-species of Gould's Petrel (*P. l. leucoptera*) breeds only on islands just offshore from Port Stephens, making it the Region's only endemic sub-species. Originally birds were only known to breed on Cabbage Tree Island. In 1997, it was discovered that some pairs were breeding on nearby Boondelbah Island, and in December 2009 a bird and egg were found in a burrow on Broughton Island (N. Carlile pers. comm.).

Adult birds forage over large areas of the Southern Ocean, returning to the Port Stephens islands for the breeding season (birds present September to May).

By the mid 1990s, the population on Cabbage Tree Island (at that time, the only known breeding location) had declined significantly, due to the cumulative impacts of habitat degradation and increased predation, such that only 186-252 breeding pairs remained, breeding success was poor (<20%) and fewer than 50 fledglings were produced each year (Priddel & Carlile 2007). A recovery effort led by DECCW targeted the key threats: predation by birds; deforestation by rabbits; and the Bird-lime Tree (*Pisonia umbellifera*), the sticky fallen fruits of which prevented many birds from flying. Each of these threats was addressed during a successful recovery program that commenced in 1993. Also, artificial nest boxes were emplaced and some young birds were relocated to Boondelbah Island to imprint them to a different breeding location (Priddel & Carlile 2001).

By 2001, the number of breeding pairs on Cabbage Tree Island had increased to 800-1,000 pairs and has since stabilised at that level, and more than 400 fledglings are produced each year (Priddel & Carlile 2007). There were 30 breeding pairs on Boondelbah Island in 2007, a significant increase from a single pair breeding there in 1999 (Priddel 2008). As a result of these improvements, the NSW Scientific Committee in July 2009 reclassified the species from Endangered to Vulnerable – a testament to the success of the recovery program.

The population of Gould's Petrel is more viable than it was 15 years ago and without the recovery effort it may have been approaching extinction. However, it still remains highly vulnerable to stochastic events (for example, fire).

Black-necked Stork *Ephippiorhynchus asiaticus*

Conservation Status

NSW: Endangered IUCN: Near Threatened

Discussion

In the north of Australia, the Black-necked Stork is widespread, occurring at freshwater wetlands across a wide distribution range. The species appears to be in serious decline at the southern end of its range, and is now considered rare south of the Manning Valley.

Within the Region, there is a resident pair in the Bulahdelah area, with several breeding records (most recently, 2007). Sightings of 1-2 birds from the Port Stephens/Karuah/Bulahdelah area probably all relate to this pair or their progeny. There is a second pair in the lower Manning Valley, with frequent records from various locations around Harrington, Taree, Wingham and at least one confirmed breeding record (pair with fledged young at Cattai Creek in January 2006).

In other northerly parts of the Region, there have been several reports since 2002 from locations such as Gloucester and Craven. However, these are usually single birds that sometimes are noted to be immature and may represent dispersal of young from one of the above-mentioned coastal breeding pairs.

In the lower Hunter Valley, 1-2 birds were frequently recorded over 1993-2005 and also with records sometimes of 1-2 immature birds in the area. It was assumed there was a breeding pair, but that was never confirmed. From February 2005, there were no records from the lower Hunter Valley until a young bird was released at the Hunter Wetlands Centre in January 2009, having been taken into care near Sydney. Although that bird is believed to have departed within a few weeks there have been occasional records of a single bird at Ash Island since October 2009.

The Black-necked Stork appears to be in decline in the Region, with only two confirmed breeding pairs now present compared to a probable three breeding pairs prior to 2005. However, the species was never common in the Region and particularly in the south of it (see for example Enwright 1933, Clancy 2010).

Australasian Bittern *Botaurus poiciloptilus*

Conservation Status

NSW: Endangered IUCN: Endangered

Discussion

The Australasian Bittern occurs in densely vegetated freshwater wetlands, particularly in areas where bulrushes, sedges, reeds and spikerushes exist. Inappropriate water quality management and the drainage of wetland areas have reduced the availability of suitable habitat for this species in NSW. Although it may occasionally occur in brackish wetlands it has a preference for freshwater habitats. The Australasian Bittern was recently reclassified as Endangered in NSW and has been nominated to be listed as Endangered under the EPBC Act.

Within the Region this species has been reported from many locations, although it is likely that the core breeding range is contained in the broader Hunter Estuary i.e. Hexham Swamp/Kooragang Island/Tomago/Williamtown (Finegan *et al.* 2001). For example, surveys at Tomago Wetlands in 2009 revealed two to four Australasian Bitterns on most

visits to the site (N. McNaughton pers. comm.). It is likely, given the ongoing and consistent records of such a cryptic species within the Region, that the area supports a reasonably substantial population.

Currently, the species probably is relatively stable within the Region but this is based on very limited data. The majority of preferred habitat for this species occurs in areas that have some level of conservation protection, such as National Parks/ Nature Reserves, Council reserves and in wetlands protected under planning instruments such as SEPP 14 ('Coastal Wetlands'). However, much habitat is unprotected and some areas may be at threat due to inappropriate hydrological practices in those areas. Furthermore it is unclear what will be the long-term impacts of the returning of brackish/saline waters to some of these areas, as part of the opening of floodgates on Hexham Swamp and at Tomago.

Black Bittern *Ixobrychus flavicollis*
Conservation Status
NSW: Vulnerable
Discussion
The Black Bittern inhabits sheltered creeks, often those with a slight tidal influence. It also occurs in other areas where there is permanent water such as flooded paperbark swamps and mangroves. The species is considered uncommon south of Sydney.

Most years there are a small number of records of Black Bittern from around creeks, rivers and freshwater lakes in the eastern parts of the Region. Usually, the sightings have been opportunistic ones. In 2005 a systematic study of some creeks around Lake Macquarie yielded seven birds in a single day and several additional records in the ensuing weeks. It seems likely that this cryptic species is under-recorded in the Region. The records received have been from widespread eastern locations, ranging as far west as the Paterson River and Krambach. The only breeding record received was from Krambach in 1994 but most breeding events are likely to be overlooked.

Much of the habitat for the Black Bittern occurs in areas where some level of conservation protection currently exists and the species seems likely to be stable within the Region. However, the future impact of climate change (leading to rises in sea level) upon the habitat for this species is not fully understood.

Eastern Osprey *Pandion cristatus*
Conservation Status
NSW: Vulnerable
Discussion
The Eastern Osprey is a fish-eating raptor that occurs along the east coast of NSW, south to Lake Macquarie, although in recent years several birds (including nesting attempts) have been reported from areas much further south (such as Narrabeen, Ulladulla) and it is well known in southern Australia. The species largely occurs in coastal areas, especially the mouths of large rivers, lagoons and lakes. The species is threatened by the removal of suitable nest trees as well as impacts to water quality affecting feeding habitat.

Within the Region, the Eastern Osprey is locally common north of Port Stephens and numerous nests have been noted in the Port Stephens area, in places such as Karuah, Tahlee and Lemon Tree Passage. In recent times, an increasing number of reports have been received of birds within the southern part of the Region, such as the Hunter Estuary and Lake Macquarie. Nesting has been recorded in the Lake Macquarie area, including two sites at Morisset and one at Swansea, but not in the Hunter Estuary (for which most records are of single birds). Despite a threat being the removal of potential nest trees, recent evidence suggests that the species may be adapting to utilise artificial structures such as communications towers, bridges and powerline structures as nest sites (Moffat 2009). Such artificial structures are used within the Region.

Overall, it appears that the species is increasing at its southern limit. The ongoing reports of birds from the Hunter Estuary and Lake Macquarie in recent times are encouraging, particularly as some of these reports are for nesting birds. It is possible that recent changes to the way that fisheries are managed in NSW could have benefited Eastern Ospreys. It appears that local populations are at least stable, if not increasing.

Square-tailed Kite *Lophoictinia isura*
Conservation Status
NSW: Vulnerable
Discussion
The Square-tailed Kite inhabits a wide range of forested/wooded areas around Australia, including dry woodlands and open forests where it hunts for passerine species, particularly nestlings.

Within the Region, this species is recorded sporadically from a range of locations. Formerly, the vast majority of records were from the north.

Since 2002 there has been a marked increase in reports from the greater Maitland/Cessnock area. It is also occasionally reported from other areas such as Morisset, Raymond Terrace and Shortland. Several, if not most, of these records have been from settled or partly settled areas.

The species is known to breed in Coopernook SF and has been reported nest-building at Brimbin NR in the past. Although no nests have been recorded in the Hunter River catchment, it is likely that birds are resident and that nesting occurs.

Given the number of reports from settled areas, it is possible that the species is adapting to hunt in semi-disturbed areas. The availability of food for birds able to adapt to such habitat is not a limiting factor, though the lack of breeding records suggests that it still requires undisturbed bushland for nesting. Large areas of potential habitat occur within the Region, although much of this habitat remains unprotected. Currently, the species appears to be relatively stable within the Region, albeit as a very small population.

Spotted Harrier *Circus assimilis*
Conservation Status
NSW: Vulnerable
Discussion
The Spotted Harrier occurs in open habitats throughout Australia, including grasslands, open woodlands, crop fields and partially cleared areas.

Within the Region this species is recorded as an uncommon inhabitant of open areas in the central and western parts of the Region, as well as from the broad floodplains in sub-coastal areas. A small population may be resident around the Hunter Estuary with the species reported moderately often from areas such as Kooragang and Ash Islands, Hexham Swamp and Tomago Wetlands.

No breeding records have been recorded for this species in the Region, although suitable habitat exists in many of the drier woodlands in the central and western areas. Due to the lack of breeding records it is possible that the Region is only inhabited by birds when conditions inland are not favourable.

The extent to which this species may have declined within the Region is poorly understood and subsequently it is difficult to determine the status of the species locally. However, there is no compelling evidence of a decline and it is anticipated that Spotted Harriers will continue to visit intermittently in response to fluctuations in conditions inland.

Little Eagle *Hieraaetus morphnoides*
Conservation Status
NSW: Vulnerable
Discussion
The Little Eagle occurs in a range of habitats, including woodlands, open forests and other vegetated areas where suitable prey exists. In addition to the generic threats for raptors, the decline of the Little Eagle also appears to be linked to the availability of undisturbed habitat that affects the long-term viability of resident, long-lived top-end predators such as this.

Within the Region the Little Eagle is recorded from widespread locations, but appears to be more regularly reported from inland and drier sub-coastal areas. Breeding records are few; in recent times the only records are of a pair nesting near Muswellbrook in both 2000 and 2001.

It is uncertain to what extent this sparse species may have declined locally. The number of records each year is reasonably constant. However, with the continuing loss and degradation of woodland habitat, any potential for decline is likely to be exacerbated in the long term.

Bush Stone-Curlew *Burhinus grallarius*
Conservation Status
NSW: Endangered IUCN: Near Threatened
Discussion
The Bush Stone-Curlew occurs within open woodlands and forests across Australia, although it has become extinct in many parts of its former range. In NSW the species is threatened by the loss of suitable habitat, predation (particularly chicks), trampling of eggs by cattle and machinery, modification of habitat through removal of litter and fallen timber, and disturbance in the vicinity of nest sites.

There are at least six pairs at locations around Port Stephens which is currently the stronghold for the species within the Region. There are few records from elsewhere and there have been none for several decades from the central and western parts of the Region where birds previously were resident (A. Morris pers. comm., Stuart & Newling 2009).

Few of the breeding attempts by the pairs at Port Stephens have succeeded in raising chicks to a stage where they are self-sufficient and can disperse to other areas. The lack of success has

mostly been associated with fledging of the chicks (parent birds appear to be able to hatch chicks reasonably consistently). The causes of mortality include collision with vehicles, predators such as dogs, cats, ravens, goannas, kookaburras and pelicans, and drowning in swimming pools. This has occurred despite the pro-active management and monitoring of breeding pairs undertaken over the past several seasons by DECCW (C. Price, A. Marchment, S. Callaghan pers. comms.). The recent breeding attempts are more promising, with two or three pairs raising young birds (which have been banded to help study the dynamics of the local population).

It is important to note that authorities have only become aware of these breeding pairs following community responses to publicity seeking information concerning the local population. This publicity has increased the awareness of the local community such that the number of known pairs in the Port Stephens area has increased each year for the past 3 years. However, there still remains a lack of sufficient data to be able to confidently assess the status of that population.

Part of the local habitat for Bush Stone-Curlew is on private property and the degree of conservation protection is low. Population growth continues apace around Port Stephens, bringing increasing levels of disturbance and predation. Recovery efforts are being co-ordinated by DECCW and Port Stephens City Council and this may be crucial for the future of this species in the Region. An HCRCMA-funded study being conducted by the University of Western Sydney researching habitat requirements for Bush Stone-Curlews in Port Stephens will help inform recovery efforts.

The local population is small and given the ongoing threats to breeding success which are multi-faceted, it must be viewed as being at a moderate to high risk of extinction in the medium to long term.

Beach Stone-Curlew *Esacus magnirostris*

Conservation Status

NSW: Critically Endangered IUCN: Near Threatened

Discussion

The Beach Stone-Curlew occurs on sandy beaches on the coast of northern Australia and nearby offshore islands. It is rare in NSW although it has expanded its range southwards since European settlement. The total Australian population is estimated at 5,000 birds (Wetlands International 2006).

For this species in NSW, the generic threats for beach-nesting birds are exacerbated by the very low population base, estimated to be just 13 birds. Mainly for this reason, in July 2009 the NSW Scientific Committee reclassified Beach Stone-Curlew from Endangered to Critically Endangered.

Within the Region, a pair is resident at the mouth of the Manning River. The only known records from further south are single birds at Corrie Island in February 2006 and Pindimar in November 2009 (both locations are in Port Stephens) and a pair at Forster in August 2006. The Manning River pair is regularly recorded at Mudbishops Point and Harrington, and occasionally at nearby locations such as Manning Point and Saltwater NP. The birds are considered to be the southernmost breeding pair in NSW (Stuart 2008b; Hole *et al.* 2001) and in the past 10-12 years there have been frequent records of them being on nest or with chicks/juvenile birds present. Clearly, there are regular breeding attempts; however, in most cases the young bird does not appear to survive to full independence (G. Crisp pers. comm.). In late 2009, after two unsuccessful breeding attempts (M. Thomas pers. comm.), the pair hatched a chick which fledged and was seen with the pair as recently as May 2010.

Both Mudbishops Point and Harrington are very popular leisure areas and are subject to substantial influxes of people (mostly using vehicles or boats) in summer and with fishing activities taking place all year. The amount of disturbance that occurs is considerable. Some small areas are protected, mainly due to the presence of Little Tern *Sterna albifrons* breeding colonies; however the Beach Stone-Curlew breeding sites are not adequately protected from their main threats.

The Beach Stone-Curlew appears to be in a very tenuous situation within the Region, with just one pair, which is experiencing poor breeding success.

Australian Pied Oystercatcher *Haematopus longirostris*

Conservation Status

NSW: Endangered

Discussion

The Australian Pied Oystercatcher occurs near undisturbed sandy and shelly shorelines throughout all of Australia and southern New Guinea, where it feeds on small bivalves and worms. It is more common in the south of the country. The most recent estimate of total world population is 11,000 birds (Wetlands International 2006). Two estimates of the NSW population suggested only 230-250

birds (Watkins 1993, Owner & Rohweder 2003) and the NSW Scientific Committee recently reclassified the species as Endangered. The key threats are generic to all beach-nesting birds but for this species they are exacerbated by the low NSW population base.

Some 200-240 Australian Pied Oystercatchers are now known to be present in the Region each year (Stuart 2010b). In recent years, Port Stephens has emerged as a very important area. The counts in summer surveys there since 2004 have mostly been of 100-110 birds and winter surveys since 2008 have recorded 122-154 birds present. These numbers represent 1.0-1.5% of the total world population and thus Port Stephens is an internationally significant location for the species. There does not appear to be enough breeding habitat within Port Stephens for more than a small fraction of these birds (M. Newman pers. comm.). It therefore seems likely that many birds spend part of their life cycle in Port Stephens, breeding elsewhere. In view of the conservation status in NSW, there is an urgent need for better understanding of this matter.

10-15 birds are frequently present around the mouth of the Manning River, and with numbers sometimes much greater there. In February/March 2010, 55 birds were roosting at Forster/Tuncurry. Pairs or small parties are recorded at many other locations. There also are several records of breeding attempts, often unsuccessful, from within the Hunter Estuary and locations along Newcastle Bight and around Swansea, while there have been at least three pairs known to be resident in the past in the Forster/Tuncurry area.

Previous estimates of the total population for NSW seem to have been somewhat underestimated given the size of the population that occurs within the Region (with Port Stephens a key refuge). While this suggests that the species is faring well in the Region, very little is known about the breeding biology especially for the birds that are recorded within Port Stephens. This represents a significant conservation risk as it appears that the Region may be dependent on external recruitment to sustain the population. There is no easing of the pressures on birds that attempt to nest along NewcastleBight and other locations in the Region. There seems a high risk that the local population of the species will decline.

Sooty Oystercatcher *Haematopus fuliginosus*

Conservation Status

NSW: Vulnerable

Discussion

The Sooty Oystercatcher is endemic to Australia and is found at rocky shorelines around the entire country. The total population has been estimated at 11,500 birds including 4,000 of the southern sub-species *H. f. fuliginosus* that occurs in the Hunter (Wetlands International 2006). Since nesting largely takes place on offshore islands and isolated rock platforms, the typical threats for beach-nesting birds are somewhat eased; however, disturbances and predation still represent key threats for this species.

Since the late 1990s, birds have regularly roosted at a rock platform at Newcastle Baths. The peak counts have grown steadily every year from an initial 3-8 birds present over 1996-98, to many counts of 25-35+ birds over 2006-10 (Figure 1). On occasions some of these birds roost at the Kooragang Dykes instead. The numbers of roosting birds rise over the January-May period, with the peak counts usually occurring in April or May. Subsequently, the counts approximately halve, and it is probable that the other birds have dispersed to their breeding territories, with only the juvenile/non-breeding birds remaining.

Another 10-15 birds usually are recorded at Port Stephens in regular surveys there, with peak count of 18 birds in February 2004, and an additional ~15 birds were between Birubi Point and Fingal Bay in late 2008. There are occasional records of 5-10 birds from locations such as Swansea and Broughton Island. A record from 2006 of >20 birds at Mudbishops Point is considered unusual since the habitat seems unsuitable and most visits there over 2008-2010 have recorded less than 4 birds (A. Stuart pers. obs.).

Pairs and small parties are often reported from all parts of the Region where suitable rocky coastal habitat occurs. It is assumed that some of these locations contain viable breeding habitat; however, very few breeding records are received. 1-2 pairs are known to breed on Cabbage Tree Island (Priddel & Carlile 2004, Stuart 2009a) but the only other breeding record is from Broughton Island in January 1998. However, local offshore islands rarely are visited by birdwatchers.

The increasing counts from around the Hunter Estuary in recent years and the frequency of reports of good numbers from other locations in the Region suggests that the local Sooty

Oystercatcher population is secure, with no immediate concerns for its future.

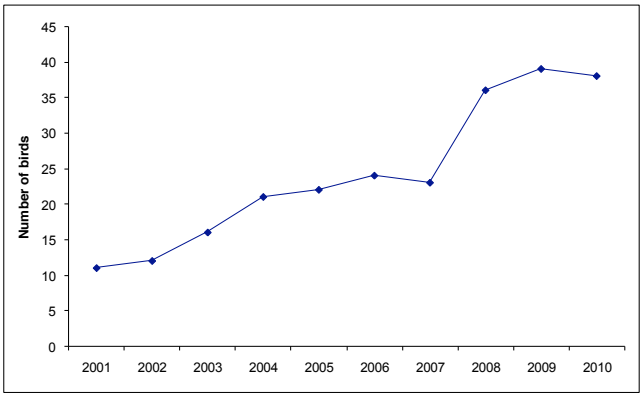

Figure 1. Peak counts for Sooty Oystercatchers roosting at Newcastle Baths

Lesser Sand Plover *Charadrius mongolus*

Conservation Status

NSW: Vulnerable

Discussion

The Lesser Sand Plover is a small shorebird that breeds in the northern hemisphere, and then disperses widely to the coastlines of western Africa, India, south-east Asia and Australia in the austral summer, where it inhabits sandy tidal flats. Although more abundant in northern Australia it occurs widely at southern coastline locations including regularly in Victoria and Tasmania. The reporting rate for the BA Atlas declined by 37% across the two projects.

Historically, the Hunter Estuary was a noteworthy destination for the Lesser Sand Plover. For example, 500 birds (some reports state 800 birds) were present in March 1972 (van Gessel & Kendall 1972). By the early 1980s, the counts were down to 100-150 birds and the peak count for the 1990s was just 68 birds in January 1997 (Kingsford *et al.* 1998). The decline has continued; birds are rare now in the Hunter Estuary, occurring in counts of <5 when present. The records from elsewhere – Manning River and Port Stephens – all are of <20 and mostly <10 birds.

The outlook for this species in the Region seems poor. It is nearly extinct in the Hunter Estuary which has lost almost all suitable foraging areas with a sandy substrate suitable for small waders through industrial developments and mangrove incursions. Elsewhere, Gir-um-bit NP, on the western shores of Port Stephens, is the only protected and undisturbed location where it has been recorded. The Manning Estuary sites are State Parks where substantial human activity occurs.

Comb-crested Jacana *Irediparra gallinacea*

Conservation Status

NSW: Vulnerable

Discussion

The Comb-crested Jacana inhabits permanent wetlands that contain floating vegetation, in particular, water-lilies. In addition to the generic threats for waterbirds, a specific threat is changes to the hydrological regime of wetlands that affect the amount of floating vegetation present or its nature (e.g. encouraging growth of weeds such as Water Hyacinth *Eichhornia crassipes*).

The Hunter Region is at the limit of the normal range of the Comb-crested Jacana, which is generally considered to be south of the Hunter River. The species has been recorded from a number of wetland areas, although many of these reports were from sites that no longer contain suitable habitat (e.g. Rathluba Lagoon near Maitland) or from areas that appear to be suitable on only a seasonal or temporal basis (e.g. Leneghans Swamp). The locations from which the most consistent records are reported are Hillville Dam near Taree (historically), Cattai Wetlands (more recently) and John Brown's Lagoon (also known as 'Colliery Dam') near Kurri Kurri. The latter was once a known breeding site for the species. Observers have been denied access for several years and it is not known if breeding still occurs there. The ongoing sightings (from the property boundary) suggest that it does.

The status of this species in the Region is unclear. Given the seasonal nature of many wetlands that may contain suitable habitat from time to time, assessing local populations is difficult and potentially only possible for those areas that contain habitat on a permanent or near-permanent basis. To adequately assess the status of the species in these core areas, targeted surveys should be undertaken to assess habitat viability, population size and if breeding is occurring. Since the vast majority of potential habitat for this species occurs on private properties, the long-term conservation outlook for the local population is uncertain.

Australian Painted Snipe *Rostratula australis*

Conservation Status

NSW: Endangered Commonwealth: Vulnerable IUCN: Endangered

Discussion

The Australian Painted Snipe occurs at freshwater wetlands across a wide distribution range in Australia. Nowhere is it common, although it appears to be more abundant in the north. The

birds are usually very cryptic and regular surveys co-ordinated by BA reap very few records.

Within the Region, there have been records from six locations since 1996. These are Ash Island (from two well separated locations, in 1996 and 2004), Pambalong Nature Reserve (1997, 2000, 2001), Irrawang Swamp (2003), Leneghans Flat (2006) and Hexham Swamp (2009). All these records were in summer months and it is unclear whether the species is resident. HANZAB describes the species as possibly dispersive or migratory and cites some evidence that birds leave the southern part of their range in winter.

The only known breeding records are from "Minmi" (presumably, Hexham Swamp) in 1972 (Lindsey 2009). Copulation was observed at Ash Island in 2004, and the fact that 4-5 birds were together at Leneghans Flat near Minmi in 2006 could indicate a breeding event occurred there, since this has been noted in other areas.

Suitable habitat exists in other parts of the Region, particularly in the lower Hunter Valley, and it is plausible that this cryptic species occurs without being detected. As for other wetland species, much of the potential habitat for the Australian Painted Snipe occurs in areas that have some level of conservation protection. However, it is unclear what will be the long-term impacts of the returning of brackish/saline waters to some of these areas, as part of the opening of floodgates on Hexham Swamp and at Tomago.

Other areas that contain potential habitat are not under formal conservation protection. Some areas could also be affected by the impacts from climate change (leading to rises in sea level). Given that some habitat loss will occur locally, the regional population of Australian Painted Snipe seems likely to decline, mirroring what is occurring elsewhere within its range.

Black-tailed Godwit *Limosa limosa*

Conservation Status

NSW: Vulnerable IUCN: Near Threatened

Discussion

The Black-tailed Godwit breeds in the northern hemisphere. In the non-breeding season, the sub-species *melanuroides* migrates to India, Indochina and Australia and is found there at both coastal and inland waters (Wetlands International 2006). Immature birds sometimes overwinter.

The Hunter Estuary is the local stronghold for the species, with 200 or more present in summer and up to 30 birds (usually <10) in winter. There are occasional records from Port Stephens and elsewhere, usually only of small numbers. A record of 51 birds at Port Stephens in February 2004 included 50 birds in one tight flock that perhaps was on passage.

In the 1970s and 1980s, large numbers of Black-tailed Godwits migrated to the Hunter Estuary. Reports of 3,000-4,000 birds present sometimes in the mid 1980s are most likely a combined count of Black-tailed and Bar-tailed Godwits; the latter were present in many thousands at that time. The generally accepted numbers were ~800 birds (F. van Gessel pers. comm.). In the past 20 years, there has been a significant decline in the numbers of Black-tailed Godwits in the Hunter Estuary. Although peak annual counts are not an ideal indicator of populations (because sometimes birds on migration passage can distort the picture) they can indicate trends. In 4 of the past 5 years, the peak count for Black-tailed Godwit has been <200 birds and in 2008 there was only one month where >200 birds were recorded.

The species seems to have an uncertain future in the Region, with visiting numbers now less than 25% of the counts in the 1970s and 1980s, and the decline seemingly continuing.

Terek Sandpiper *Xenus cinereus*

Conservation Status

NSW: Vulnerable

Discussion

The Terek Sandpiper breeds in the northern hemisphere and then disperses widely to the coastlines of southern Africa, India, south-east Asia and Australia. Immature birds sometimes overwinter. The world population is >1 million but only some 50,000 birds migrate within the East Asian-Australasian Flyway (Wetlands International 2006). This species prefers to roost on rocks or in mangroves at high tides, rather than the flat open areas favoured by most other waders. It is more widespread and common in northern Australia.

Historically, the Hunter Estuary was a noteworthy destination for Terek Sandpiper. For example, 600 birds were present in January 1970 and 500 birds in March 1972 (van Gessel & Kendall 1972; Rogers 1973). In the 1980s and 1990s, counts of 80-100+ birds were the norm and there are credible records of 350+ and 231 birds in 1992 and 1997 respectively (Morris & Burton 1994; Morris 2000). A report of 633 birds in January 1997 (Kingsford

et al. 1998) is a typographical error – only 63 birds were present (D. Geering pers. comm.).

In recent years there has been a drastic decline in the numbers of Terek Sandpiper in the Hunter Estuary. Figure 2 illustrates the steady fall in peak counts from 83 birds in 1999 down to just 11 birds in 2009. The decline, which may reflect a lack of recruitment, also matches that for some other sandpiper species migrating to the Estuary. For example, Curlew Sandpiper *Calidris ferruginea* numbers have dropped by ~60% over the same period.

There are only occasional records from elsewhere in the Region – Port Stephens and sometimes Manning River – and these have been small numbers of birds that probably were on passage. The stronghold for the species has been the Hunter Estuary, which no longer hosts large numbers of Terek Sandpiper. In February 2010, 20-24 birds were occasionally recorded there but it is too soon to tell if this is representative of a recovery being underway. The outlook for this species in the Region seems poor.

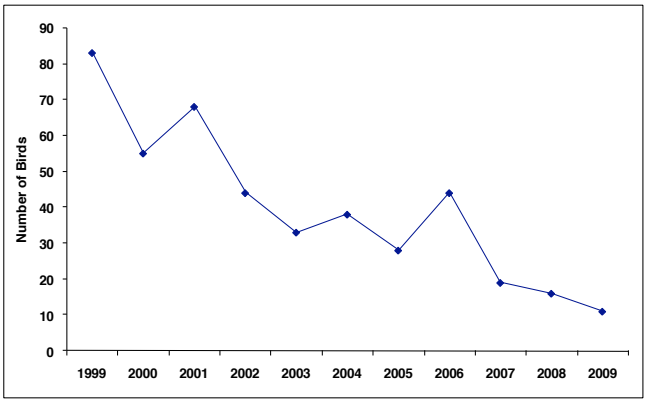

Figure 2. Annual peak counts for Terek Sandpiper in the Hunter Estuary

Great Knot *Calidris tenuirostris*

Conservation Status

NSW: Vulnerable IUCN: Vulnerable

Discussion

The Great Knot breeds in north-east Siberia and disperses to coastlines in Indochina and Australia after breeding. It is more common in northern Australia. The key threats for the species are in common with those for all migratory shorebirds. However, traditionally, large numbers have staged at Saemangeum (South Korea) on their migration passage through the East Asian-Australasian Flyway, and the destruction of that wetland for industrial/agricultural developments represents a greater specific threat for Great Knot than for most other migratory shorebirds.

Great Knots have been recorded in the Hunter Estuary most years, usually in counts of <10 birds. The maximum count over 1970-1990 was 30 (Smith 1991); in March 1996 36 birds were present (Kingsford *et al.* 1998). In more recent times, the typical numbers each year have been <10, with some exceptions. In particular, 90 birds were present in the Estuary in November 2008, 60 birds October 2003 and 30-55 birds over October 2002 to January 2003. The latter record is consistent with birds that have spent summer here, whereas the other records probably reflect birds on passage migration.

The Hunter Region does not appear especially important for Great Knots other than possibly as foraging habitat for birds with depleted fat reserves on arrival from their northern breeding grounds. Only small numbers are recorded most years. It may be opportunistic that larger numbers are sometimes present. The status of this species in the Region is uncertain.

Sanderling *Calidris alba*

Conservation Status

NSW: Vulnerable

Discussion

The Sanderling is a migratory shorebird that breeds in the northern Palaearctic, and disperses to coastlines globally after the breeding season. The world population is >500,000 but only some 22,000 birds migrate within the East Asian-Australasian Flyway (Wetlands International 2006). Birds favour sandy shorelines with surf, where they feed in shallow water.

The mouth of the Manning River is the preferred location for this species within the Region. Most records are from Mudbishops Point, occasionally Harrington. Single birds at Newcastle Bight in November 1999 and November 2009 are the only records from elsewhere. Since 2000, there have been frequent records of 15-30 birds at Mudbishops Point. 46 birds were present in January 2006, the highest known count. Prior to 2000, numbers apparently were lower; however, the frequency of visits also was much less. McGill (1951) commented on the absence of Sanderling records from the Manning River, where he visited regularly. Possibly it is a modern phenomenon for Sanderling to be present.

The small population of Sanderling that migrate to the Region appears stable and probably has increased in recent years. There seems an abundance of suitable habitat for the species, and it is surprising that there are not more birds recorded

and from other locations, such as Newcastle Bight. The degree of disturbance that occurs along that coastline is not dissimilar to Mudbishops Point. Until recently, Newcastle Bight was rarely surveyed for shorebirds, and it still remains under-surveyed.

Broad-billed Sandpiper *Limicola falcinellus*
Conservation Status
NSW: Vulnerable
Discussion
The Broad-billed Sandpiper is a migratory shorebird that breeds in the northern Palaearctic, and disperses to coastlines mainly in Indochina after the breeding season.

In the 1960s, the Hunter Estuary hosted around 100 Broad-billed Sandpipers each year (Smith 1991) and 180 birds were present in February 1972 (van Gessel & Kendall 1972). By the 1980s, numbers had plummeted – 15 birds were recorded in February 1983 and all other records were <10 birds. Now it is considered to be a rare visitor to the Estuary. Since 1993, the maximum count was four birds in 2004 and birds were present in just six of the 16 years. There are very few records from elsewhere within the Region.

The Hunter Estuary no longer receives large numbers of Broad-billed Sandpiper. This may be associated with a range contraction (the Region is towards the southern limit of the main range) or to habitat degradation and loss in the Estuary. Either way, the species seems to be approaching extinction locally.

Red-backed Button-quail *Turnix maculosus*
Conservation Status
NSW: Vulnerable
Discussion
The Red-backed Button-quail occurs in grasslands, forests and woodlands with a grassy understorey and in the vicinity of swamps and wetlands. It prefers coastal and sub-coastal habitats where there is water nearby and in areas that receive consistent rains. The species is seldom recorded within NSW, being more common in the northern part of its range.

In NSW, habitat for the Red-backed Button-quail is affected by inappropriate fire regimes and over-grazing of areas that in turn become more susceptible to weed invasion and removal of lower strata vegetation. The modification of wetlands through drainage or livestock grazing in coastal and sub-coastal areas has resulted in the loss of preferred breeding habitat. The species is also highly vulnerable to introduced predators, and modification of its habitat increases the likelihood of their presence.

Few records of Red-backed Button-quails exist from the Region. Records have been from Woodville and from Kooragang Island, the latter being the only location where the species has been recorded on more than one occasion. Ascertaining the conservation status of the local population is difficult due to the cryptic nature of the species and the paucity of knowledge of its local habitat preferences. The habitat on Kooragang Island where the species has been recorded is undergoing major modification and the area has been earmarked for further development. This may result in the disappearance of this species from Kooragang Island.

Little Tern *Sternula albifrons*
Conservation Status
NSW: Endangered
Discussion
In NSW, the Little Tern is a summer migrant, with most birds arriving in August-September and remaining until March. It breeds colonially at suitable locations along the coast, preferring to utilise coastal sand dunes and sand banks within lagoons/estuaries and laying its eggs in a small scrape. Colonies can range from a just a few pairs to 100 or more pairs.

Currently, there are two main breeding colonies within the Region. Both are in the Manning River, at Mudbishops Point (on the southern side of Farquhar Inlet) and Harrington. The numbers of breeding pairs vary and can be in excess of 100 pairs at both colonies (NPWS 2003). Some years, these two colonies yield ~45% of the Little Tern recruits in NSW.

There are often many non-breeding birds also present around the Manning River, with several credible records of 200-400+ birds, from Mudbishops Point in particular. This suggests that it is an important assembly point for the species.

In the 1990s, there was another breeding colony on the northern side of Farquhar Inlet but there are no known recent breeding records from this location. Similarly, a breeding site near Forster has been abandoned since 2001, and a former breeding site at Big Gibber (in Myall Lakes NP) is no longer used (A. Morris, pers. comm.). In the 2009/2010 season, breeding colonies briefly established at Newcastle Bight near Fern Bay (33 nests) and Swansea Channel (3 nests). Both colonies were

soon abandoned as a result of predation/human disturbance.

Lesser numbers (peak count 22 birds; M. Roderick pers. obs.) have been regularly present in summer from locations around Newcastle Harbour and foreshore areas since 2006, with some birds in breeding plumage and courtship behaviour sometimes noted. However, there were no reports of breeding until this most recent season.

Both Mudbishops Point and Harrington are very popular leisure areas and are subject to substantial influxes of people, the vast majority of which use vehicles for access. DECCW manages the two breeding colonies, the main areas of which are roped off and with extensive signage in place. Generally this is successful in keeping people and vehicles away from the eggs (A. Stuart pers. obs.) but the young runners are unlikely to remain confined within the roped-off areas. In January 2009, a fox was able to gain access to a sub-colony on one of the sandbanks at Mudbishops Point and caused considerable devastation (G. Crisp pers. comm.). Nonetheless, 164 fledglings were recorded, representing the second most successful breeding colony on the NSW coast (NPWS officers pers. comm.).

The Little Tern has declined in the Region in recent years, with at least one and probably two breeding colonies abandoned since around 1999-2001 and no new colonies established. The two remaining colonies at Manning River continue to be very productive but the locations within State Parks are prone to disturbances from human activities and they lack any substantial protection from predators. The possible impacts from climate change (leading to rises in sea level) are potentially significant. The medium- to long-term future for the Little Tern population of the Region is uncertain.

Gang-gang Cockatoo *Callocephalon fimbriatum*
Conservation Status
NSW: Vulnerable
Discussion
The Gang-gang Cockatoo occurs in woodlands and sclerophyll forests of south-east Australia, dispersing from higher altitude breeding areas to coastal and sub-coastal woodlands in autumn-winter.

All records are from the south of the Region. The stronghold of the species is within the Wollemi/ Yengo wilderness and the Watagan Mountains. It is also recorded on the Sugarloaf Range and during winter small numbers disperse onto the lowland forests around Cessnock, with the northern limit being approximately Kurri Kurri. There are regular reports from near the Watagans of adults feeding fledged young.

The local population seems stable. Much of the habitat for this species in the Region is under some form of conservation protection, particularly its breeding areas.

Glossy Black-Cockatoo *Calyptorhynchus lathami*
Conservation Status
NSW: Vulnerable
Discussion
The Glossy Black-Cockatoo inhabits forests and woodland where an abundance of preferred foraging habitat exists. The species has a noted preference east of the GDR to feed on *Allocasuarina* cones, in particular *A. littoralis* (Black She-oak) and *A. torulosa* (Forest She-oak).

Records of this species are reasonably widespread within the Region, although there appear to be some stronghold areas such as Wyee Point, Wollombi/Laguna, Watagan Mountains and the greater Wollemi/Yengo wilderness. Occasional records are noted from other areas such as the drier forests in the Cessnock LGA and Port Stephens.

Within the majority of forested habitats in the Region, there exists an ample resource of foraging habitat in the form of the two preferred feed tree species. Thus, the availability of food resources may not be the limiting factor affecting the species locally. There is a general paucity of breeding records and the reasons for this are unclear. Areas that contain the most suitable breeding habitat for this species (Cameron 2006) occur within large forested areas in conservation reserves. It is possible that other factors related to nesting success are impacting upon the local population. The status of Glossy Black-Cockatoos within the Region is difficult to gauge but given the amount of suitable foraging and nesting habitat available it is likely to be stable in the short to medium term.

Little Lorikeet *Glossopsitta pusilla*
Conservation Status
NSW: Vulnerable
Discussion
The Little Lorikeet occurs in dry sclerophyll forests on the coast, ranges and western slopes where it forages on the blossoms of eucalypts and other trees. Although the species may be resident in some areas it has nomadic tendencies, following

the flowering of eucalypt trees in a variety of forest types, both in western and coastal areas.

This species has been recorded regularly from a variety of locations throughout the Region. It does not appear to be experiencing as serious a decline as in other parts of its NSW range. It appears to be locally common to abundant in some areas, particularly when plentiful sources of nectar are available. 2009 was a particularly prolific year for Little Lorikeet, with large numbers present at many locations around the Region.

Most records are from areas situated on the floor of the Hunter Valley, rather than from the forested ranges where the vast majority of protected areas exist. The long-term viability of the local population may require protection of the preferred habitat on the floor of the Hunter Valley. However, in the short to medium term, the species seems secure.

Swift Parrot *Lathamus discolor*

Conservation Status

NSW: Endangered Commonwealth: Endangered
IUCN: Endangered

Discussion

The Swift Parrot breeds in Tasmania in summer. During autumn it crosses to the mainland, moving northwards through Victoria and NSW. Birds spend the winter in areas containing suitable feeding habitat, which is dry woodland/open forest habitat with plentiful blossom and lerps present. The total population has now declined to only around 2,500 birds (Saunders & Heinsohn 2008).

Swift Parrots visit the Region most years, albeit sometimes in small numbers and often in transit. Some years, the numbers are substantial. In 2000, at least 100 birds were present, an estimated 250-300 birds in 2002, 160-180 birds in 2005 and 200+ birds in 2007. These high counts are 10-15% of the estimated total population. The majority of records have been from the dry woodland areas around Cessnock and Kurri Kurri, such as Werakata NP/SCA, and several areas of privately- or Crown/ Council-owned land. In the years of peak counts there have also been frequent records from various areas around Lake Macquarie, and less frequently from other parts of the Region. In all years for which there are good data, the dry woodland areas around Cessnock and Kurri Kurri and the forests around Lake Macquarie have hosted at least small numbers of Swift Parrots.

Habitat loss and degradation are the most significant threats to the species in the Region. For example, the Hunter Economic Zone (HEZ) industrial subdivision near Kurri Kurri is likely to see the loss of a significant amount of foraging habitat for this species. In 2002, the Swift Parrot Recovery Team highlighted the significance of this area, calling it "one of the most important foraging sites for Swift Parrots in NSW" (Saunders 2002). Swift Parrots show fidelity to particular sites and records from these forests have been recorded for the past 24 years (D. Saunders pers. comm.) whilst anecdotal evidence suggests they have been using the Spotted Gum/Ironbark forests of the Lower Hunter for at least the past 60 years (Saunders 2002). It is likely that Swift Parrots consistently occurred within the Region before this time.

Many other areas containing Spotted Gum/ Ironbark forests are also under threat from large-scale residential subdivisions and coal mining. This, combined with increasing encroachment on coastal forests (where supplementary foraging habitat occurs) is placing much pressure on this species locally.

The Hunter Region is crucially important for the Swift Parrot. Its future in the Region and thus nationally, is of considerable concern. A usual practice for species whose population is under threat is that locations where >1% of the total population is regularly present, become targets for increased conservation/protection focus. It seems remarkably anomalous that the dry woodlands of the Hunter Region, known to support 10-15% of the total population of Swift Parrot, continue to be destroyed.

Turquoise Parrot *Neophema pulchella*

Conservation Status

NSW: Vulnerable

Discussion

The Turquoise Parrot is found in the open grassy woodlands and coastal heaths of south-eastern Australia. Nowhere is it common but numbers have recovered from the 1920s when it was feared to be nearing extinction (Morse & Sullivan 1929).

In the Region, birds are recorded fairly frequently at dry woodland and heath habitats in some National Parks in the west (e.g. Goulburn River, Wollemi) and nearby State Forests, Crown land and private properties. Most records are of pairs or small parties but groups of 10-15 birds sometimes are reported. Movements appear to be highly nomadic and sporadic records are noted from the forested areas around Cessnock/Quorrobolong.

There is also an isolated but apparently stable and resident population in Myall Lakes NP, with 6-12 birds often recorded there. They presumably breed locally, but there are no known breeding records from anywhere within the Region.

Much of the local habitat for this species occurs in areas with some level of conservation protection. Habitat loss/degradation is occurring in some dry woodland areas that lack any formal protection. Despite this, the local population of this nomadic species seems stable. However, because the population is small and the breeding areas are unknown, the future for the local population of the Turquoise Parrot is uncertain.

Powerful Owl *Ninox strenua*
Conservation Status
NSW: Vulnerable
Discussion
Australia's largest owl, the Powerful Owl, is found in open forests in south-east Australia, at altitudes up to 1,500m. On the coast its primary prey species is Common Ringtail Possum *Pseudocheirus peregrinus* and on the tablelands probably Greater Glider *Petauroides volans*. Pairs occupy large territories of 800-1,000+ ha (Debus & Chafer *in* Roberts 1994).

There are regular reports of Powerful Owl from many locations within the Region, including from the interface between forested habitats and settled areas. These include several widespread breeding records (sightings of birds with juveniles) and it is possible that the species may be adapting to cope with some level of habitat disturbance.

The majority of known sites for the species have some form of conservation protection in place or are effectively managed to protect owl habitat. The local population seems stable and there are no immediate causes of concern for the status of Powerful Owl in the Region.

Barking Owl *Ninox connivens*
Conservation Status
NSW: Vulnerable
Discussion
The Barking Owl is found in open forests and woodlands throughout Australia, except in the dry interior and in heavily forested areas. Birds often roost near watercourses.

Although it is probably resident in the Region, there are only occasional scattered records and it is considered rare. Recent work within Yengo NP has revealed several pairs (DECCW 2005b) and the species may be locally common in this reserve. A pair was observed within Yengo NP in May 2010 (M. Roderick pers. obs.). Other reserves such as Manobalai NR and Wollemi NP also contain small populations (DECCW 2005a; 2005c). Isolated records have also been noted from farther east within Werakata NP in the vicinity of Pelton (DECCW 2008).

It is possible that areas such as the Wollemi/Yengo wilderness hold stable populations of Barking Owls, although until such time as definitive surveys have been undertaken, the status of this species within the Region is uncertain.

Sooty Owl *Tyto tenebricosa*
Conservation Status
NSW: Vulnerable
Discussion
The Sooty Owl inhabits closed forest (rainforest) and tall open forest in the tablelands of south-east Australia (a sub-species occurs in Queensland). Previously considered rare, it is a cryptic species that often is overlooked (Debus *in* Roberts 1994). Pairs have territories with home ranges of 2-8 km^2.

There are regular records of Sooty Owl in the Region, in particular from the Watagan Mountains and the Barrington Range. Occasional records are also known from the Sugarloaf Range and in areas around Lake Macquarie. Historically, the species was more numerous than Powerful and Masked Owls at a property near Curricabark (Hyem 1979).

Most known sites for the species have some form of conservation protection in place or are effectively managed to protect owl habitat. Consequently, the local population seems stable and there are no immediate causes for concern for the status of Sooty Owl in the Region.

Masked Owl *Tyto novaehollandiae*
Conservation Status
NSW: Vulnerable
Discussion
The Masked Owl is found in open forests and woodlands throughout Australia, except in the dry interior. In NSW it is the least common of the three large forest owls. The inferred home range is around $2km^2$ per pair. The main prey is small and medium sized terrestrial mammals (Debus & Rose *in* Roberts 1994).

There are regular reports of Masked Owl from around the Region, in particular from Awaba SF, the Watagan Mountains, the western end of Port Stephens and the Barrington Range. In 2005, a pair

successfully raised young in Awaba SF, and a recently fledged young bird was recorded at Medowie in 2006.

The proportion of records as birds found dead by roadsides is higher than for most other nocturnal birds. The exclusively terrestrial diet of the Masked Owl seems to render it more susceptible to traffic threats. Despite this, most known sites for the species have some form of conservation protection in place or are effectively managed to protect owl habitat. There are no immediate causes for concern for the status locally.

Eastern Grass Owl *Tyto longimembris*
Conservation Status
NSW: Vulnerable
Discussion
The Eastern Grass Owl is found in grassy plains, heathlands, lignum swamps and similar habitats in northern Australia. In good seasons, birds disperse widely including to swampy depressions inland as far as Lake Eyre.

The Hunter Region is the southern limit of its range. Surveys found birds at many locations in Crowdy Bay NP and it was concluded that there was a potential population of around 40 birds there (Debus *et al.* 2001). In recent years, a population has been discovered in the lower Hunter Valley. Birds have been recorded from various locations such as Tomago, Ash Island, Hexham Swamp, Leneghans Flat and Williamtown. A recent study into this population has revealed at least ten birds present, spread over several sites (Blundell *et al.* unpublished results). It seems likely that the Eastern Grass Owl is breeding within this area. Elsewhere within the Region, records are known from the Allworth/Karuah/Bulahdelah area and also Anna Bay, Myall Lakes NP and Broughton Island.

Although also a hunter of terrestrial prey, there are fewer records of road-kill birds compared with the Masked Owl. This might be due to a combination of habitat preference and the relative scarcity of Grass Owls.

The widespread records suggest a healthy status for the species in the Region. The population in Crowdy Bay NP presumably is stable and secure; this is not the case for the Ash Island and Tomago birds as there is significant pressure for further industrial development around the Hunter Estuary. The opening of the Hexham Swamp and Tomago floodgates could adversely affect the local population and the future impacts of climate change (leading to rises in sea level) are an additional threat. There appears to be a high risk that habitat for Grass Owls within the Hunter Estuary will be lost in the short to medium term, thus threatening the viability of the local population.

Rufous Scrub-bird *Atrichornis rufescens*
Conservation Status
NSW: Vulnerable IUCN: Vulnerable
Discussion
This species occurs in rainforests and wet eucalypt forests in north-eastern NSW extending into Queensland. Its habitat is ferns and other dense low vegetation, often associated with the presence of Antarctic Beech *Nothofagus moorei*. The southern limit of the range lies in the Hunter Region. The population of the southern sub-species *A. r. ferrieri* is estimated at just 4,000 birds. Loss of habitat due to logging and clearing was previously a key threat, and most of its former lowland habitat has been cleared.

Locally, almost all records are from locations along Kerripit Road in the Gloucester Tops. This is a readily accessible area and biases the apparent distribution. NPWS organised surveys of some less accessible sites around Gloucester Tops and The Mountaineer (in Barrington Tops) over 1999-2001. In 1999, transects were made of 65 sample sites, finding 12 birds in total. The 2000 survey was less productive. In 2001, 13 male birds were recorded in a survey of 68 sites.

Rufous Scrub-bird habitat in the Gloucester and Barrington Tops has conservation protection and the local population probably is stable. A risk is that very little monitoring occurs; hence any changes in status might go unnoticed. The potential impacts of climate change upon this species are also not fully understood. All of the known habitat for Rufous Scrub-bird in the Region is included in the Barrington Tops/Gloucester Tops Important Bird Area. It is anticipated that this will reinvigorate efforts to monitor the species.

Brown Treecreeper *Climacteris picumnus*
Conservation Status
NSW: Vulnerable
Discussion
The Brown Treecreeper occurs in eucalypt woodland and dry open forests, predominantly on the western slopes and plains with some scattered occurrences east of the GDR. The species is particularly susceptible to habitat fragmentation and has been shown to suffer population declines when habitat remnants are below 300ha in size. At

a national level, the Brown Treecreeper underwent only a small decline (of 11%) in reporting rate in the period between the first and second Birds Australia Atlas projects (Barrett *et al.* 2003). However, in south-eastern Australia, although still widespread, it is one of a suite of woodland species that has declined in abundance (Garnett & Crowley 2000).

Although the Brown Treecreeper still is quite often recorded as pairs or small parties in dry woodland habitat within the Hunter Region, its numbers have declined locally, in keeping with the general situation in south-eastern Australia. There are many local examples where birds are absent from apparently suitable habitat or are present there in much fewer numbers than previously (such as Tarrant 2008, Stuart 2008a, Newman 2009, A. Zoneff pers. comm., authors' pers. obs.)

Part of the reason for the local decline may be an effect from the prolonged drought during 2005-2007. Although that drought broke in mid 2007 it probably will take time for the numbers to recover. However, it seems very likely that habitat loss, fragmentation and degradation are significant local factors. Furthermore, one of the most easterly known breeding populations of the species is under immediate threat due to clearing of significant woodland habitat for the proposed HEZ development near Kurri Kurri.

Although the Brown Treecreeper still is a reasonably common breeding resident, it appears to be in serious decline across its range within the Region.

Speckled Warbler *Chthonicola sagittata*

Conservation Status

NSW: Vulnerable

Discussion

The Speckled Warbler is found in grassy open woodlands in sub-tropical eastern Australia. Its numbers have declined substantially, throughout the distribution range. In habitat fragments of <100 ha, numbers declined by 40% over 1990-2000, while degradation due to loss of ground cover from grazing is implicated in high rates of nest failure; these approach ~80% in some areas (Garnett & Crowley 2000). Revegetation following cessation of grazing has also been shown to have a negative impact (Newman 2009 and 2010).

The range within the Region is widespread across the central and western parts, with many breeding records. However, although birds continue to be recorded quite frequently, circumstantial evidence suggests a decline in recent years. There are very few records of more than 10 birds from any areas, when previously this was reasonably common, and birds are noted to be scarce in some locations where previously they were not (Newman 2009).

The severe droughts of recent times may account for some of these observations (Newman 2010). However, loss, fragmentation and degradation of dry woodland habitat continue to occur. It seems likely that the Speckled Warbler population in the Region will continue to decline.

Regent Honeyeater *Anthochaera phrygia*

Conservation Status

NSW: Critically Endangered

Commonwealth: Endangered IUCN: Endangered

Discussion

The Regent Honeyeater occurs in dry eucalypt woodland and open forests of south-eastern Australia, predominantly west of the Great Divide. However, when conditions are favourable the species does inhabit drier forests and woodlands of the coastal belt and occasionally occurs in wetter coastal forests.

In the early 20th Century, the Regent Honeyeater was abundant in eastern Australia. For example, many thousands of birds were in the upper Hunter at times (White 1909). The species has undergone a dramatic decline across its range in the past 30 years. It is generally accepted that the total population is fewer than 1,500 birds and recent estimates for the NSW population are of possibly fewer than 250 mature individuals. The species was recently reclassified as Critically Endangered in NSW, which is the highest recognised level of threat to an extant species (NSW Scientific Committee 2010).

In spring, breeding colonies usually form at favoured locations (in particular, the Capertee Valley). After breeding, birds disperse widely and the non-breeding biology is not well known. However, it is believed that birds move nomadically, following well-established routes, until they find suitable areas for foraging (plentiful blossom).

In addition to the generic threats for woodland birds, the Regent Honeyeater is susceptible to competition from larger honeyeaters. This is exacerbated where the habitat has been modified allowing more adaptable/aggressive species to occur.

The Regent Honeyeater is recorded within the Region most years. The numbers range from less than 20 birds in some years, to 70+ birds in peak years (representing at least 3-4% of the total estimated population). In the lower Hunter Valley birds utilise the Spotted Gum/Ironbark dominated areas around Cessnock and Kurri Kurri, such as Werakata NP, and several areas of privately- or Crown/Council-owned land. The species is also recorded regularly in similar habitat from the foothills of the Watagan Mountains, at Quorrobolong. In the upper Hunter Valley, the favoured locations appear to be within intact woodlands along the northern escarpment of Wollemi NP (such as Widden Valley). The species also occasionally inhabits the Swamp Mahogany dominated forests around Lake Macquarie, such as Galgabba Point near Swansea and the Morisset Hospital reserve.

Birds frequently breed in the Region, although not to the extent of the population within the Capertee Valley. In 2006, several pairs nested in *Casuarina* sp. along Widden Creek (where some birds also bred in 1993). Several breeding events have been recorded in the Quorrobolong area, with pairs nesting in 2000, 2003 and in 2007. Of potentially greater significance was a larger breeding colony that established in the Spotted Gum/Ironbark forests south of Kurri Kurri in November 2007. The breeding occurred in an area zoned for industrial development in the HEZ site and was of particular importance not just locally but because the species did not breed in its usual stronghold in the Capertee Valley that season. The breeding event was also very successful, with a higher than normal ratio of fledged birds to nests noted (D. Geering pers. comm.). It is also likely that the species bred in the same location in the early 1990s (A. Zoneff pers. comm.) suggesting that the species may be faithful to particular breeding sites in the Region.

The future of the species in the Region is of much concern, due to the immediate threats of habitat loss and degradation combined with the recent alarmingly low population numbers within the State. The most significant threat is associated with the clearing of large areas of known habitat in areas such as HEZ and large coal mines that are expanding onto suitable habitat along the northern edge of the Wollemi escarpment. A considerable number of the other favoured locations for Regent Honeyeaters are either under private ownership or are administered by the Crown or local councils and are not under any form of conservation protection. Whilst it is unlikely that the species will go extinct locally in the short term, the continued pressures placed upon the local population can only be viewed as contributing to the factors that threaten the species as a whole.

As with the Swift Parrot, it seems remarkably anomalous that the woodlands of the Hunter Region, known to support at least 3-4% of the total population of Regent Honeyeaters, continue to be cleared.

White-fronted Chat *Epthianura albifrons*

Conservation Status

NSW: Vulnerable

Discussion

The White-fronted Chat occurs in open habitats in southern Australia, particularly in damp or low-lying areas. In coastal areas it occurs mainly in saltmarsh but also on sand dune swales, wetland edges and low mangroves. It is thought to be predominantly sedentary in these habitats.

Within the Region, White-fronted Chats are fairly localised and recorded from a small number of key locations. The species is most consistently recorded from Kooragang/Ash Island, Hexham Swamp, Newcastle Bight and Swan Bay. It is also recorded less often from other locations such as Stockton Sandspit and Forster, with isolated sightings from other parts of the Region. Small numbers were present in Manning Entrance SP in 2005/2006 (M. Thomas pers. comm.). Breeding records have only been noted from Kooragang/ Ash Island (mainly the latter) although the number of observers that visit these locations increases the chances that breeding is recorded.

Much of the habitat occupied by this species occurs within conservation reserves, as do other areas containing potential habitat. However, much of the preferred habitat (saltmarsh, itself recognised as an endangered vegetation type in NSW) is under threat from altered tidal prisms, mangrove-encroachment and also would be highly susceptible to the possible impacts of climate change. Therefore, whilst the species does not appear to be declining locally at present, the localised occurrence combined with the increasing threats to preferred habitat types suggest that the long-term viability of the regional population could be questionable.

Black-chinned Honeyeater *Melithreptus gularis*
Conservation Status
NSW: Vulnerable
Discussion
The Black-chinned Honeyeater occurs in drier forests and woodlands dominated by eucalypts that provide a foraging resource during flowering periods. Populations of this species forage over a large home-range and are known to utilise the largest forested remnants within which they are usually nomadic, following the flowering of eucalypt species.

In addition to the generic threats for woodland birds, the Black-chinned Honeyeater is susceptible to competition from larger honeyeaters. This is exacerbated in small remnant habitat fragments that are likely to be dominated by more aggressive, adaptive species.

Records of this species from within the Region, although fairly widespread, appear to be somewhat localised. Very few areas appear to have been consistently occupied, except for the Spotted Gum/ Ironbark forests of the greater Cessnock/Broke area, the northern edge of Wollemi NP and sites within Goulburn River NP.

In some areas where there has been consistent monitoring (such as the forests in the Cessnock area), the species appears to be sedentary. The populations that exist in the Cessnock LGA are significant in that they appear to represent one of the few large populations of this species that exist east of the GDR in NSW.

Of particular concern for the regional population are developments situated upon large forested areas occupied by this species, such as the HEZ and coal mine expansions in the upper Hunter Valley. Clearing of occupied habitat in these areas is likely to result in the loss of local populations. The areas with better conservation protection are more marginal for the species and displaced birds which attempt to move into those areas will cause stresses on the pre-existing populations; how this would affect those populations is difficult to gauge. What is clear is that the demonstrated difficulty for the species to persist in fragmented landscapes means that the viability of the species within the Region will decrease.

Painted Honeyeater *Grantiella picta*
Conservation Status
NSW: Vulnerable IUCN: Vulnerable
Discussion
The Painted Honeyeater inhabits a range of woodlands generally west of the GDR where Mistletoes (in particular *Amyema* spp.) occur. Although widespread within drier woodlands in the eastern half of the continent, the species generally occurs in low densities. Within its range it is fairly nomadic although there are some seasonal movements associated with the flowering of Mistletoe species.

Within the Region, Painted Honeyeaters are most often recorded in the woodlands of the Upper Hunter and Goulburn River catchments. There are some breeding records. It seems probable that birds occur in the Region regularly, perhaps influenced by conditions west of the GDR, and that they are overlooked due to the remoteness of some areas of preferred habitat. Likewise, undetected breeding events probably also occur.

The local population favours locations on the Hunter Valley floor with more fertile soils and better foraging resources. The vast majority of such habitat is unprotected and is under threat from further clearing for agriculture and coal mine expansion. Whilst the species is not under any short- to medium-term risk of local extinction within the Region, the longer-term outlook is uncertain.

Grey-crowned Babbler *Pomatostomus temporalis*
Conservation Status
NSW: Vulnerable
Discussion
The Grey-crowned Babbler inhabits woodlands and open forests in eastern Australia where it occurs in small family groups. The species nests and roosts communally.

The species is locally extinct in parts of its former range. In addition to the generic threats for woodland birds, a further threat is the isolation of small populations that are not viable in the long term. Recruitment does not occur for those populations, which progressively decline (Traill & Duncan 2000).

Within the Region, this species is recorded commonly and widely, including in areas where much habitat modification has taken place, and with regular breeding records. The species appears to be locally common around rural and rural-residential settlements in parts of the Lower Hunter

where wooded habitat exists in the vicinity. The species will readily forage in areas that are predominantly cleared and at some distance from woodland habitat and may even be favouring such habitat for foraging purposes (M. Roderick pers. obs.; Newman 2009).

It seems reasonable to conclude that the trend of decline experienced throughout the remainder of the NSW range has not occurred to the same extent locally and that the Grey-crowned Babbler is secure within the Region. However, some of the groups may be isolated populations that are about to decline. Also, the species would be vulnerable to the impacts of further habitat loss or modification.

Varied Sittella *Daphoenositta chrysoptera*
Conservation Status
NSW: Vulnerable
Discussion
The Varied Sittella occurs in a variety of wooded habitats throughout Australia, where several sub-species have been recognised. The nominate race (*D. c. chrysoptera*) occurs within the Region. It is recorded often and from a widespread number of sites, being locally common in a range of forested areas, and there have been many breeding records.

However, although still locally common, the species has declined within many parts of the Region, consistent with trends seen across the BA Atlases that led to its listing as a threatened species. Long-term systematic datasets from woodland areas have shown that the species has suffered a 25% decline in reporting rates over the past 14 years (Newman 2009). The same study and other parallel studies (e.g. Newman 2007, Newman & Lindsey 2008) have shown that the species may be mobile between woodland patches and hence could be dependent on connectivity and susceptible to the impacts of further fragmentation of habitat.

As with other declining woodland birds, the Varied Sittella is likely to be vulnerable to the impacts of further habitat loss or modification and to the long-term impacts of climate change. Whilst the species is not under any short- to medium-term risk of local extinction within the Region, the longer-term outlook is uncertain.

Olive Whistler *Pachycephala olivacea*
Conservation Status
NSW: Vulnerable
Discussion
This species occurs in temperate rainforests and wet forests in south-eastern Australia, including Tasmania where it is widespread. Southern birds disperse to lowland areas in autumn-winter but birds in Queensland and northern NSW (including the Hunter Region) are mostly sedentary.

Locally, birds are present in Barrington Tops and Gloucester Tops, and they are probably well distributed in any suitable habitat there. Although the majority of records are from locations in Gloucester Tops, this is the most readily accessible area and there are several known locations in Barrington Tops. In winter 1990, a single bird was recorded in the Watagans (A. Morris pers. comm.) – this is the only known record from elsewhere.

The majority of the Olive Whistler habitat in the Gloucester and Barrington Tops has conservation protection. The local population probably is stable. However, the potential impacts of climate change upon this species are not fully understood.

White-eared Monarch *Carterornis leucotis*
Conservation Status
NSW: Vulnerable
Discussion
The White-eared Monarch inhabits rainforests and wet forests east of the Great Dividing Range, from Cape York to around Grafton and casually further south. It is more common coastally than in highland areas.

The only records for the Region are from Crowdy Bay NP, which is generally considered to be the southern limit for casual occurrences. 1-2 birds (presumably a pair) were recorded regularly over 2003-2008 at Fig Tree in the north of the NP. There are no records since January 2008 (but the site is visited infrequently). An immature bird was reported to be present there in January 2007.

A single bird was also recorded in the NP in 1993. For many years this was not widely known and the Fig Tree location was not often visited. Birds may have been present in the intervening years, before the 2003 discovery prompted more frequent visits by observers.

The status of White-eared Monarch in the Region is unclear. A single pair appears to have been resident for several years and may have bred. This residency may be a chance occurrence or may represent a southward expansion of the range, as appears to be occurring for some other species.

Scarlet Robin *Petroica boodang*
Conservation Status
NSW: Vulnerable
Discussion
This species occurs in woodlands and forests in south-east and south-west Australia. Within the Region it is largely an altitudinal migrant, spending summer in habitats at higher altitudes and dispersing to lower elevations during winter.

It is recorded in most years from a wide range of sites, although infrequently and seldom in numbers greater than 1-2 birds. No breeding records have been noted within the Region, although there appears to be ample breeding habitat within large conservation reserves where it is recorded during the spring/summer months. The main threat to this species within the Region is likely to be loss of wintering habitat, due to the high levels of clearing within those habitats.

It is difficult to quantify to what extent the Scarlet Robin may have declined within the Region. Large areas of habitat remain, particularly in areas where the species could potentially breed during the warmer months. It is possible that the loss of wintering habitat has caused local declines and as such, any further losses of lowland habitat could be seen as contributing to the overall decline of the species. As the species is an altitudinal migrant within the Region, the future impacts of climate change cannot be discounted. However, there does not appear to be any immediate cause for concern about the conservation status within the Region.

Flame Robin *Petroica phoenicea*
Conservation Status
NSW: Vulnerable IUCN: Near Threatened
Discussion
This species occurs in woodlands in south-east Australia and Tasmania. Like the Scarlet Robin, it is predominantly an altitudinal migrant within the Region, spending summers in habitats at higher altitudes and dispersing to lower elevations during winter. However, the vast majority of records for the species are from higher altitudes in summer (where the species is known to breed), with very few winter records.

The relative paucity of winter records is difficult to explain. It is possible that birds may move onto the western slopes during the winter months, with only a few birds dispersing into sub-coastal lowland habitats. As for the Scarlet Robin, there appears to be ample breeding habitat within large conservation reserves where it is recorded during the spring/summer months.

It is difficult to quantify to what extent the Flame Robin may have declined within the Region. Large areas of habitat do persist, particularly in areas where the species is known to breed during the warmer months. As the species is an altitudinal migrant, future impacts of climate change cannot be discounted. However, there does not appear to be any immediate cause for concern about the conservation status within the Region.

Hooded Robin *Melanodryas cucullata*
Conservation Status
NSW: Vulnerable
Discussion
This species has a widespread distribution range across dry woodland areas of Australia. The south-eastern sub-species *M. c. cucullata* is found in eucalypt woodlands, acacia and mallee shrublands from about Mundubbera in Queensland to Spencer Gulf in South Australia. It has almost completely disappeared from many parts of central NSW. Once lost from a habitat fragment, re-colonisation rarely occurs without assistance (Garnett & Crowley 2000).

The range within the Region is widespread across the central and western parts. Locations around Broke and Jerrys Plains seem to be the stronghold but nowhere are birds common. Since 1988 there are only three known breeding records: 1999, 2000 and 2003.

The Hooded Robin population in the Region has declined and continues to do so. The severe droughts of recent years may partly account for this. However, loss, fragmentation and degradation of dry woodland habitat continue. The outlook for this species locally is of concern.

Diamond Firetail *Stagonopleura guttata*
Conservation Status
NSW: Vulnerable IUCN: Near Threatened
Discussion
The Diamond Firetail occurs in south-eastern Australia from Eyre Peninsular in South Australia to around Longreach in Queensland. It inhabits grassy open woodlands. Key threats in NSW are habitat loss, fragmentation and degradation; the latter includes loss of key food plants from invasion by exotic grasses more suitable for flock-foraging Red-browed Finches *Neochmia temporalis* (Garnett & Crowley 2000). Some illegal trapping probably continues to occur.

Once widely distributed as far as the coast (Stuart 2009b) it is now mostly recorded from the central and western parts of the Region. Regular breeding

records are received from these areas. Birds continue to be recorded frequently, but the data suggest a decline in recent years. There are very few records of more than 10 birds from any areas, when previously this was reasonably common.

The Diamond Firetail population in the Region has declined since European settlement and this trend appears to be continuing as a result of the ongoing loss, fragmentation and degradation of dry woodland habitat, and also the sowing of exotic grasses for pasture improvement. There is some evidence that recent droughts allowed the species to be more competitive against other native finch species (Tarrant 2008). However, on balance, the outlook for this species locally is of concern.

Regular Non-breeding Seabirds

Several pelagic species that are recorded relatively often in the offshore part of the Region are classified as threatened largely because of threats that are external to the Region. Mostly, those are manifest at the breeding grounds (which are on islands in the Pacific and/or Southern Oceans) where habitat degradation and predation can occur, and also the breeding populations are sometimes constrained to just a small number of islands. In some cases, for example albatross species, commercial long-line fishing practices (which lead to birds drowning when they take bait) are another significant threat.

For completeness, the regional status of each of the regularly visiting seabird species is discussed below.

Wandering Albatross *Diomedea exulans*

a) D. e. exulans (Snowy Albatross)
Conservation Status
NSW: Endangered Commonwealth: Endangered IUCN: Vulnerable
Discussion
There are few confirmed records, but observers are not always able to distinguish this sub-species in the field. A single bird was recorded in August 2002, two birds in August 2003 and four birds the following month, eight birds in October 2006, and a single bird in January 2007. An illustration of the relative rarity of this sub-species is that 26 Wandering Albatross were recorded offshore on 25 October 2008 and none were sub-species *D. e. exulans*.

b) D. e. antipodensis (Antipodean Albatross)
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable IUCN: Vulnerable
Discussion
This sub-species often is recorded in the Region. In October 2006, eight *D. e. antipodensis* birds were recorded during a pelagic survey off Newcastle. This was ~20% of the Wandering Albatross numbers seen that day. It is unusual for such a high proportion of the sub-species to be present – all other records have been of 1-2 birds.

c) D. e. gibsoni (Gibson's Albatross)
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable IUCN: Vulnerable
Discussion
This is the most common sub-species of Wandering Albatross occurring in the Region. In October of both 2006 and 2008, 25 *D. e. gibsoni* birds were recorded on a single day and 6-8 birds are not uncommon on pelagic surveys in winter.

Black-browed Albatross *Thallassarche melanophris*
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable IUCN: Endangered
Discussion
The Black-browed Albatross is one of the most common albatrosses of the Region, along with the Yellow-nosed Albatross *T. chlororhynchos*. Winter pelagic surveys regularly find up to 10 birds, and occasionally up to 20 birds. Sightings from land occur frequently as the species often forages near-shore.

The sub-species *T. m. impavida* and *T. m. melanophrys* are both recorded; the former seems to be marginally more common. Birds have only been recorded between May and early November.

Shy Albatross *Thallassarche cauta*
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable IUCN: Near Threatened
Discussion
Small numbers of Shy Albatross are offshore each year. Sub-species *T. c. cauta* and *T. c. steadi* are recorded most often, the latter being marginally more common. Occasional *T. c. salvini* birds have also been recorded. Birds are usually only present between June and October. An exception is a single bird which was off Saltwater Beach in April 2006. This is also unusual in that it is uncommon for the species to forage near-shore.

Unusually, 40 birds were present at about 10 nautical miles off Swansea in August 2002; there is only one other instance of >5 birds being recorded since the intermittent pelagic surveys commenced in 2000.

Southern Giant-Petrel *Macronectes giganteus*
Conservation Status
NSW: Endangered Commonwealth: Endangered
Discussion
Small numbers of immature Southern Giant-Petrel are recorded offshore between June and October each year. Most records are of dark phase birds: a white phase bird (its age therefore less certain) was present off Swansea in August 2002. All the confirmed records are from pelagic surveys, where birds generally come close enough to allow differentiation from *M. halli* which is very similar in appearance. Many near-shore sightings of giant-petrels are unable to be identified to species level.

Northern Giant-Petrel *Macronectes halli*
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable
Discussion
Small numbers of immature birds are recorded offshore between June and October each year. Most of the confirmed records are from pelagic surveys. On 31 May 2009, six giant-petrels were observed near Newcastle Baths and two of these were confirmed to be Northern Giant-Petrels (M. Roderick pers. obs.).

Flesh-footed Shearwater *Ardenna carneipes*
Conservation Status
NSW: Vulnerable
Discussion
Substantial numbers of birds are present offshore from October each year, departing in late March – early April. It is not uncommon for reports of 100+ birds to be received. Most records are from pelagic surveys; sightings from land are uncommon but not exceptional (but, they are of far fewer birds).

Providence Petrel *Pterodroma solandri*
Conservation Status
NSW: Vulnerable IUCN: Vulnerable
Discussion
Providence Petrels are commonly recorded on pelagic surveys between March and October, with the exception being a single bird in early November 2000. Most counts are of 10-30 birds but the numbers occasionally are higher. 100+ birds were recorded off Swansea in June 2001 and 150+ birds off Port Stephens in July 2009.

Vagrants and Rare Visitors

Several threatened species have been recorded only occasionally in the Region, with no known local breeding records. The Region does not play any important role in the long-term conservation of those species. For completeness, these vagrant/ rare species are briefly discussed below.

Cotton Pygmy-goose *Nettapus coromandelianus*
Conservation Status
NSW: Endangered
Discussion
The only known records are of female or immature birds at Minmi (at the former sewage works) in July 2002 and Hands Lagoon, Bolwarra in October 2002 (possibly the same bird at both locations).

Superb Fruit-Dove *Ptilinopus superbus*
Conservation Status
NSW: Vulnerable
Discussion
Principally an obligate rainforest species and predominantly restricted to Queensland and northern NSW in its range, there are only four recent records of Superb Fruit-Doves. These were of single birds at Pacific Palms in April 1996, Gloucester in December 1999, Harrington in November 2006 and a bird that collided with a window in Merewether in May 2009. The status within the Region is unclear, but most likely it is an irregular visitor. The vast majority of suitable habitat for this species occurs in conservation reserves within the Region and none of the threats affecting the species are likely to be significant locally.

Rose-crowned Fruit-Dove *Ptilinopus regina*
Conservation Status
NSW: Vulnerable
Discussion
Inhabiting rainforests and occasionally mangroves and other coastal forests, the Rose-crowned Fruit-Dove is more common in northern Australia and is not considered to be a resident within the Region. There have been frequent summer records from littoral rainforests in the north (mainly Harrington and Seal Rocks) matching with the partial north-south migration in eastern Australia that is described in HANZAB. Unusually, a bird remained at Balickera (north of Raymond Terrace) for several weeks over September/October 2007. The occasional record of dead birds in autumn and spring suggests that birds may be in transit through the Region at those times. The vast majority of suitable habitat for this species within the Region occurs in conservation reserves and none of the

threats affecting the species are likely to be significant locally.

White-bellied Storm-Petrel *Fregetta grallaria*
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable
Discussion
The only records are single birds at the continental shelf in March 2006, January 2007 and March 2010.

Little Shearwater *Puffinus assimilis*
Conservation Status
NSW: Vulnerable
Discussion
A single bird was recorded at the continental shelf in January 2007, and beach-washed birds were found at Mudbishops Point in February and March 2002.

Kermadec Petrel *Pterodroma neglecta*
Conservation Status
NSW: Vulnerable Commonwealth: Vulnerable
Discussion
Birds were at the continental shelf in February 2001, April 2005 and March 2006. Three individuals were recorded in 2005 and five birds in 2006 - these numbers suggest that Kermadec Petrels may be frequently present in the Region.

Black-winged Petrel *Pterodroma nigripennis*
Conservation Status
NSW: Vulnerable
Discussion
The only record for the Region is of a single bird at the continental shelf in January 2007.

Masked Booby *Sula dactylatra*
Conservation Status
NSW: Vulnerable
Discussion
There is only one confirmed record, this being a beach-cast bird found in September 1979.

Brolga *Grus rubicunda*
Conservation Status
NSW: Vulnerable
Discussion
The only confirmed record is of a single bird flying over Morpeth in November 2005.

Greater Sand Plover *Charadrius leschenaultii*
Conservation Status
NSW: Vulnerable
Discussion
Single birds were at Mudbishops Point in November 2004 and November 2009, Newcastle Bight in November 2009 and Stockton Sandspit in January 2005, and up to three 3 birds at the latter location over January-March 2007. It is somewhat surprising that birds do not visit the Region more regularly.

White Tern *Gygis alba*
Conservation Status
NSW: Vulnerable
Discussion
The only record for the Region is of a single bird at the continental shelf in March 2003.

Grey Ternlet *Procelsterna cerulea*
Conservation Status
NSW: Vulnerable
Discussion
A single bird was at the continental shelf in March 2002, while in February 1995, after heavy storms, a single bird was offshore from Booti Booti NP.

Sooty Tern *Onychoprion fuscata*
Conservation Status
NSW: Vulnerable
Discussion
Many birds were recorded at sea in January 2007 in several pelagic surveys, including 15+ birds on 21 January off Newcastle and 4-5 birds off Port Stephens 21-22 January. Prior to 2007 there had only been six records for the species although this included 7+ birds off Swansea in January 2001.

Sooty Terns are often recorded further south of the Region in February-March, and it seems plausible that they may be regular visitors locally. However, the records are intermittent and more data will be needed in order to confirm this.

Pied Honeyeater *Certhionyx variegatus*
Conservation Status
NSW: Vulnerable
Discussion
There are only four known records of this species in the Region – a single bird at Paxton in October 2002, two birds at Wingen in March 2003, Baerami Creek in September 2007 and Warkworth November 2008.

Barred Cuckoo-shrike *Coracina lineata*
Conservation Status
NSW: Vulnerable
Discussion
The Harrington rainforest is the only known location for the species, with records of single birds there in December 1996, January 2000, October and November 2003, and November 2004. The rainforest is surveyed fairly frequently by birdwatchers and it seems clear that these birds are not regular visitors.

CONCLUSIONS

The Hunter Region hosts 74 threatened bird species or subspecies listed under the NSW *Threatened Species Conservation Act 1995*, some present regularly and some only occasionally. In the local context, three guilds appear significantly threatened – woodland birds, migratory shorebirds and beach-nesting birds. Loss, modification and fragmentation of habitat and disturbances at roosting, feeding or nest sites are key local issues for those guilds.

The Hunter Region is nationally important for two Endangered species: the Swift Parrot and the Regent Honeyeater, the latter of which has been recently listed as Critically Endangered in NSW. For both species the outlook within the Region is of considerable concern. These species are increasingly being pushed into marginal habitat as the result of removal of their preferred habitat for mining and residential/industrial developments.

In a NSW context, the Region is very important for migratory shorebirds and beach-nesting birds. The Terek Sandpiper is in significant decline, as is probably the Black-tailed Godwit, while the Lesser Sand Plover and the Broad-billed Sandpiper are close to extinction locally. The ongoing industrial developments around the Hunter Estuary and future rising sea levels both mitigate against the conservation of these and other shorebirds, with the further dilemma that off-set programs remove habitat that was suitable for other threatened species such as Australasian Bittern, Australian Painted Snipe and Eastern Grass Owl.

With the exception of the Critically Endangered Beach Stone-Curlew, the local beach-nesting threatened species populations are stable and in some cases are growing. However the two established Little Tern colonies are at locations that are liable to disturbance and predation, and there are few successful breeding records for Australian Pied Oystercatchers. For the latter, it is not known how recruitment occurs and this is a significant conservation risk.

The Little Lorikeet and Grey-crowned Babbler seem to be faring well compared with the wider trends and the Region is a relative stronghold for them. However, for many other species the medium to long-term outlook is uncertain. Further habitat loss is a major threat for a great many of them. The potential impacts to threatened waterbirds and rainforest birds from climate change are yet to be fully understood. Mostly, climate change will be a threat to threatened species in the Region (e.g. rising sea levels and possible isolation of highland populations) but conversely it may result in southerly range expansions for some species – an example being the White-eared Monarch.

Some species appear to have stable or increasing populations locally. However, until actions are taken to more adequately prevent the loss and fragmentation of habitats for threatened species and to conserve areas where such species are known to be present, it is very likely that the majority of the threatened species populations of the Hunter Region will continue to decline.

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Distribution of threatened bird species in the Hunter Region (1998-2009)

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Distribution maps at 10-minute grid scale for the Hunter Region are presented for 42 bird species listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as "threatened") under the *Threatened Species Conservation Act 1995* (NSW). The maps are based on data for the Region extracted from the database of the Birds Australia Atlas project. This is the first time that maps of Atlas data have been produced at such fine scale and they reveal a number of records which appear to represent either isolated occurrence or extra-limital occurrence at the micro-scale. A capability for data manipulation and mapping has been developed that substantially enhances our knowledge about the distribution of threatened species in the Region and can be extended to other species in future.

INTRODUCTION

The previous paper in this volume of *The Whistler* (Roderick & Stuart 2010) reviewed the status in the Hunter Region of the 71 species listed under the *Threatened Species Conservation Act 1995* (NSW). This paper provides the distribution maps for 42 of these species based on records from the Birds Australia Atlas project database. Some species were excluded from the analysis because there was either insufficient information to provide a meaningful distribution map for the Hunter Region (e.g. pelagic seabirds, coastal Emu *Dromaius novaehollandiae*) or their distribution was relatively restricted (e.g. Gould's Petrel *Pterodroma leucoptera*, White-eared Monarch *Carterornis leucotis*, some species of shorebirds).

BACKGROUND

The distribution maps are based solely on observations submitted to Birds Australia (BA) over the period 1998 to 2009 through its Atlas project. The first four years of this project involved the active phase of the New Atlas of Australian Birds (Barrett *et al.* 2003). During this phase, the New South Wales Bird Atlassers made their records available for the Atlas project. When the active phase was completed, BA decided to continue the Atlas project indefinitely as a bird monitoring project termed the "Ongoing Atlas" using unchanged survey methods.

Most of the observations submitted to the BA Atlas involve one of two different types of surveys. The predominant method (68% of the surveys for the Hunter Region over the 12 years) involves surveys conducted by either individual or groups of observers who submit observations for an area defined by a central point and a radius of either 500m or 5km. While most of these surveys cover a period of up to one day, it is possible to submit records covering periods of up to one month. The second type of survey involves records collected in an area of 2ha over a period of 20 min. Because of the small site area and short duration this type of survey generates much shorter lists than the larger area surveys. Both types of survey provide valuable information on bird distributions and have been used to generate the distribution maps presented in this paper. However, the differences in survey method do impact on the reporting rates (the frequency that a species is recorded during Atlas surveys, abbreviated below as RRs). This

complicates the analysis of the data. A brief explanation for this follows.

RRs are a convenient means of summarizing the results of large sets of bird observations like those in the BA Atlas database. The interpretation of RRs is complex because the magnitude of a RR is affected not only by changes in the relative abundance of a species, but also by changes in survey type, observer experience and survey effort. Over the 12-year period of Atlas data collection there have been significant variations in observer participation rates, observers and their abilities, survey types and the spatial distribution of survey effort. All of these factors militate against the use of variations in reporting rates as an index of change in bird populations over a period of years. However, under strictly controlled conditions subsets of the Atlas data can be used for this purpose. For example another paper in this volume (Newman 2010) demonstrates changes in the status of the Speckled Warbler *Chthonicola sagittata* at Green Wattle Creek by using long-term sets of either monthly 2ha or 500m area surveys carried out in identical manner by the one observer. However, most of the BA data set has been generated under conditions that are too variable for temporal interpretation, particularly at the 10-minute grid scale. The situation becomes even more difficult when attempting to use RRs to gauge the relative abundance of different species. Nevertheless RRs do provide a very crude indication of the status of species. For instance very common species like the Yellow-faced Honeyeater *Lichenostomus chrysops* and Grey Fantail *Rhipidura albiscapa* have much higher RRs and broader distributions than uncommon species like the Speckled Warbler and Varied Sittella *Daphoenositta chrysoptera*. Species considered to be scarce or even rare like the Olive Whistler *Pachycephala olivacea* and the Rufous Scrub-bird *Atrichornis rufescens* have even lower RRs and more restricted distribution.

The boundaries of the Hunter Region used in the maps presented in this paper are based on the area defined in the Hunter Region Annual Bird Report series (Stuart 1994 to 2010) and are reported at a grid scale of 10 minutes latitude/longitude.

METHODS

The BA data were exported from their main database and supplied as an Excel file. To produce the maps presented in this paper, the Excel data were imported into the geographic information system Arcview 3.3. Once imported, data for each of the threatened species were overlayed onto spatially referenced geographic features such as the boundaries of the Region and important waterways and towns. To aid with the vetting and analysis of the individual species records, an Excel macro was developed that allows the distribution data and reporting rates (for the Region and for the individual cells) for the selected species to be extracted for any individual year or for the complete 12-year period.

There are many records which do not get submitted to the BA Atlas project and some of these have been published in the Hunter Region Annual Bird Reports. No attempt has been made to incorporate these additional observations into the BA Atlas database or into the maps presented here. Indeed, as many of these observations involve incidental sightings as opposed to survey lists, their incorporation into the Atlas would bias the analysis of reporting rates which are an important attribute of the data when assigning variations in abundance to the distribution of individual species. Another difficulty impacting on the decision not to include additional records is the probability that the same data may have been submitted to more than one organisation (e.g. to HBOC or to NSW Bird Atlassers as well). The downside is the omission of some records that may supplement knowledge of distribution.

DISCUSSION

Figure 1 shows the variation in Atlas survey effort. As expected, the effort is biased towards the centres of population, but there is some coverage of the whole Region except in four remote cells. It should be appreciated when examining maps for nocturnal species that BA Atlas surveys, especially 2ha surveys, are predominantly diurnal, and consequently under-record night-birds. These require a specific focus and specialised techniques.

42 species-distribution maps are presented in this paper. Each map indicates the number of records of that species during the 12-year period. RRs have been calculated for individual 10-minute cells for which 20 or more surveys have been made, this being the minimum number considered necessary for the reporting rate to be meaningful.

Some threatened species, while uncommon, remain widely distributed and relatively numerous. For instance the Varied Sittella was reported from 55 percent of the 10-minute grid cells which comprise the Hunter Region. There were 601 records from 7,254 surveys made in the 82 cells where the Varied Sittella occurred. These numbers equate to an average reporting rate of 8.3 percent, and based on work in the central Hunter was declining over the period of this study (Newman 2010). The map

for the Varied Sittella shows how the reporting rate varied across the Region. Areas where the Varied Sittella is present, but with insufficient survey effort to assign a meaningful RR, are also shown.

At the opposite end of the spectrum, the Rufous Scrub-bird has a very limited distribution, being recorded just 20 times and from only four cells. The average reporting rate for the species from the 324 surveys made in those four cells was 6.2 percent.

Space limitations prevent discussion about the 40 other species for which distribution maps have been generated. Readers will note from the maps that many threatened species have a wide distribution in the Hunter Region whilst others have much more restricted ranges.

The maps provided in this paper are the first time that detailed distributions of birds have been produced at the 10-minute grid scale for the Hunter Region, previous publications involving 1-degree grids (Barrett *et al.* 2003, Blakers *et al.* 1984). At the 36-times finer scale, this set of distribution maps shows a number of records which appear to represent either isolated occurrence or extra-limital occurrence at the micro-scale. Such instances have been marked with a "?" in the maps. These records occur outside the core distribution of the species and may involve areas apparently lacking suitable habitat. Although misidentification is always a possibility, the authors are expressing no judgment on these records. HBOC, BA and the New South Wales Bird Atlassers all use data vetting procedures and therefore we have no reason to believe the records are incorrect. However, we question whether they reflect the regular and ongoing occurrence of the species in those areas. Publication of the "?" records is intended to stimulate further investigation.

CONCLUSIONS

The recently acquired capability for data manipulation and mapping has enhanced our knowledge about the threatened species in the Hunter Region. In time, it will do the same for our knowledge about all species, not just the threatened ones. It will also greatly assist in vetting for anomalous records, which then can be investigated more closely. These maps will allow both observers and database custodians to identify records that require verification because of their importance at the 10-minute scale. For vetting and verification to be effective it is desirable that the importance of a record is appreciated at the time of observation, so that appropriate field notes are kept.

In the future it is our intention to extend the analysis of the database to understand what limits the distribution of various species. Clearly the Rufous Scrub-bird is restricted to high altitude areas. Similarly the breeding range of the Flame Robin *Petroica phoenicea* is known to be restricted to high altitude areas, but in contrast to the Rufous Scrub-bird this species moves to lower altitudes in winter. It is intended to extend the analysis to compare the distributions throughout the year and determine the breeding and non-breeding ranges.

An even more adventurous opportunity is to determine reporting rates at short intervals throughout the year to in order to search for evidence of migration through the Region (Griffioen & Clarke 2002).

Although in this paper the Atlas data have been evaluated at a 10-minute grid scale, they are in fact collected at even finer scale around precisely known co-ordinates. This provides a future opportunity to exploit GIS capabilities to overlay the bird distributions with topographical information. In addition to improving the understanding of existing bird distributions, this approach may have applications for monitoring and estimating populations of threatened species in Important Bird Areas (IBA). For this application an exciting possibility is to use the GIS tools predictively to interpolate where to search for specific species in areas of difficult terrain, where there has been no previous survey effort.

We have demonstrated in this paper that the outcomes of the Atlas project have the potential to greatly exceed merely mapping bird distributions. However in order to achieve these future ambitions, we need more data and are dependent on the ongoing participation of volunteers in systematic bird survey effort. We hope that this paper will inspire that contribution, as well as providing an improved basis for informed management decisions involving the conservation of the threatened species of the Hunter Region and their habitats.

ACKNOWLEDGEMENTS

We thank Birds Australia for agreeing to provide records from the BA Atlas database and in particular, the strong support from Andrew Silcocks, the BA Atlas Coordinator, throughout this initiative.

Birds Australia has data exchange arrangements with other organizations including the New South Wales Bird Atlassers and the use of the latter's Hunter Region records is gratefully acknowledged.

The authors wish to thank an anonymous referee and the Editor (Harold Tarrant) for a number of helpful comments, which have been taken into account in this version of the text.

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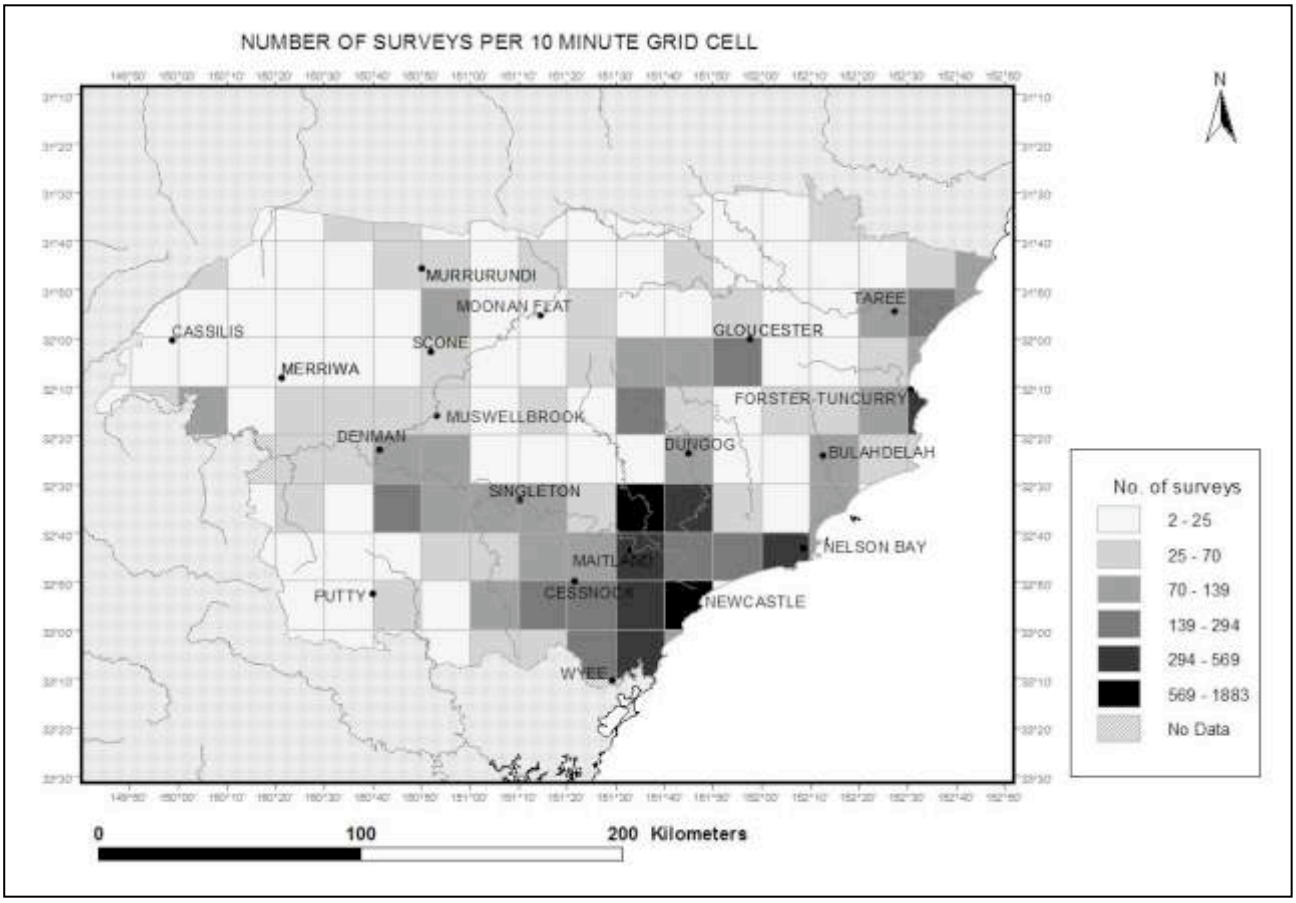
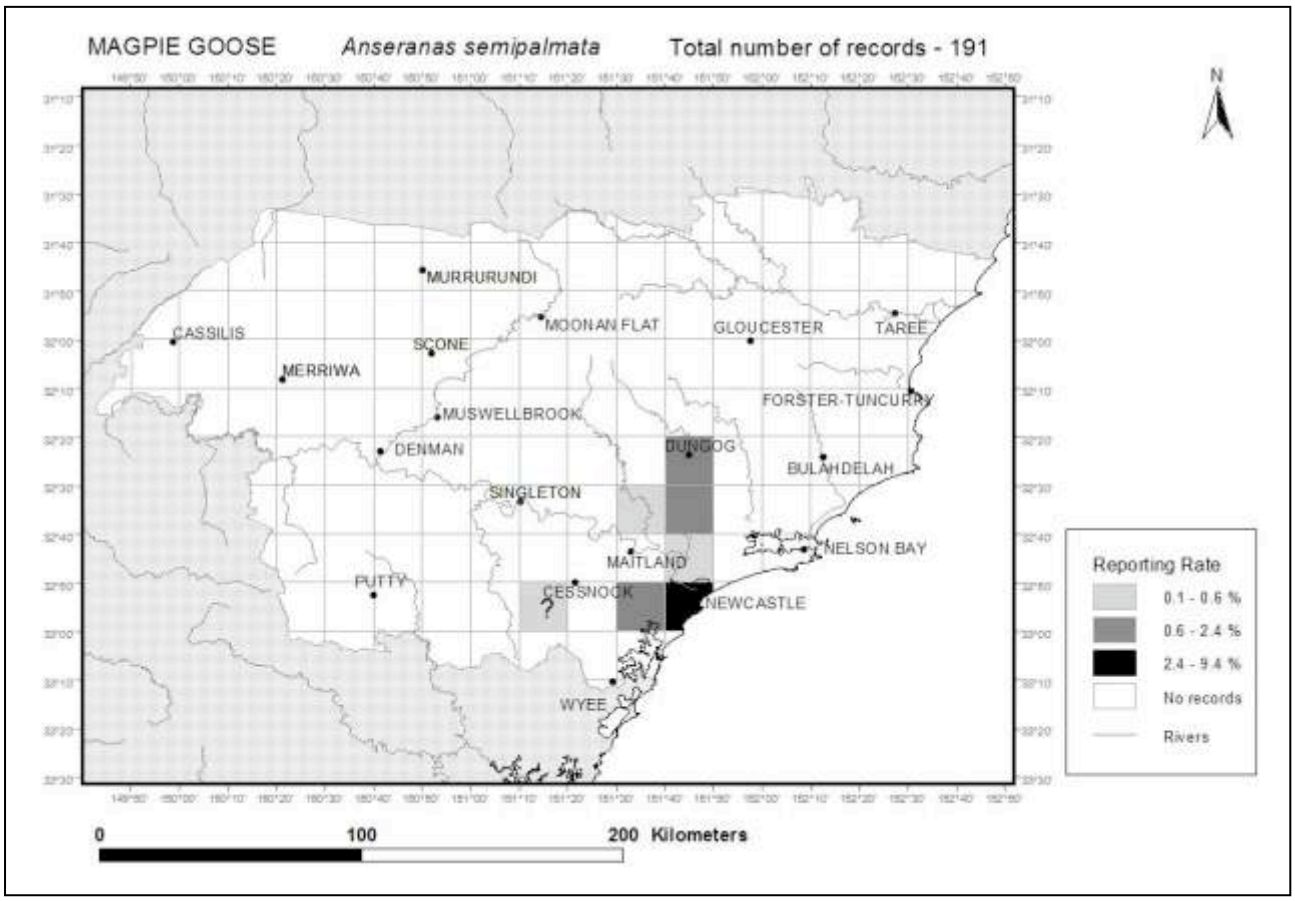
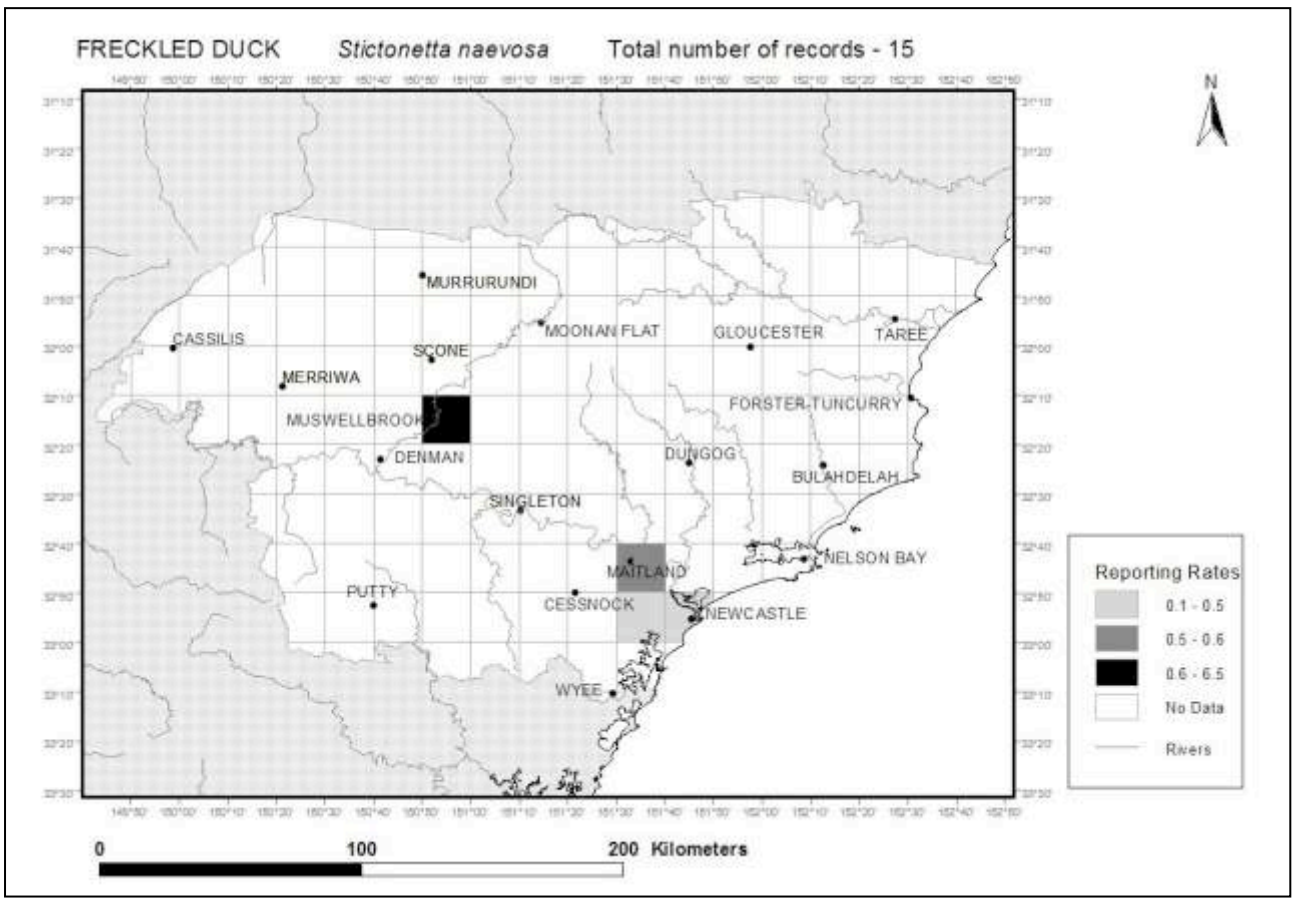
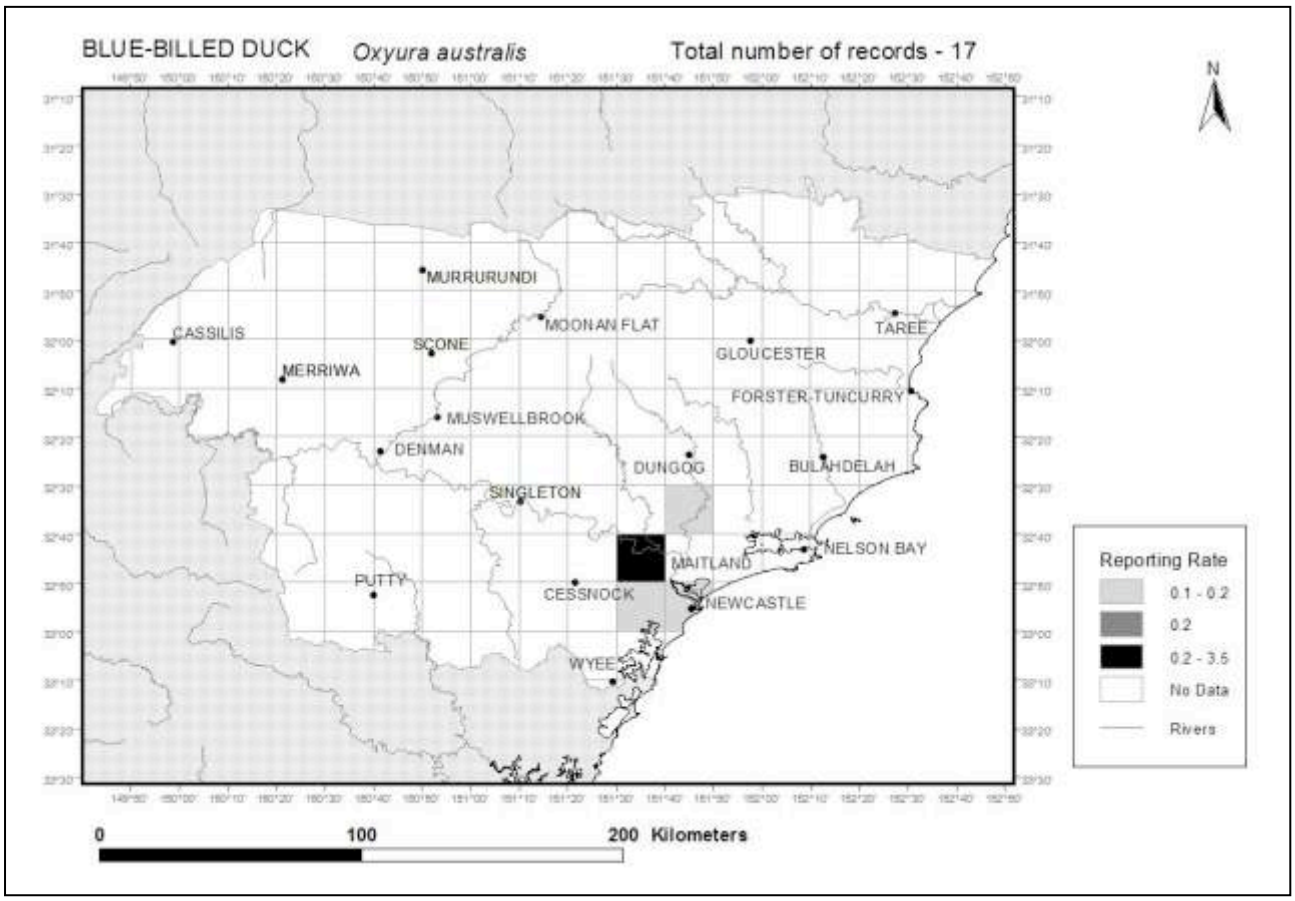
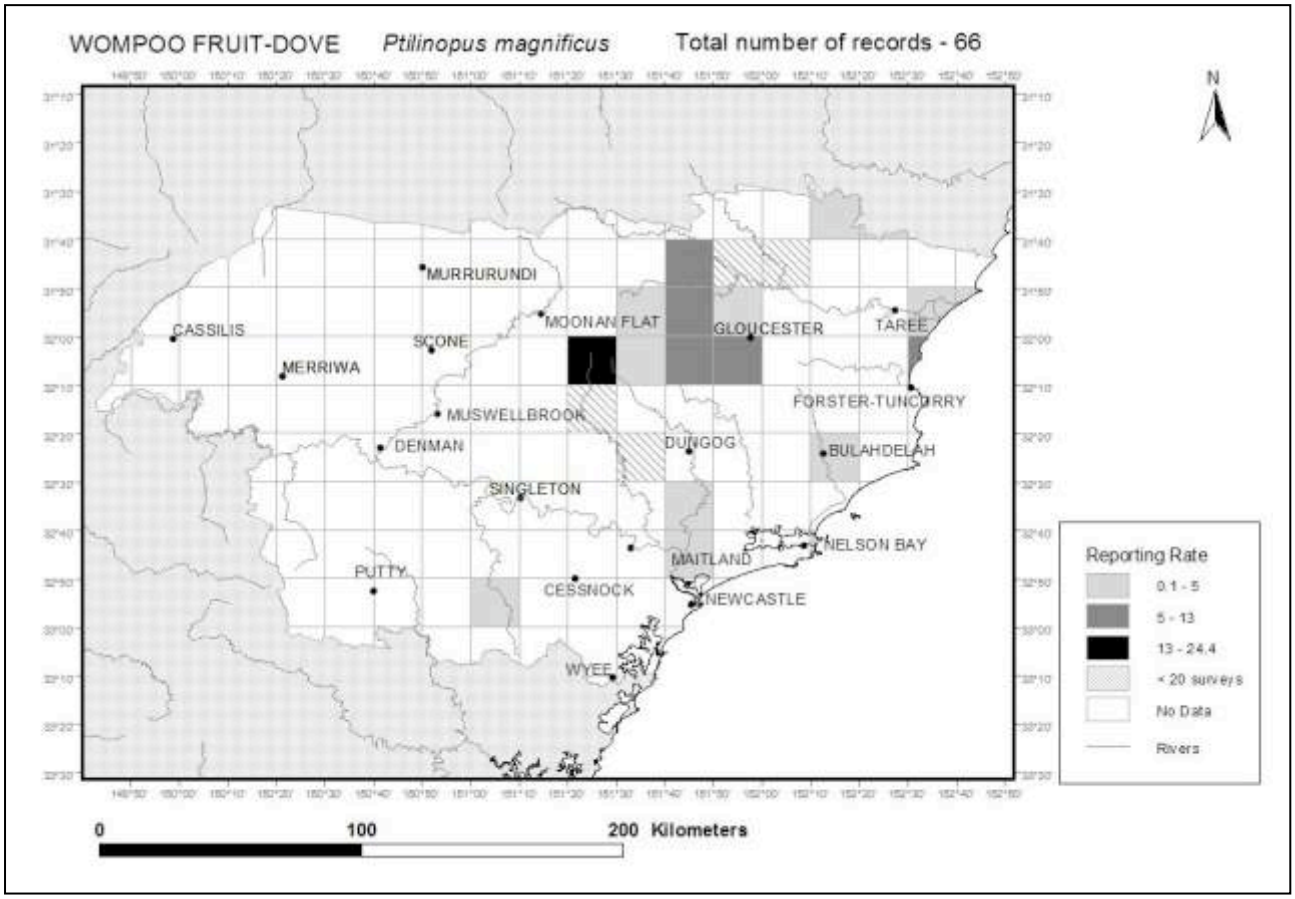


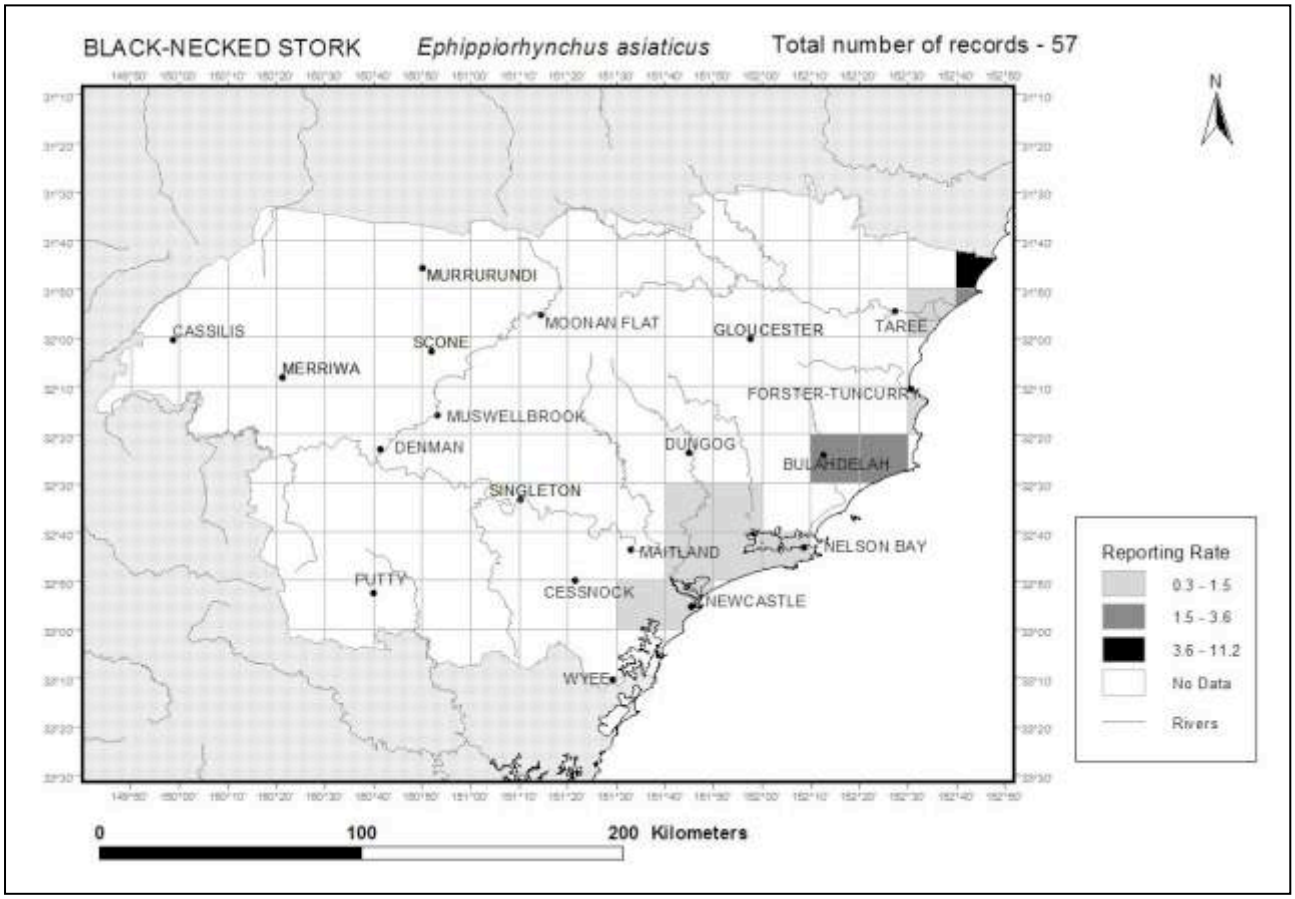
Figure 1. Birds Australia Atlas survey effort in the Hunter Region

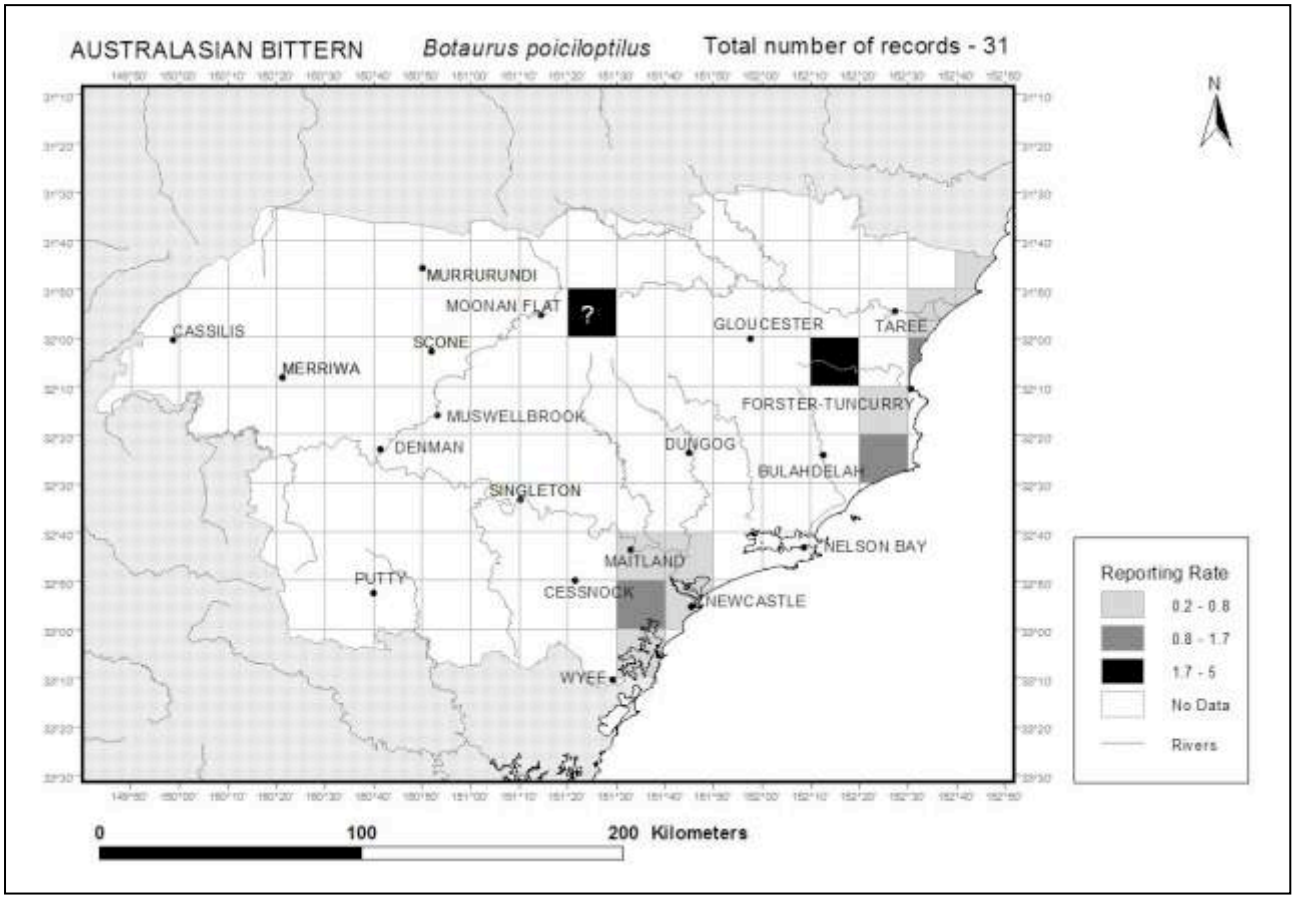

MAGPIE GOOSE
Anseranas semipalmata
Total number of records - 191
N
MURRURUNDI
CASSILIS
SCONE
MOONAN FLAT
GLOUCESTER
TAREE
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 0.6 %
0.6 - 2.4 %
2.4 - 9.4 %
No records
Rivers
0
100
200 Kilometers

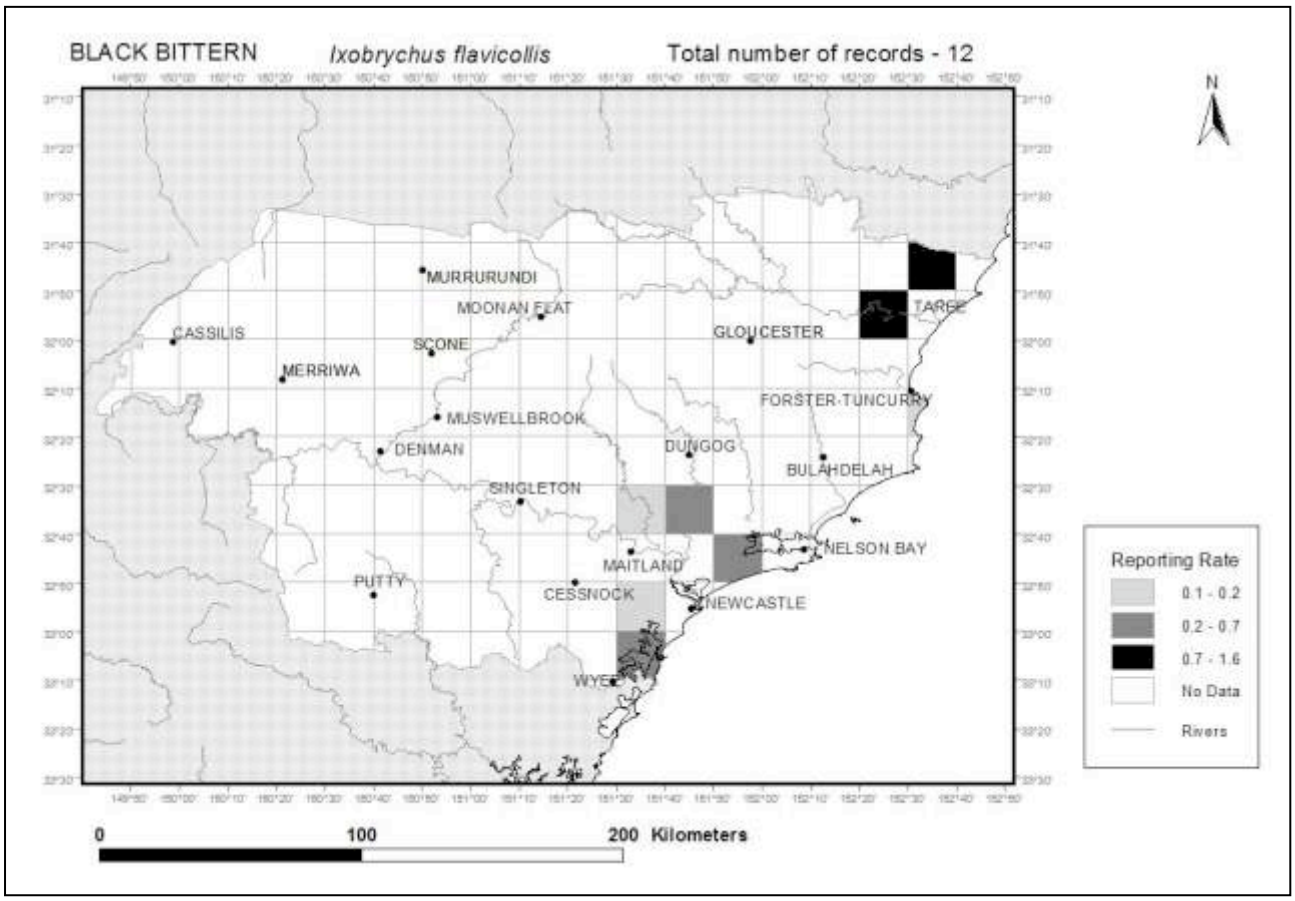

FRECKLED DUCK
Stictonetta naevosa
Total number of records - 15
N
MURRURUNDI
CASSILIS
SCONE
MOONAN FLAT
GLOUCESTER
TAREE
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rates
0.1 - 0.5
0.5 - 0.6
0.6 - 6.5
No Data
Rivers
0
100
200 Kilometers

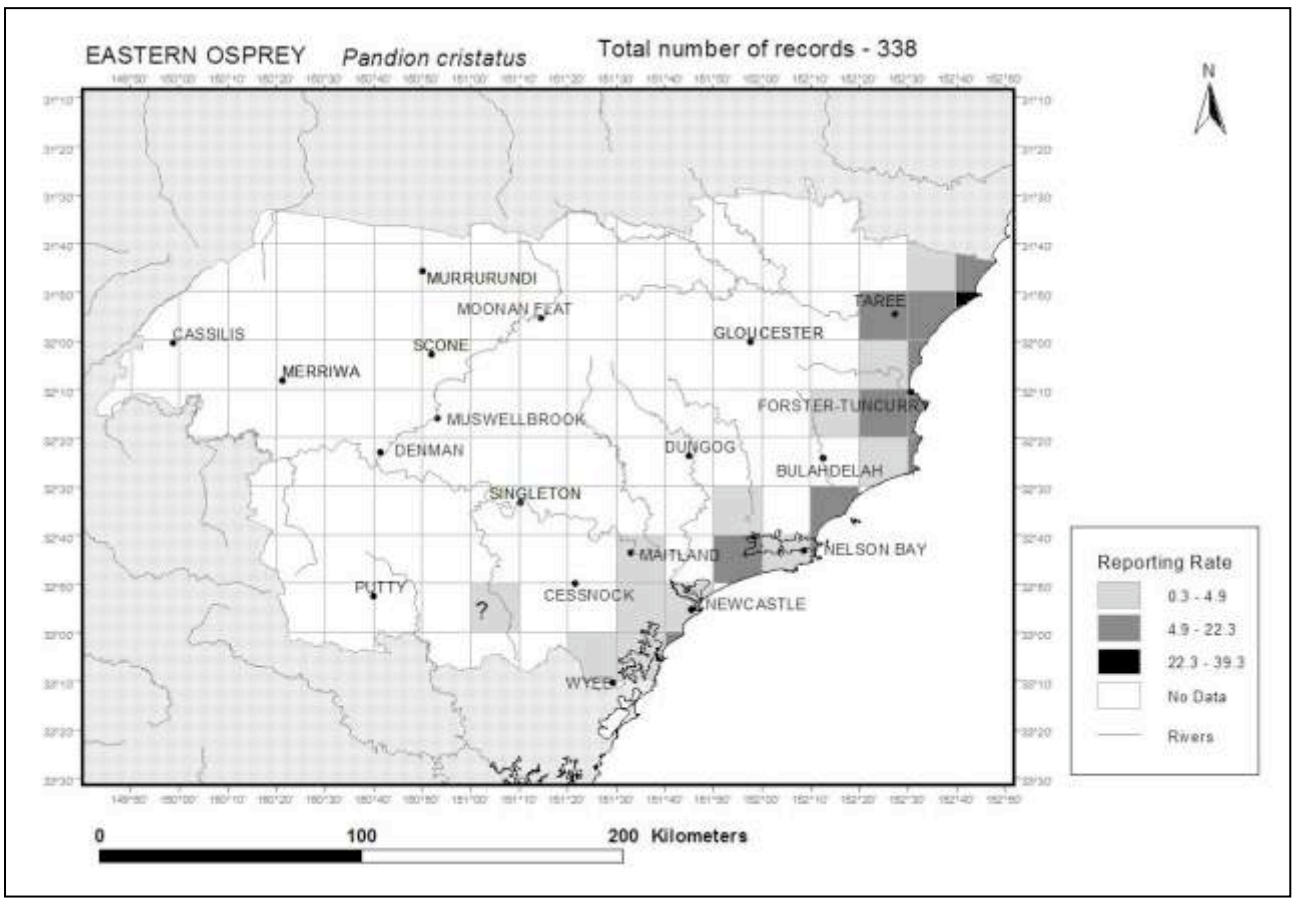

BLUE-BILLED DUCK
Oxyura australis
Total number of records - 17
N
MURRURUNDI
CASSILIS
SCONE
MOONAN FLAT
TAREE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 0.2
0.2
0.2 - 3.5
No Data
Rivers
0
100
200 Kilometers

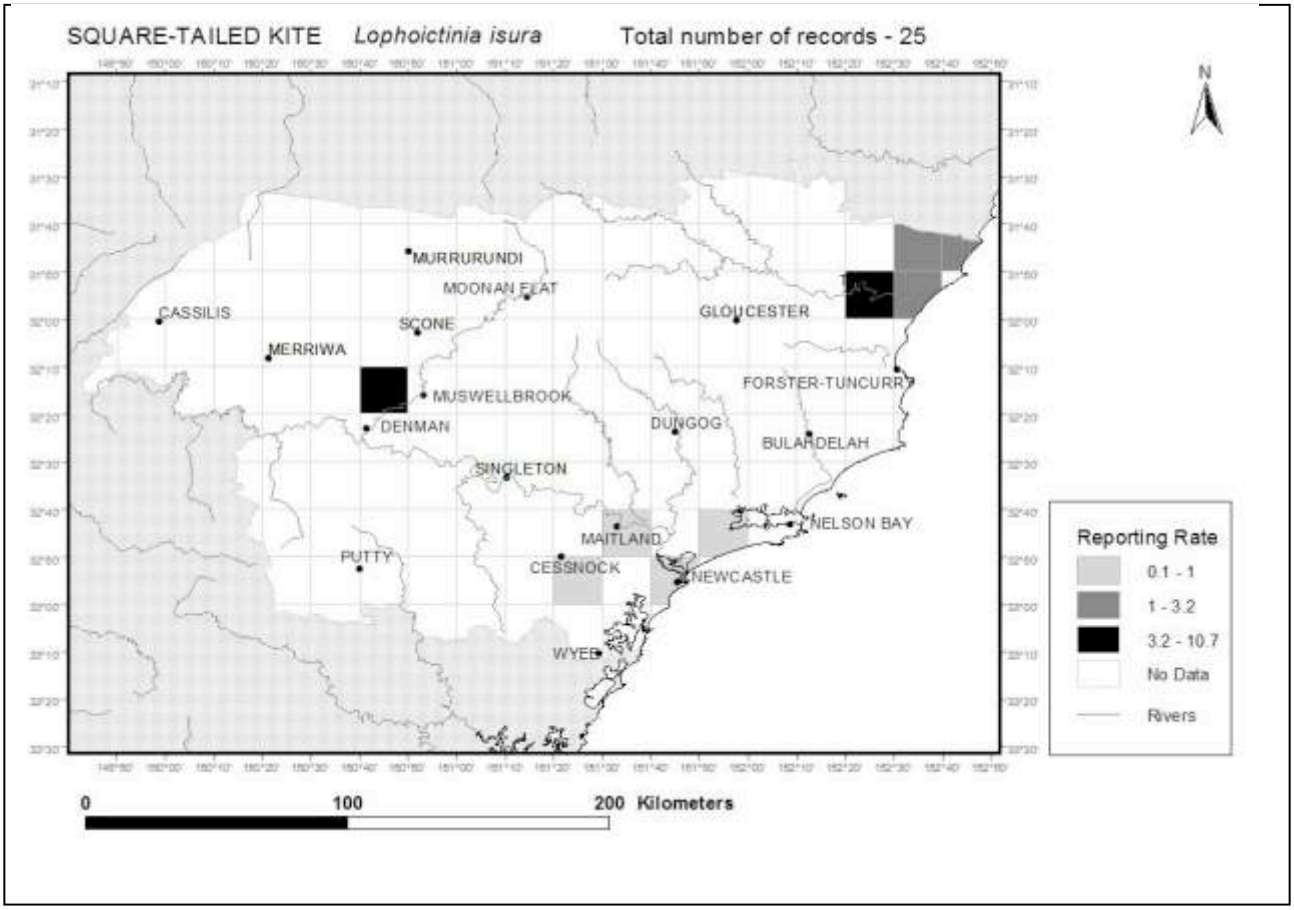

WOMPOO FRUIT-DOVE
Ptilinopus magnificus
Total number of records - 66
N
MURRURUNDI
CASSILIS
MOONAN FLAT
GLOUCESTER
TAREE
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 5
5 - 13
13 - 24.4
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

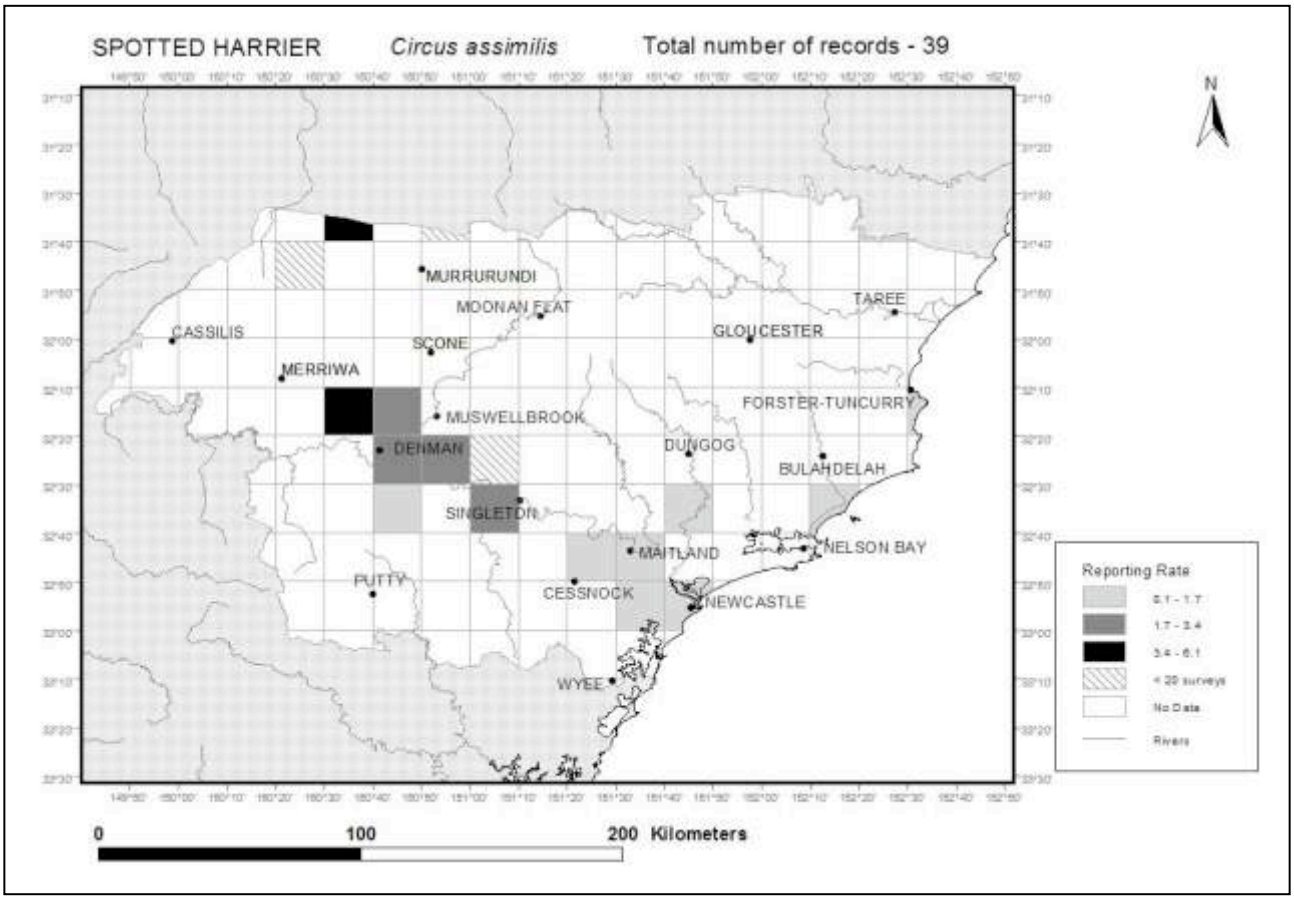

BLACK-NECKED STORK
Ephippiorhynchus asiaticus
Total number of records - 57
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.3 - 1.5
1.5 - 3.6
3.6 - 11.2
No Data
Rivers
0
100
200 Kilometers

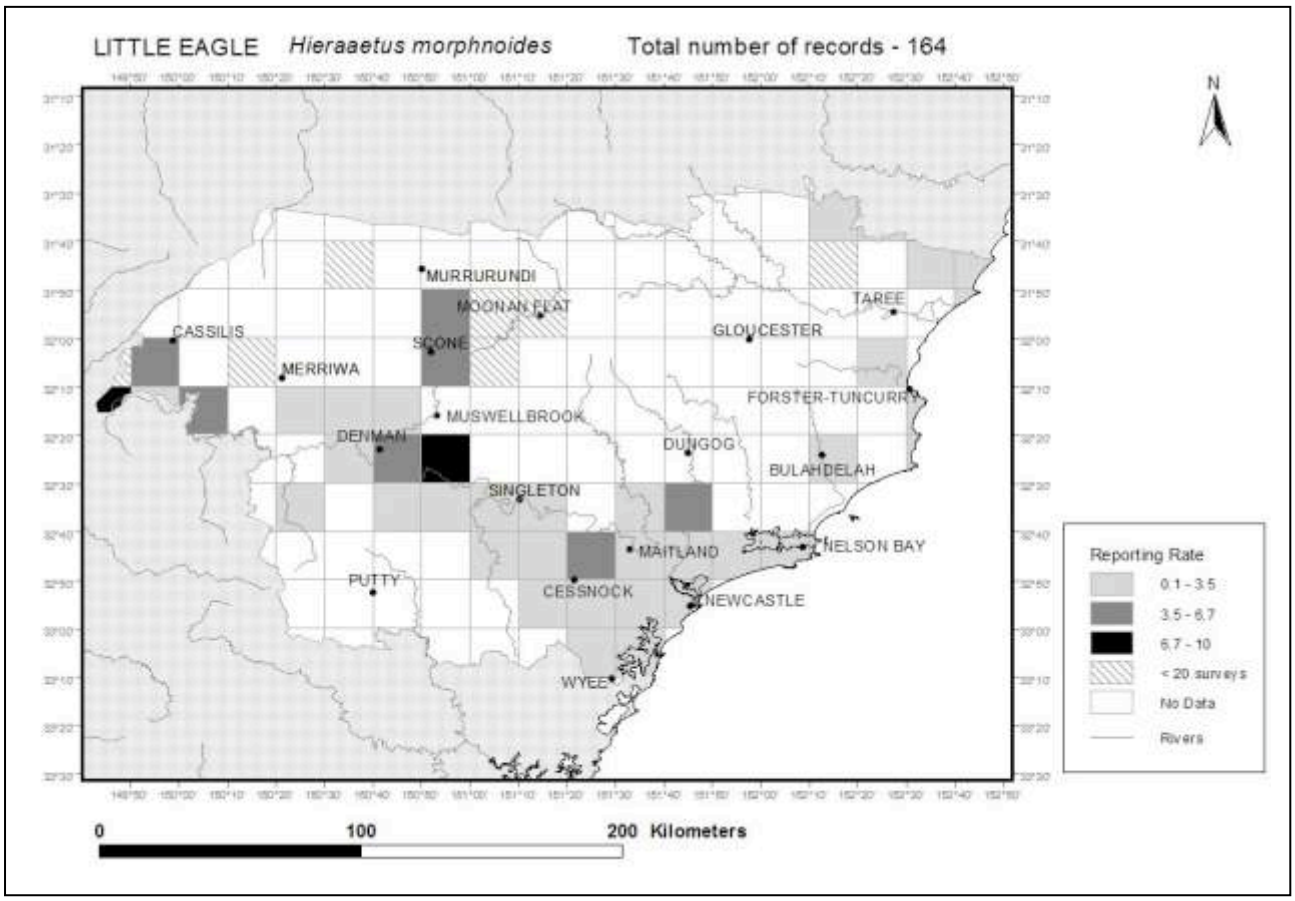

AUSTRALASIAN BITTERN
Botaurus poiciloptilus
Total number of records - 31
N
MURRURUNDI
MOONAN FLAT
?
CASSILIS
GLOUCESTER
TAREE
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.2 - 0.8
0.8 - 1.7
1.7 - 5
No Data
Rivers
0
100
200 Kilometers

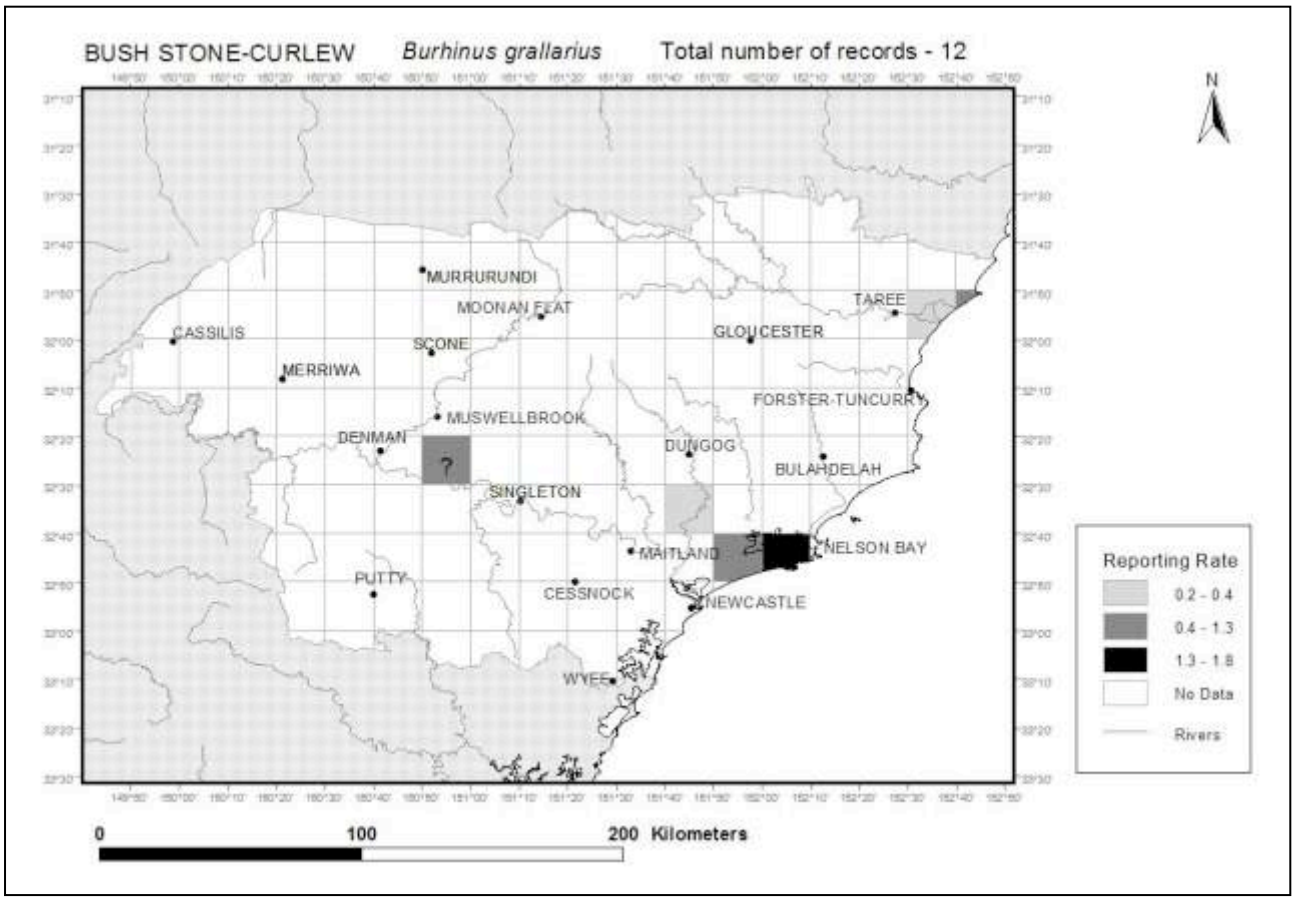

BLACK BITTERN
Ixobrychus flavicollis
Total number of records - 12
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 0.2
0.2 - 0.7
0.7 - 1.6
No Data
Rivers
0
100
200 Kilometers

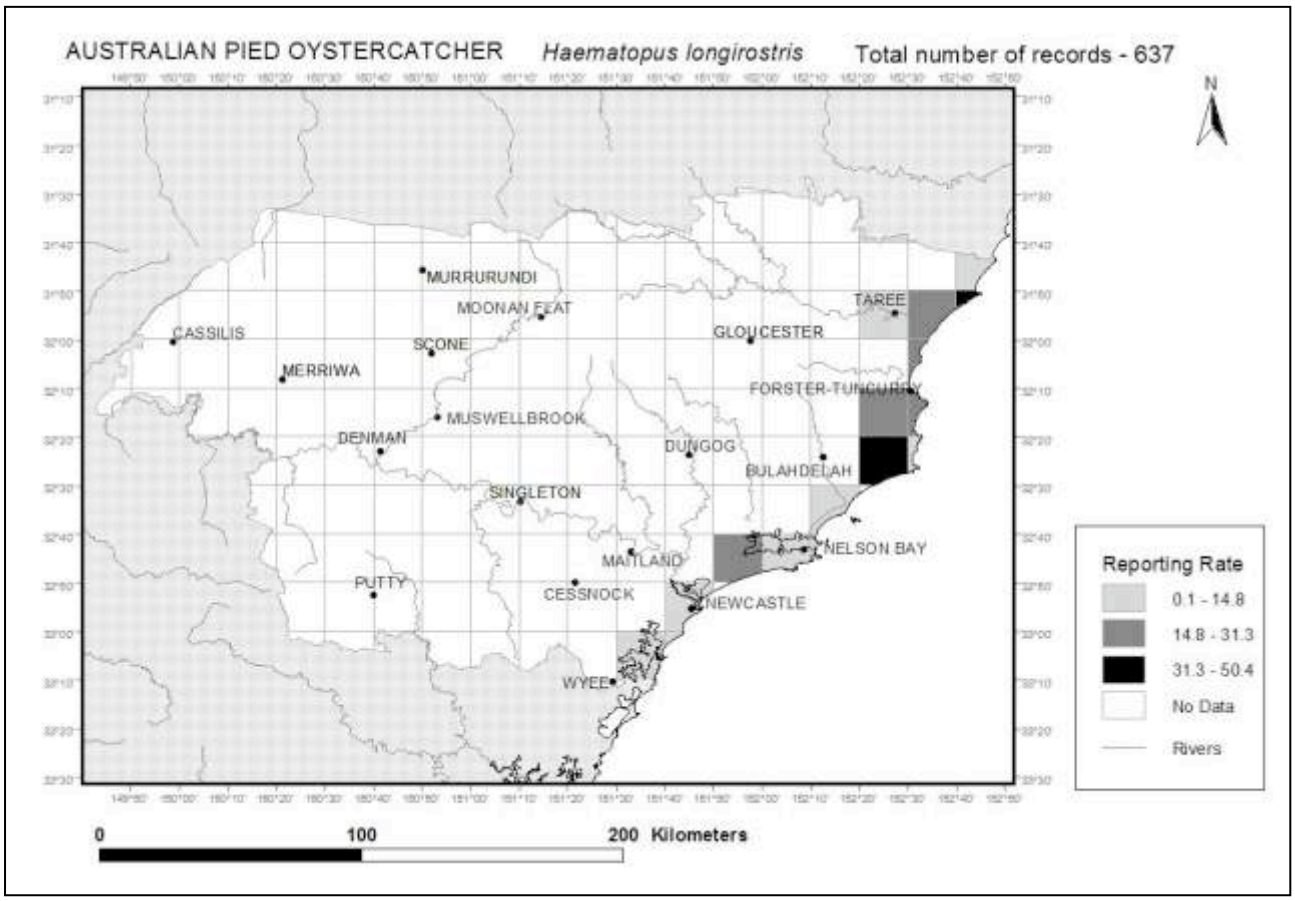

EASTERN OSPREY
Pandion cristatus
Total number of records - 338
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
?
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.3 - 4.9
4.9 - 22.3
22.3 - 39.3
No Data
Rivers
0
100
200 Kilometers

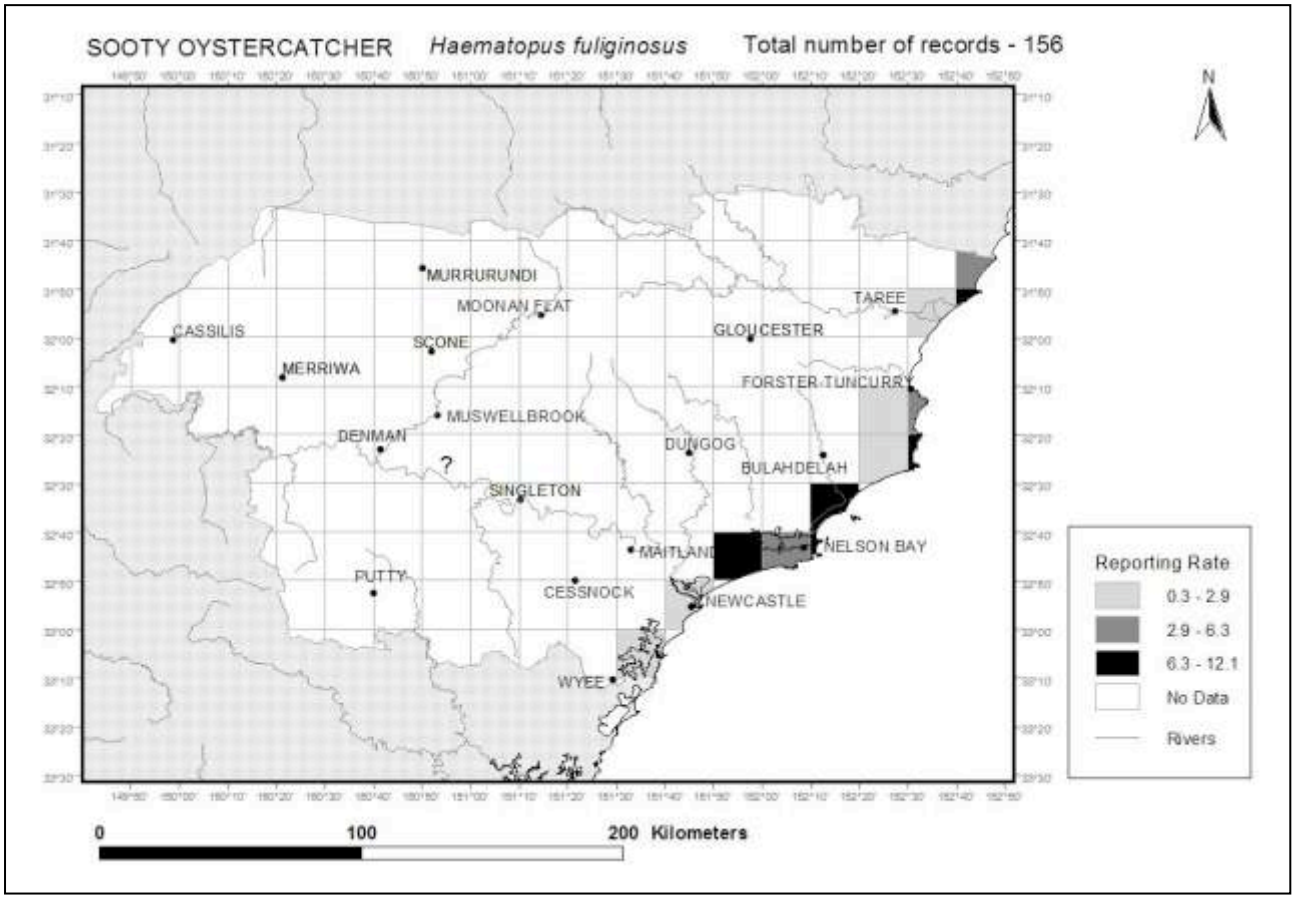

SQUARE-TAILED KITE Lophoictinia isura Total number of records - 25
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 1
1 - 3.2
3.2 - 10.7
No Data
Rivers
0
100
200 Kilometers

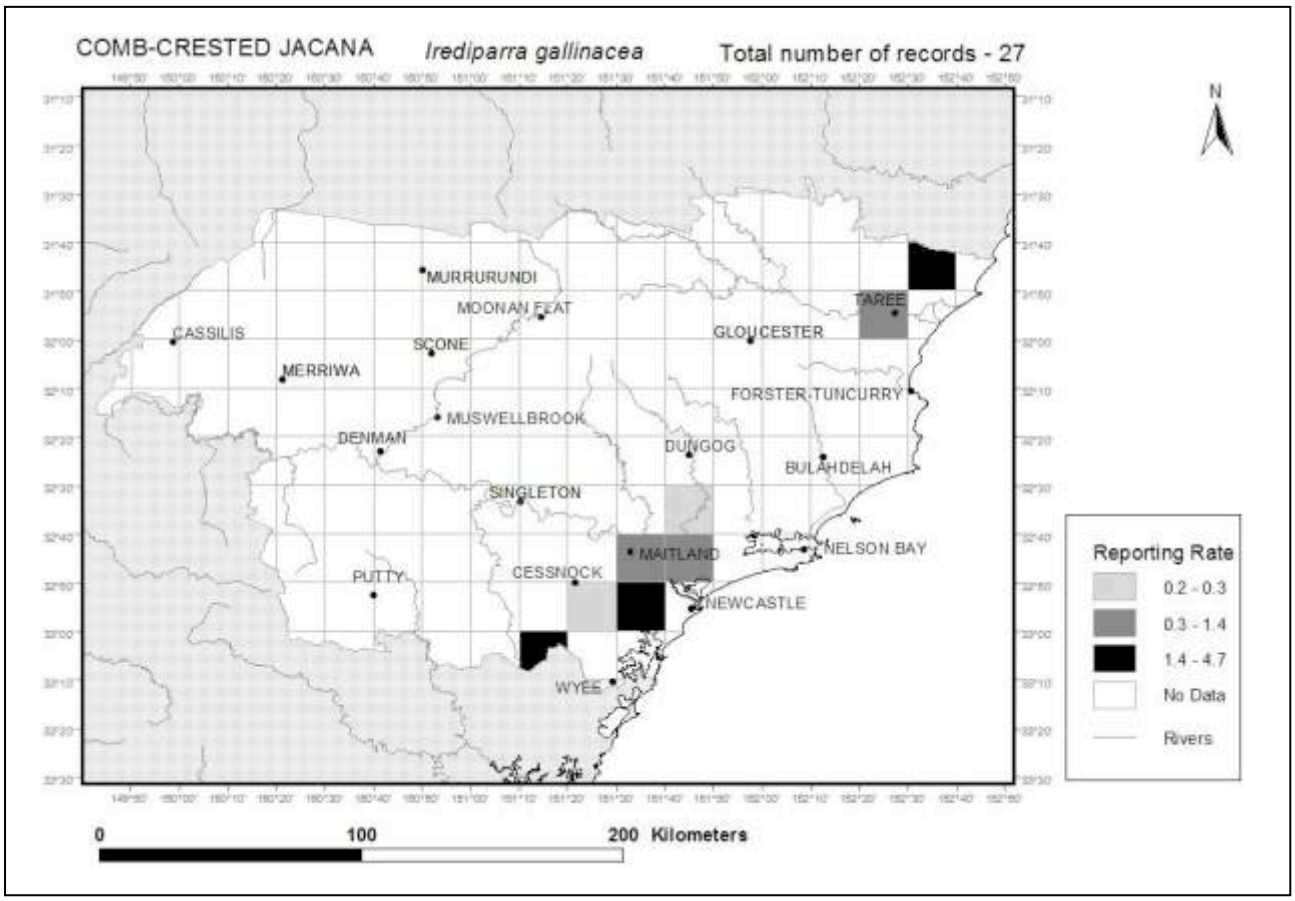

SPOTTED HARRIER Circus assimilis Total number of records - 39
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 1.7
1.7 - 3.4
3.4 - 6.1
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

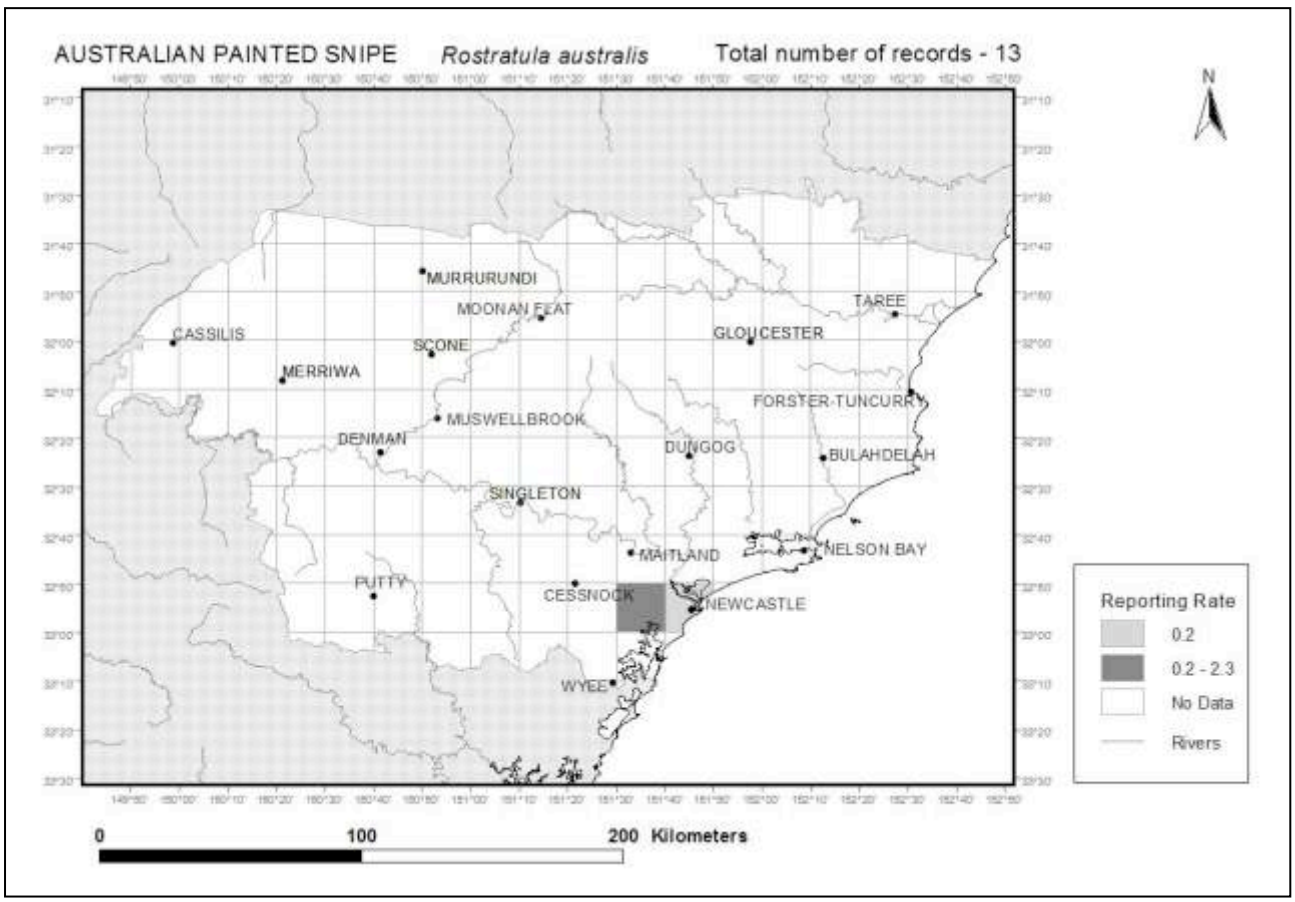

LITTLE EAGLE Hieraaetus morphnoides Total number of records - 164
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 3.5
3.5 - 6.7
6.7 - 10
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

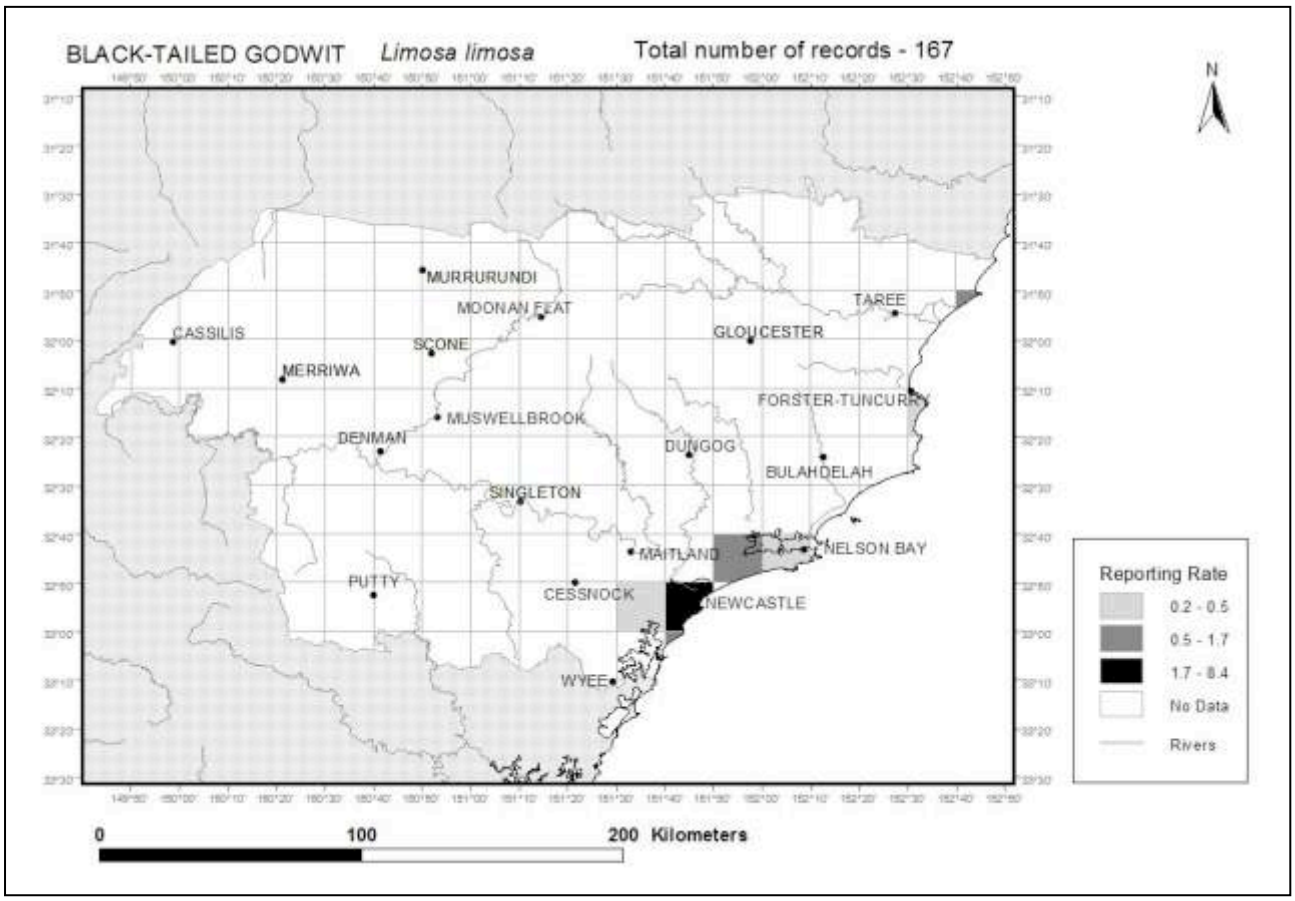

BUSH STONE-CURLEW Burhinus grallarius Total number of records - 12
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
?
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.2 - 0.4
0.4 - 1.3
1.3 - 1.8
No Data
Rivers
0
100
200 Kilometers

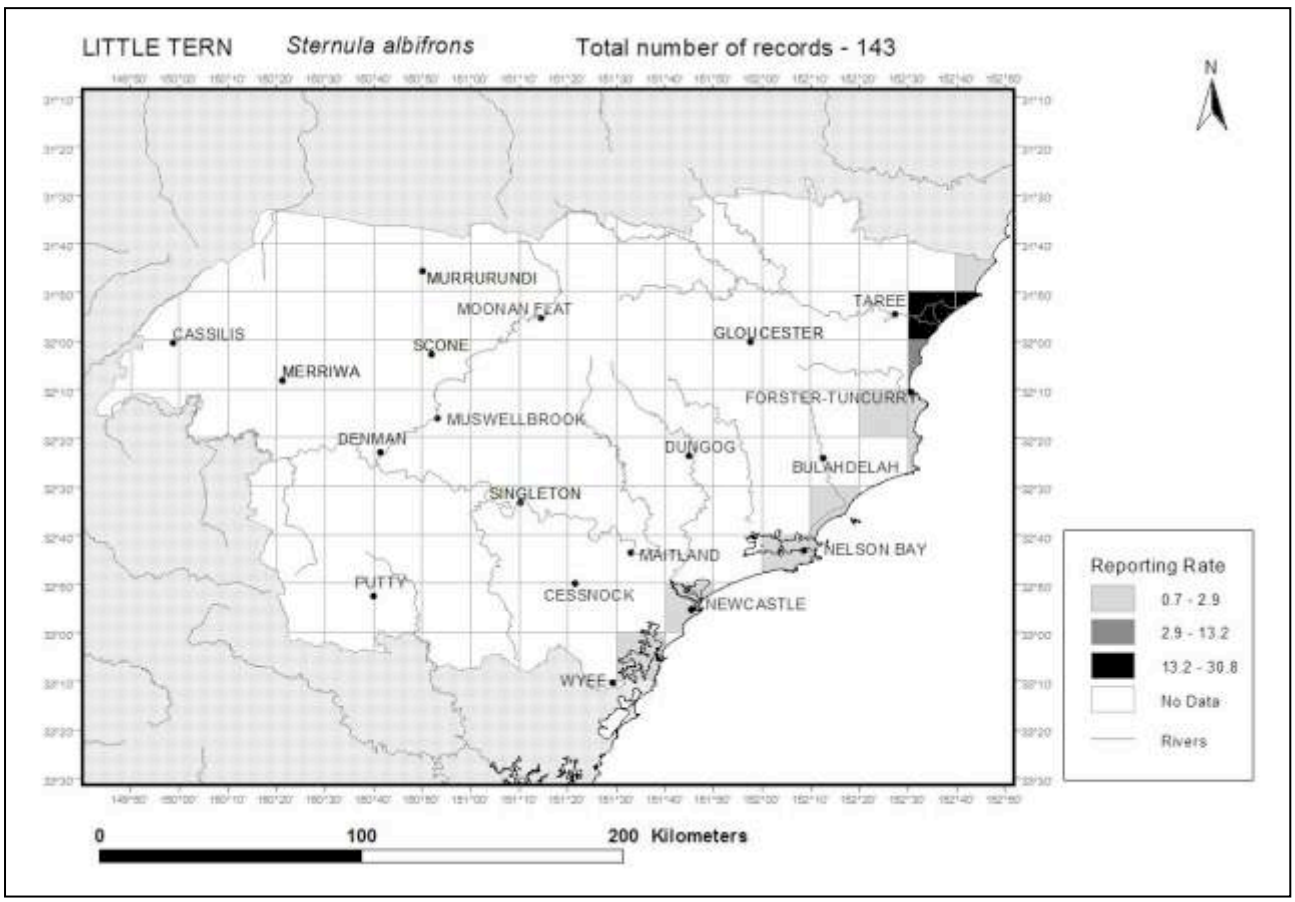

AUSTRALIAN PIED OYSTERCATCHER Haematopus longirostris Total number of records - 637
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 14.8
14.8 - 31.3
31.3 - 50.4
No Data
Rivers
0
100
200 Kilometers

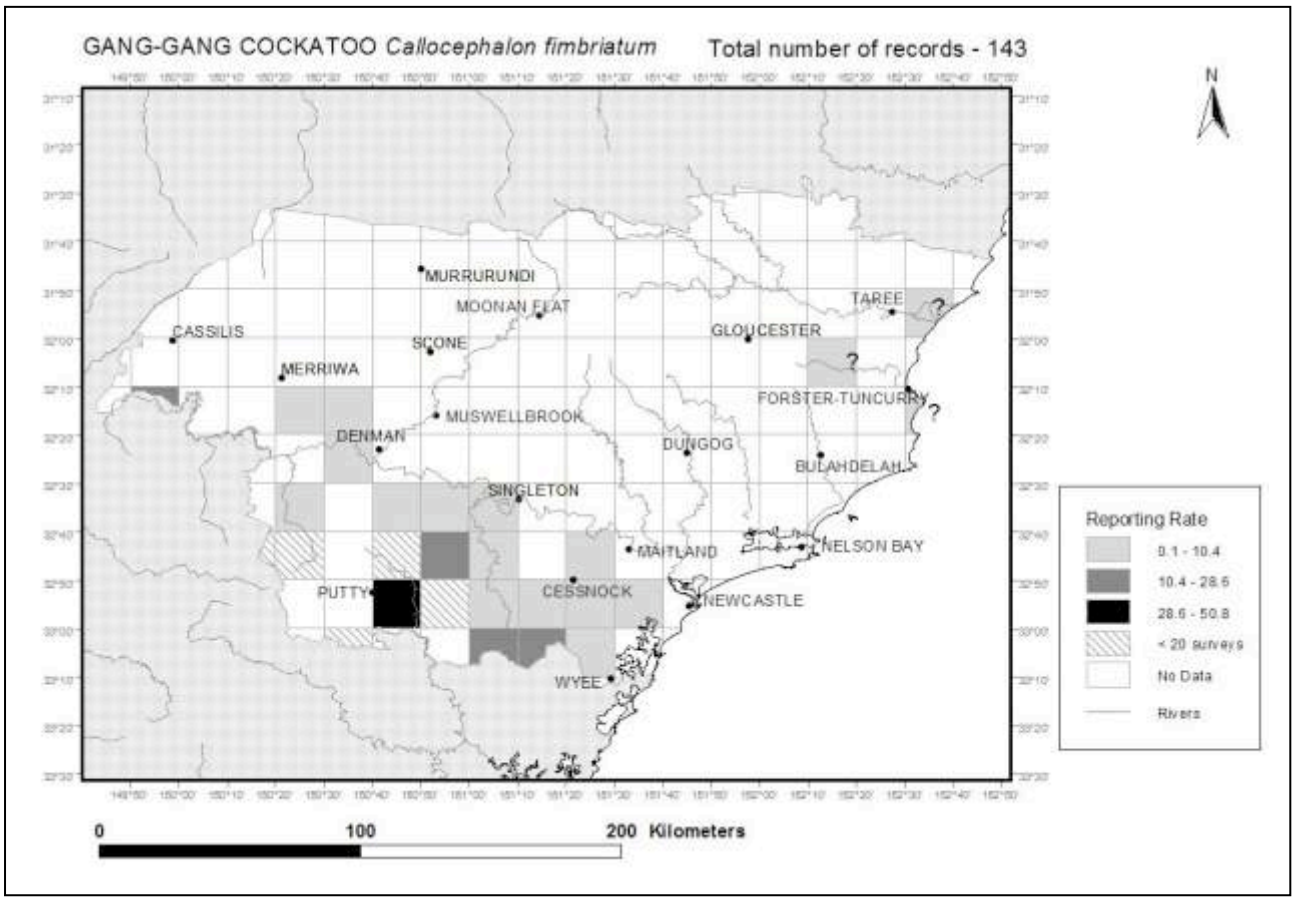

SOOTY OYSTERCATCHER Haematopus fuliginosus Total number of records - 156
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
?
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.3 - 2.9
2.9 - 6.3
6.3 - 12.1
No Data
Rivers
0
100
200 Kilometers

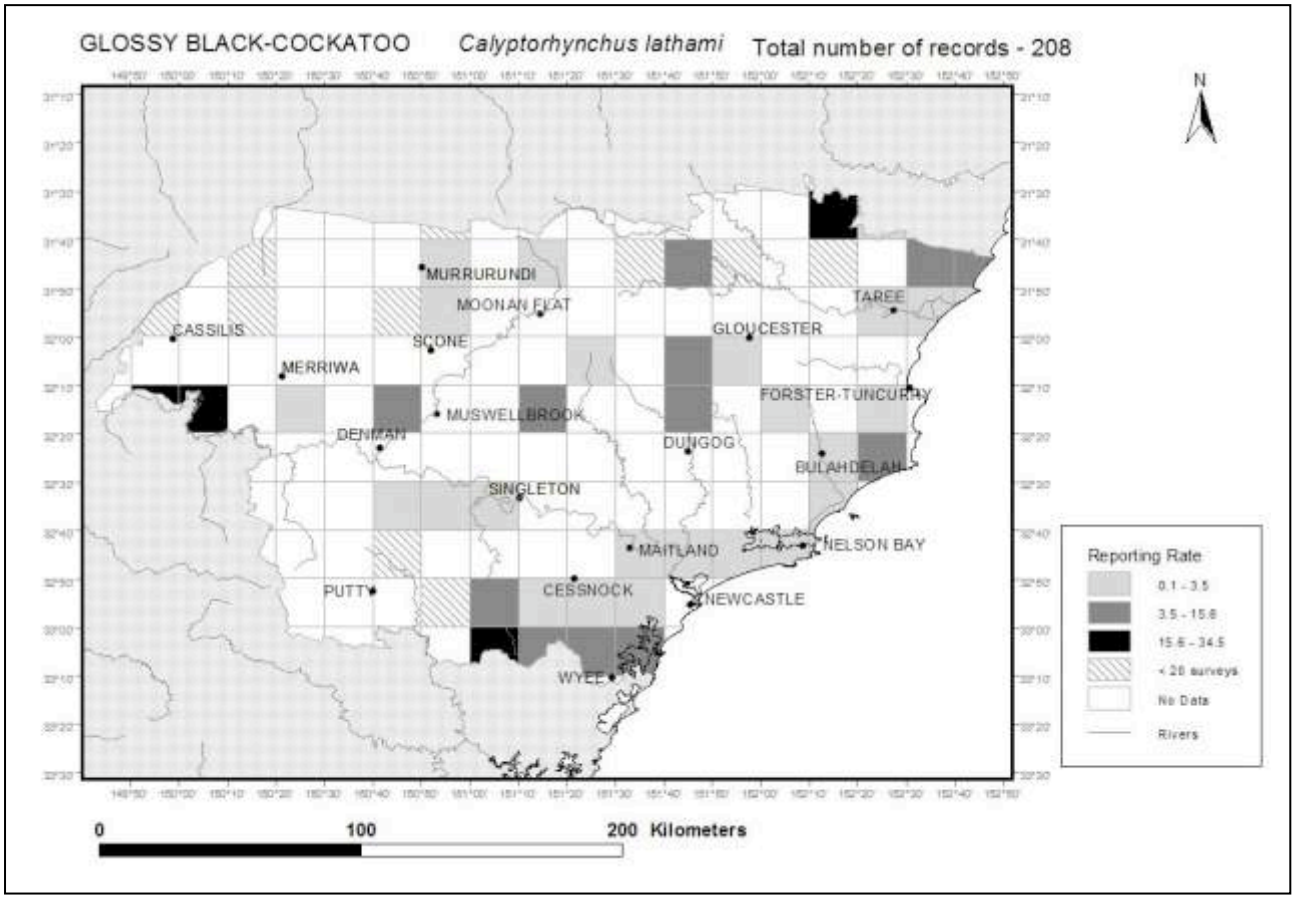

COMB-CRESTED JACANA
Irediparra gallinacea
Total number of records - 27
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
TAREE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.2 - 0.3
0.3 - 1.4
1.4 - 4.7
No Data
Rivers
0
100
200 Kilometers

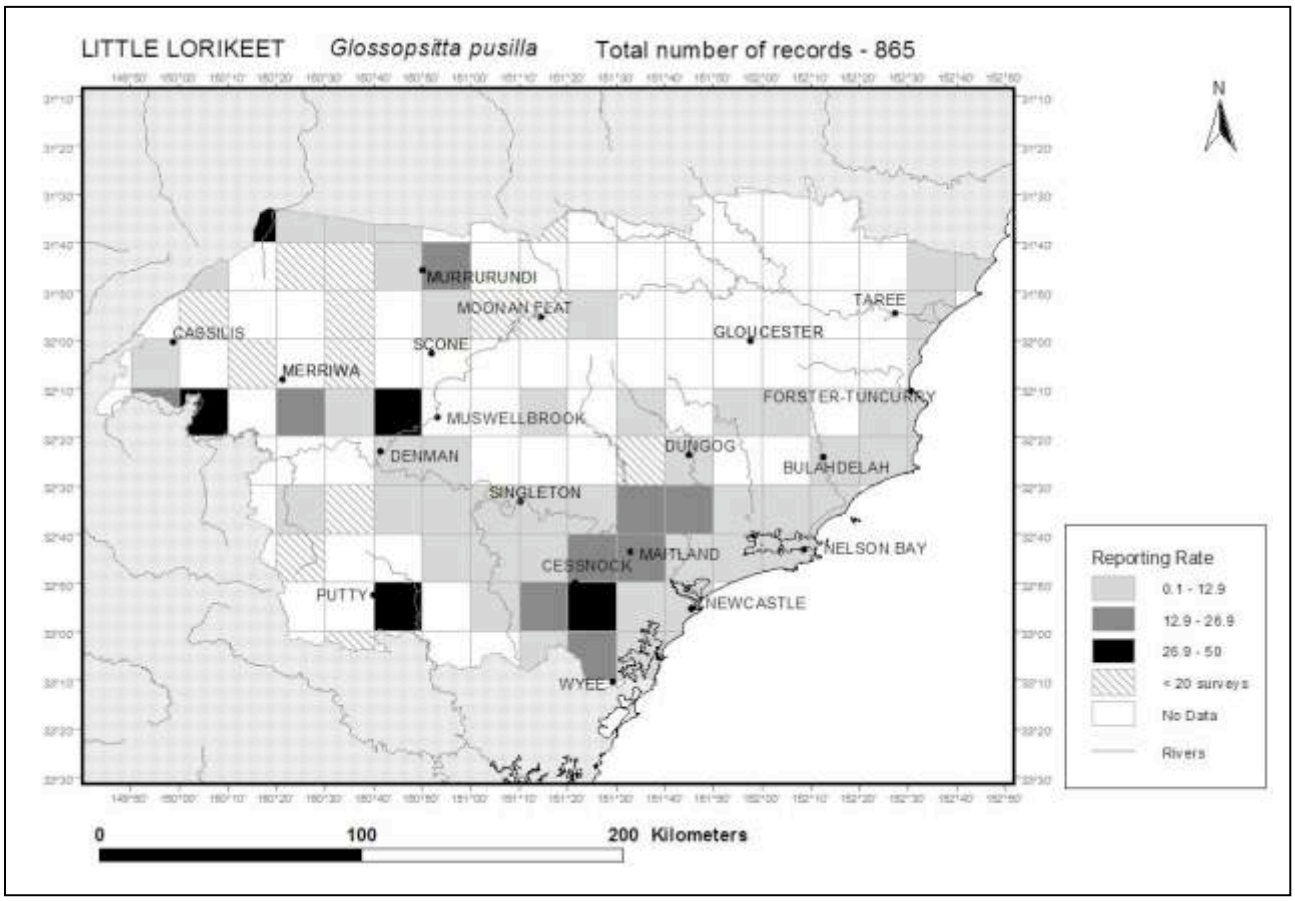

AUSTRALIAN PAINTED SNIPE
Rostratula australis
Total number of records - 13
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.2
0.2 - 2.3
No Data
Rivers
0
100
200 Kilometers

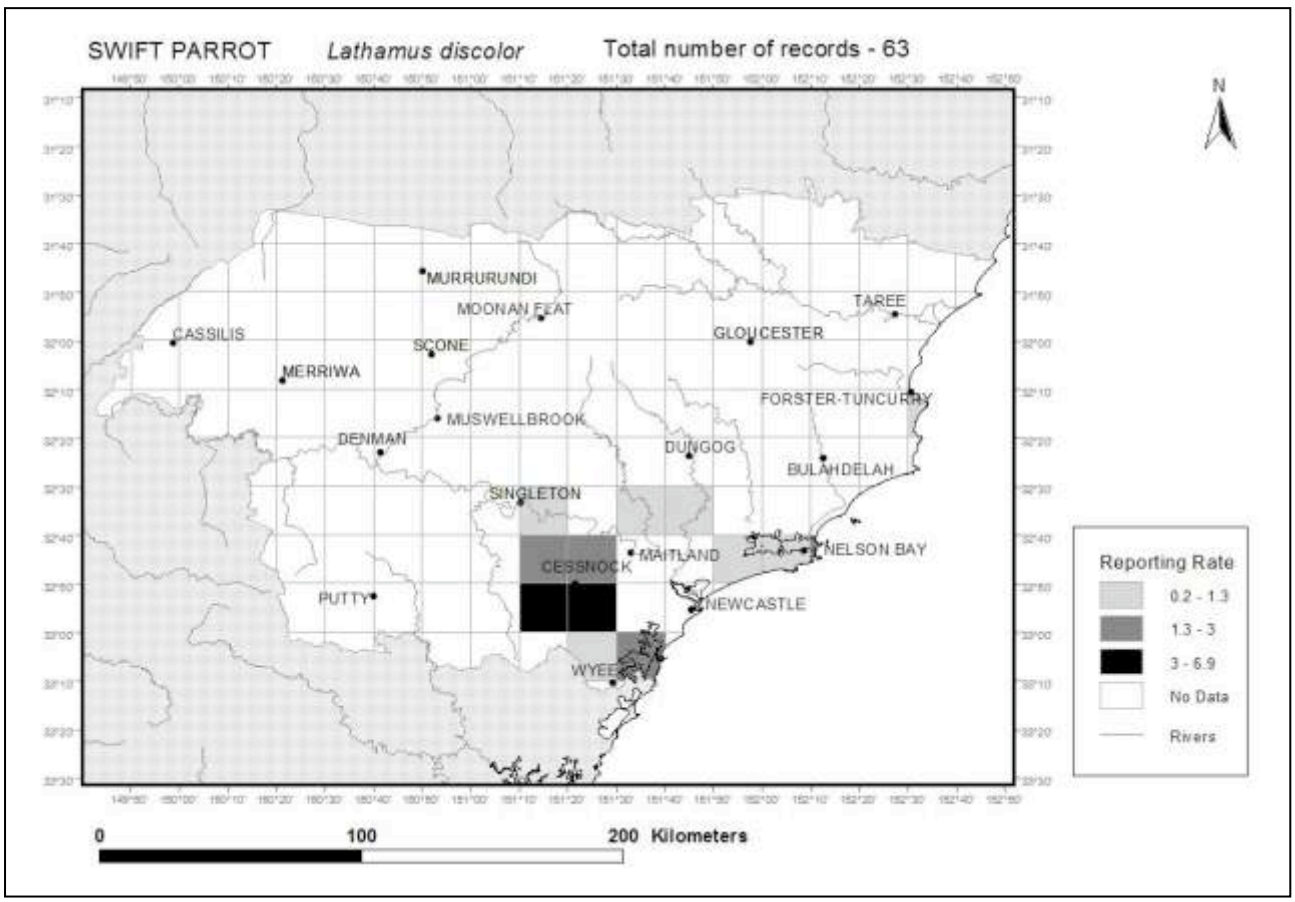

BLACK-TAILED GODWIT
Limosa limosa
Total number of records - 167
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.2 - 0.5
0.5 - 1.7
1.7 - 8.4
No Data
Rivers
0
100
200 Kilometers

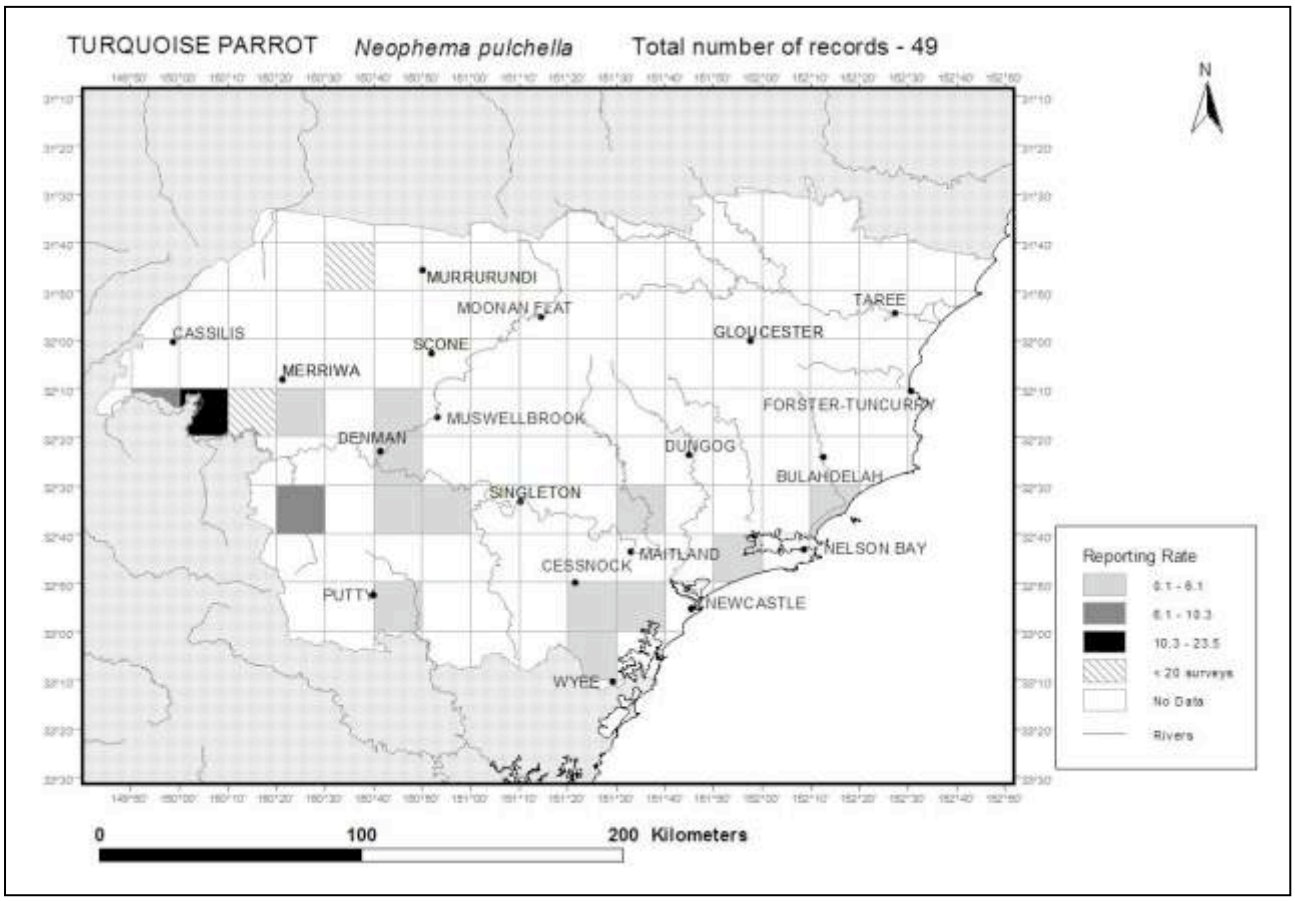

LITTLE TERN
Sternula albifrons
Total number of records - 143
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.7 - 2.9
2.9 - 13.2
13.2 - 30.8
No Data
Rivers
0
100
200 Kilometers

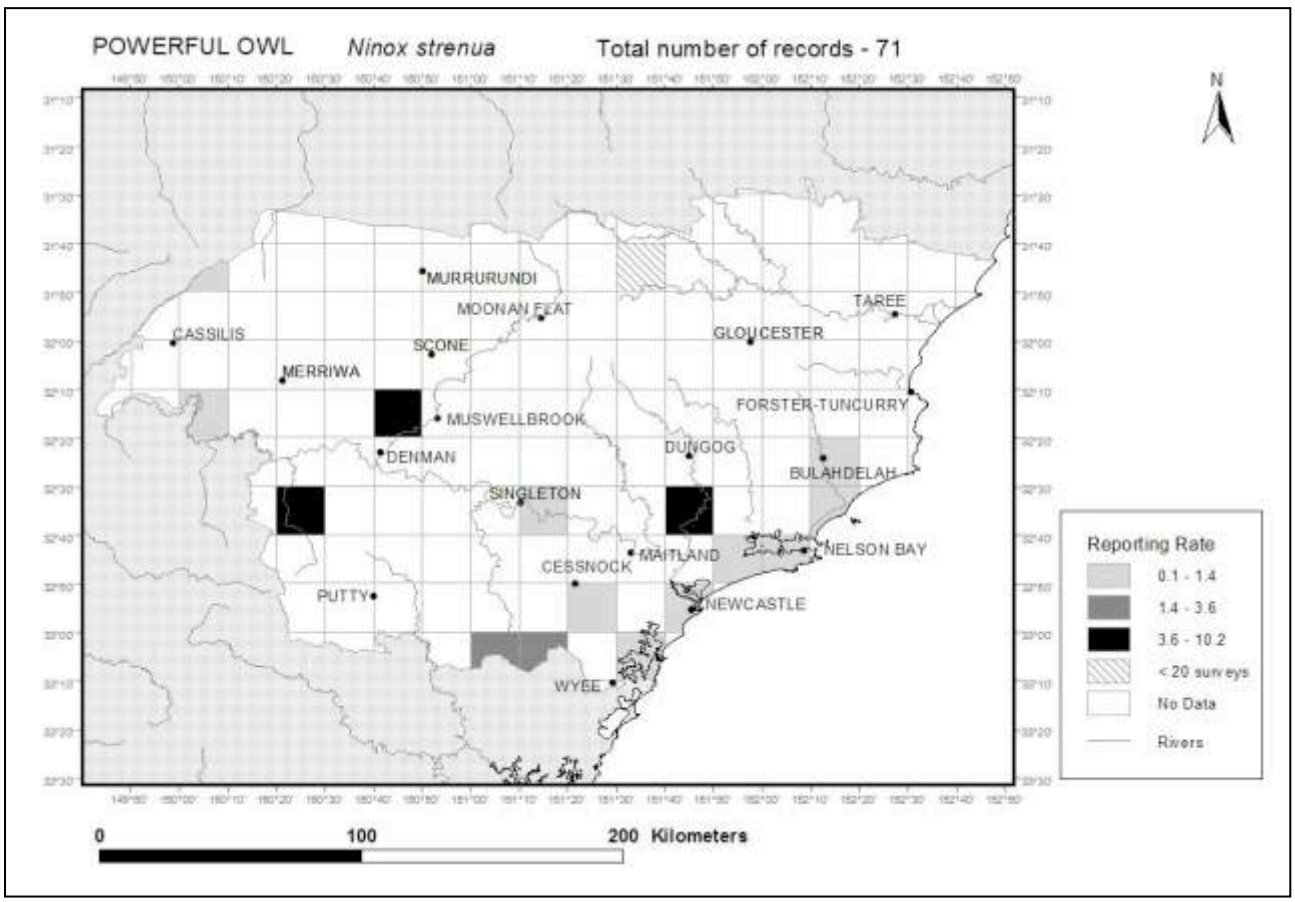

GANG-GANG COCKATOO Callocephalon fimbriatum
Total number of records - 143
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 10.4
10.4 - 28.6
28.6 - 50.8
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

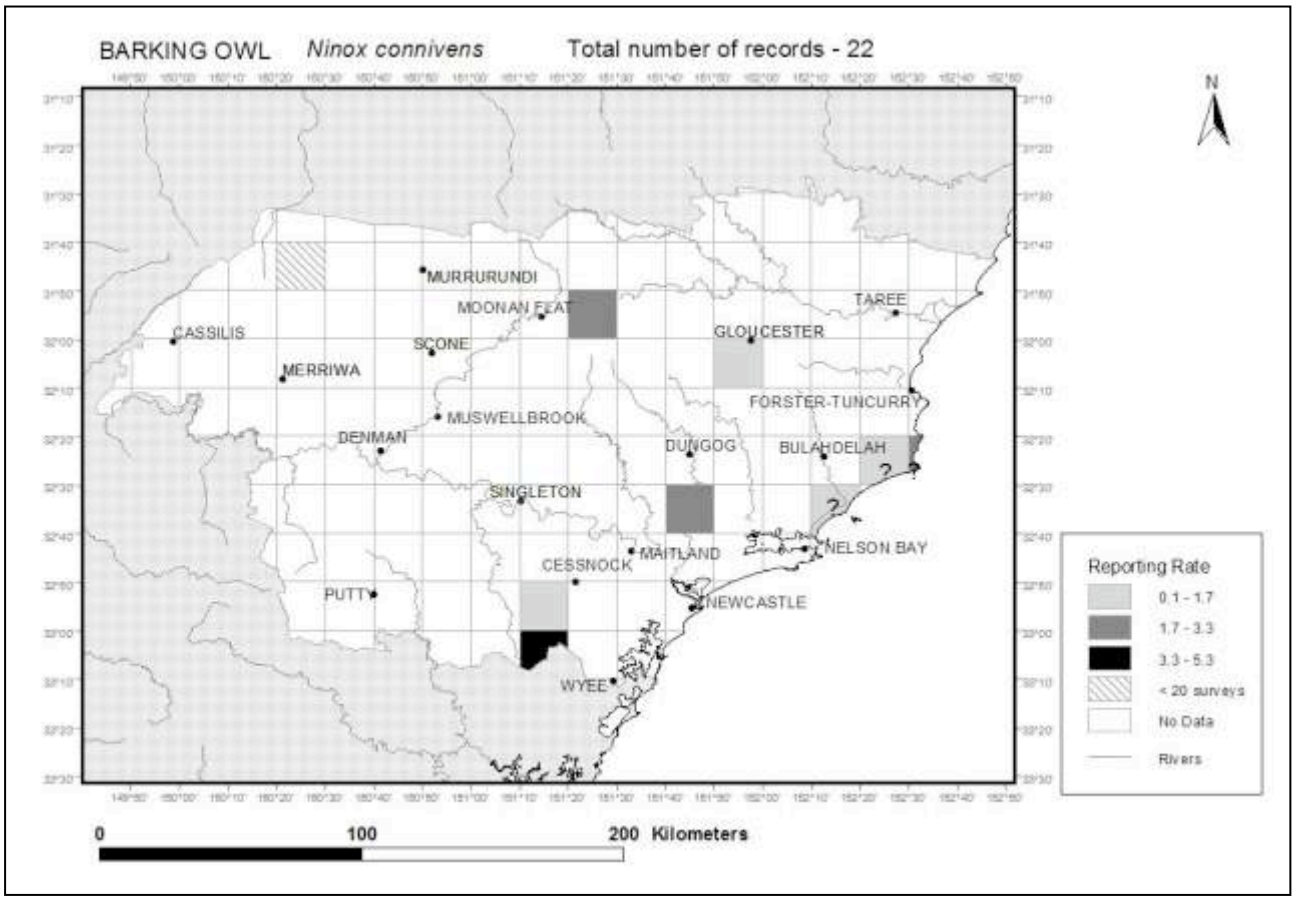

GLOSSY BLACK-COCKATOO Calyptorhynchus lathami
Total number of records - 208
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 3.5
3.5 - 15.6
15.6 - 34.5
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

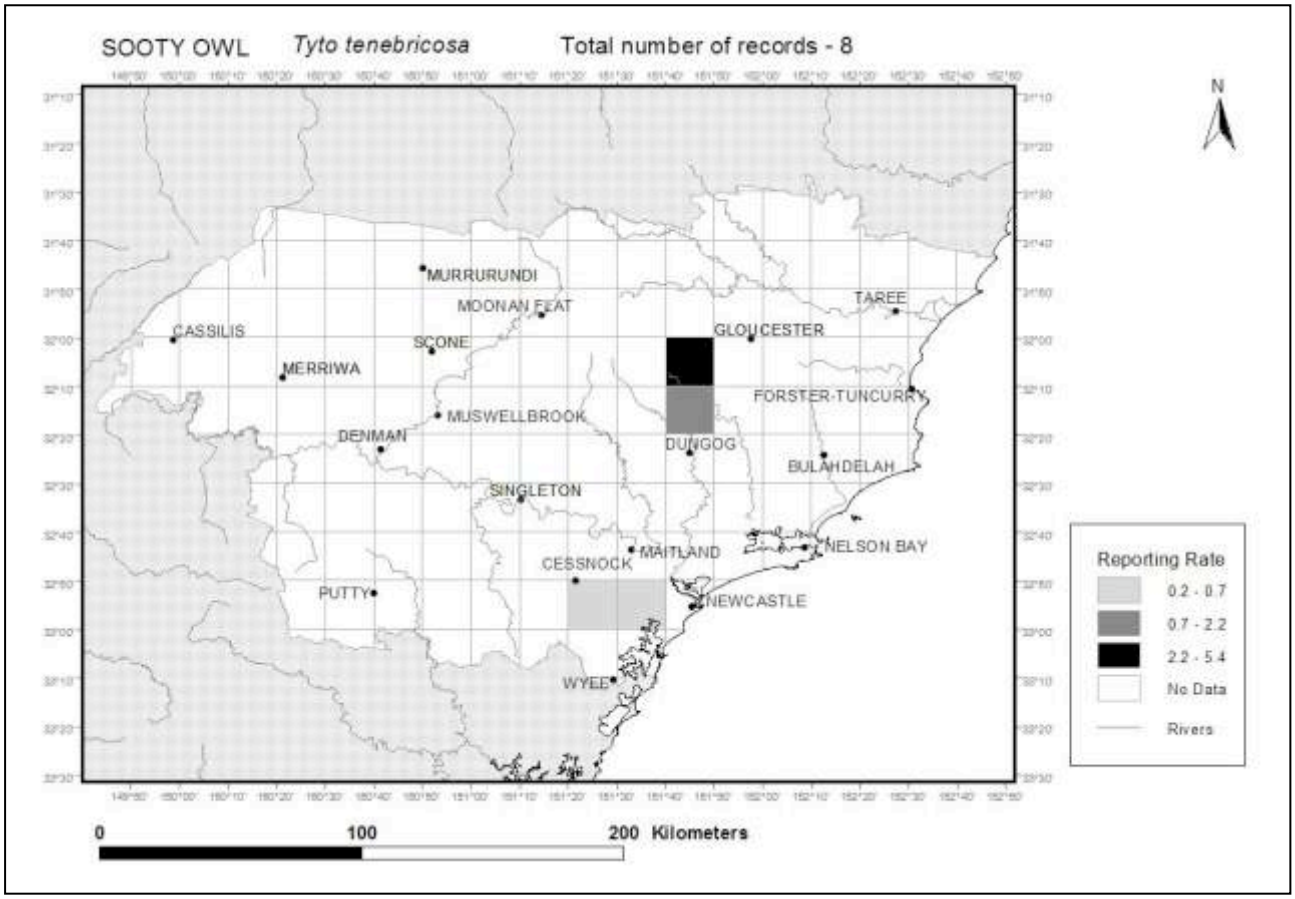

LITTLE LORIKEET Glossopsitta pusilla Total number of records - 865
N
MURRURUNDI
MOONAN FEAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 12.9
12.9 - 26.9
26.9 - 50
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

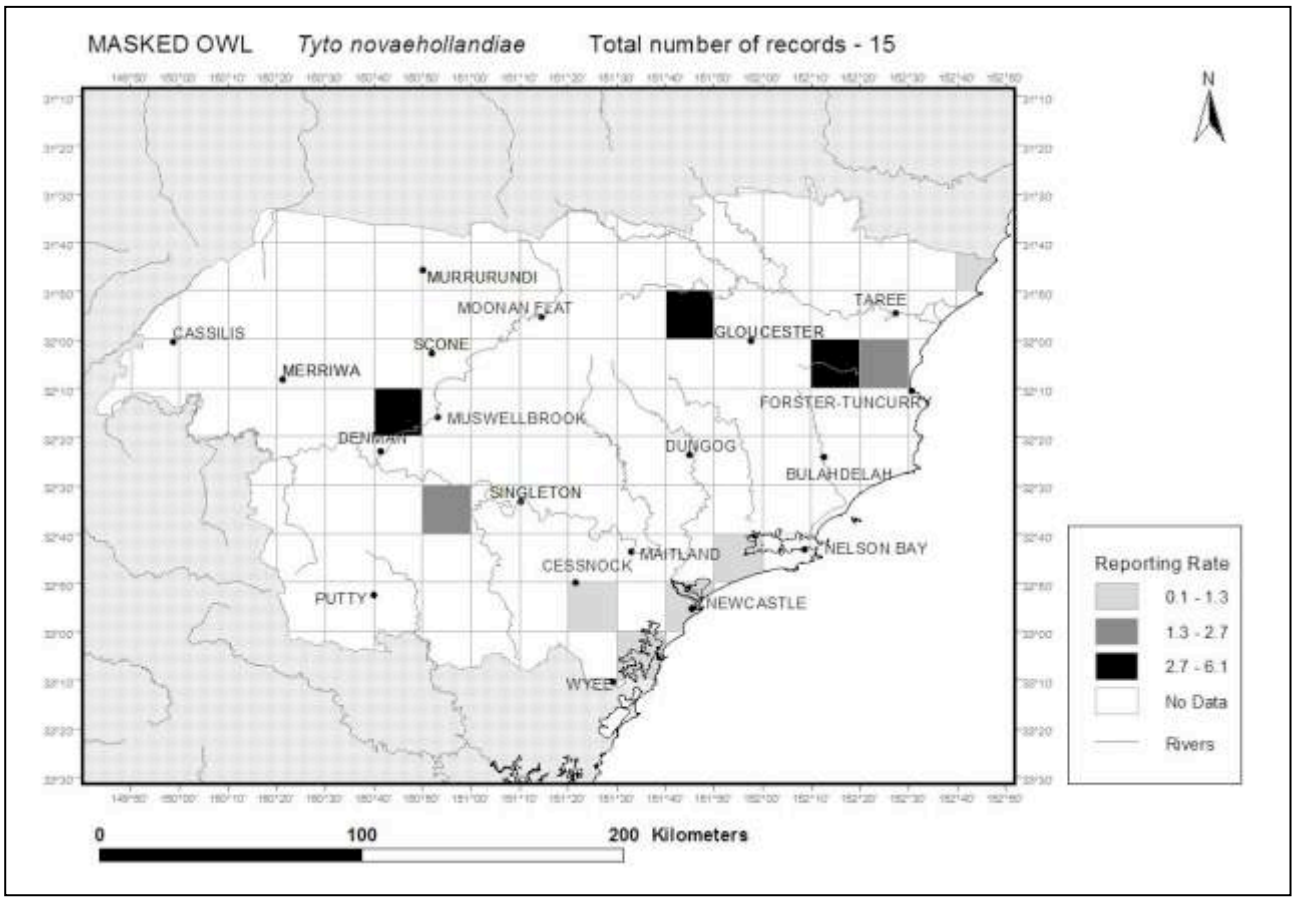

SWIFT PARROT Lathamus discolor Total number of records - 63
N
MURRURUNDI
MOONAN FEAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.2 - 1.3
1.3 - 3
3 - 6.9
No Data
Rivers
0
100
200 Kilometers

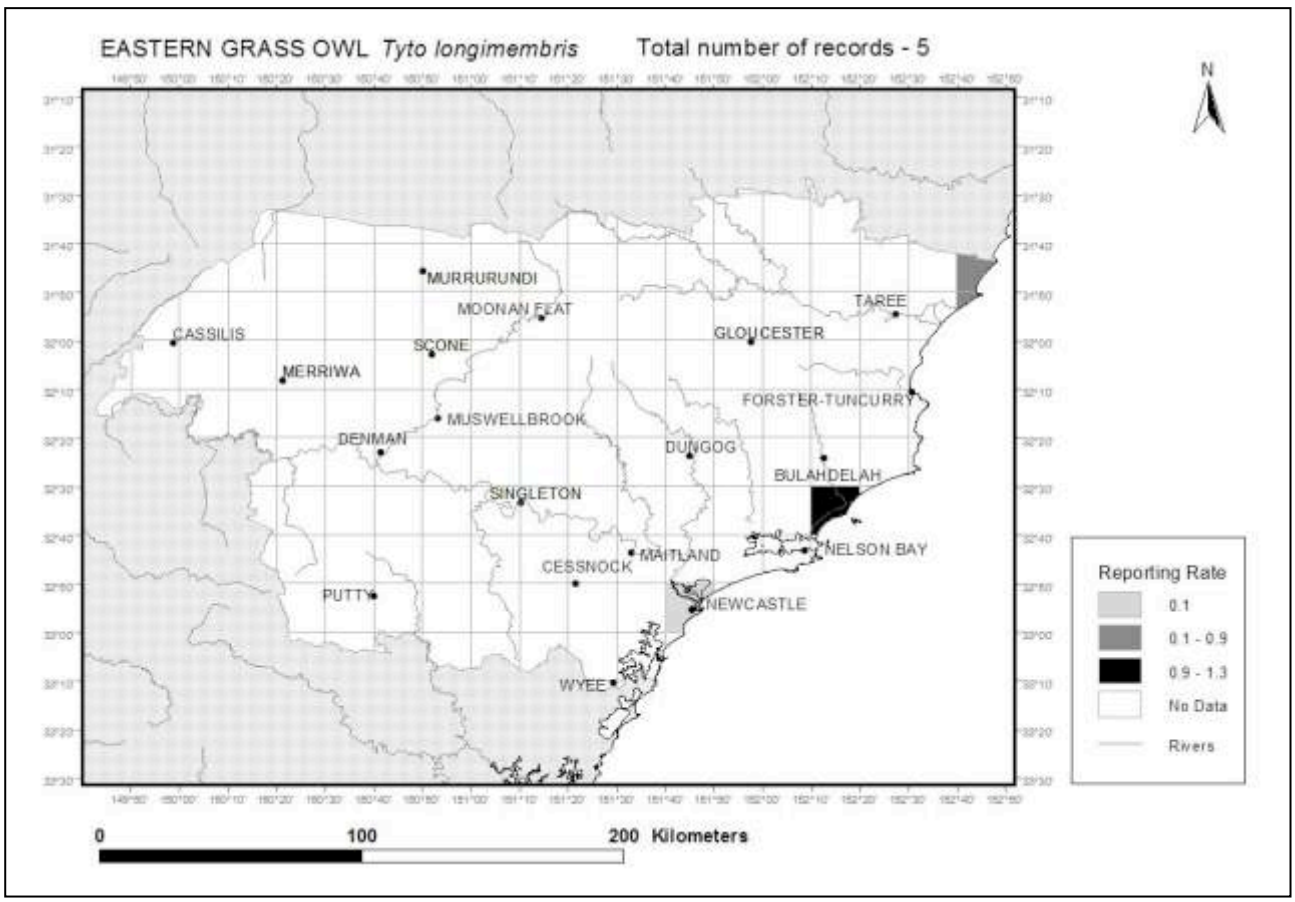

TURQUOISE PARROT
Neophema pulchella
Total number of records - 49
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 6.1
6.1 - 10.3
10.3 - 23.5
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

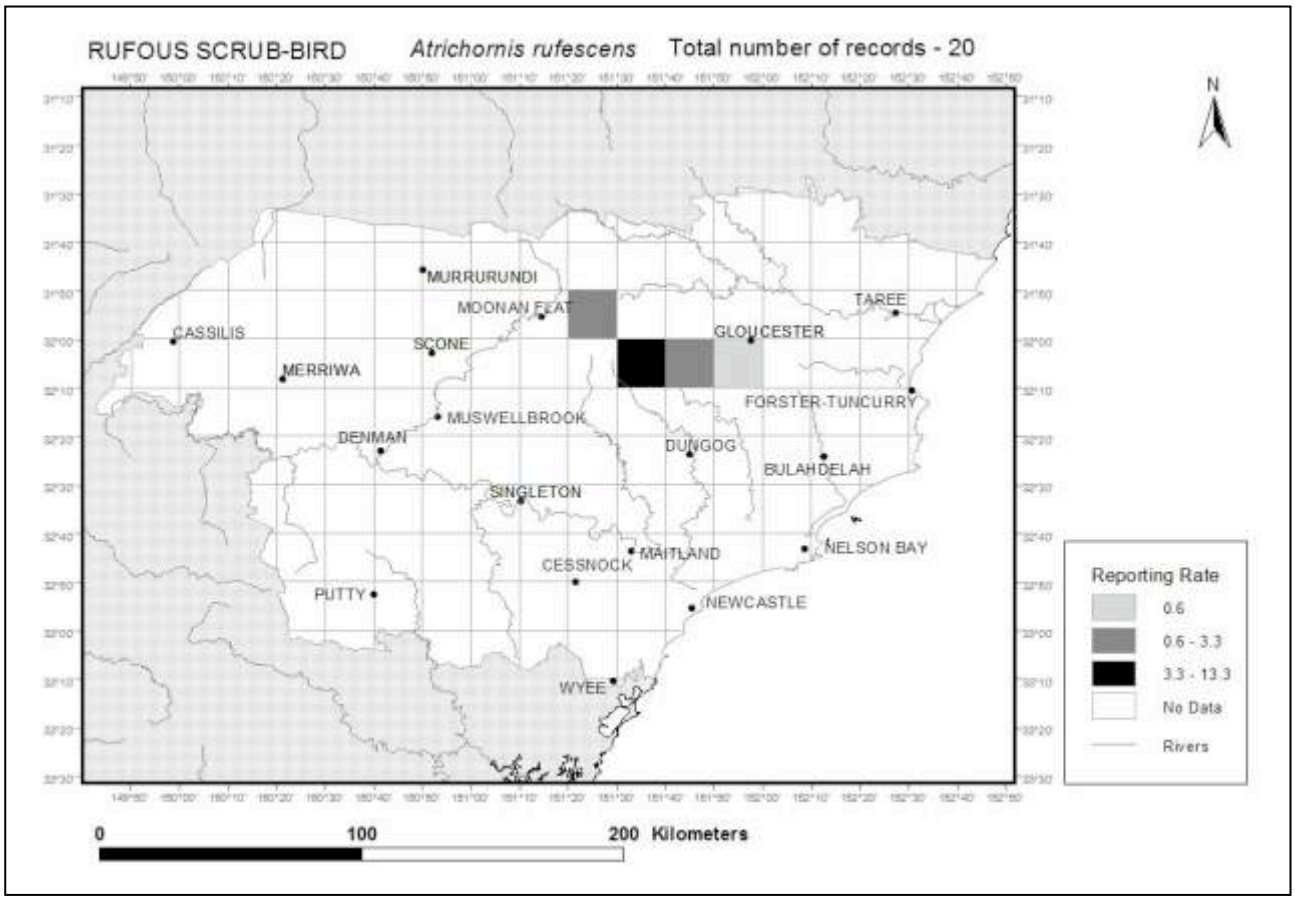

POWERFUL OWL
Ninox strenua
Total number of records - 71
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 1.4
1.4 - 3.6
3.6 - 10.2
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


BARKING OWL Ninox connivens Total number of records - 22
N
MURRURUNDI
MOONAN FEAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
NEWCASTLE
PUTTY
WYEE
Reporting Rate
0.1 - 1.7
1.7 - 3.3
3.3 - 5.3
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


SOOTY OWL Tyto tenebricosa Total number of records - 8
N
MURRURUNDI
MOONAN FEAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
NEWCASTLE
PUTTY
WYEE
Reporting Rate
0.2 - 0.7
0.7 - 2.2
2.2 - 5.4
No Data
Rivers
0
100
200 Kilometers


MASKED OWL Tyto novaehollandiae Total number of records - 15
N
MURRURUNDI
MOONAN FEAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 1.3
1.3 - 2.7
2.7 - 6.1
No Data
Rivers
0
100
200 Kilometers


EASTERN GRASS OWL Tyto longimembris Total number of records - 5
N
MURRURUNDI
MOONAN FEAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1
0.1 - 0.9
0.9 - 1.3
No Data
Rivers
0
100
200 Kilometers


RUFOUS SCRUB-BIRD
Atrichornis rufescens
Total number of records - 20
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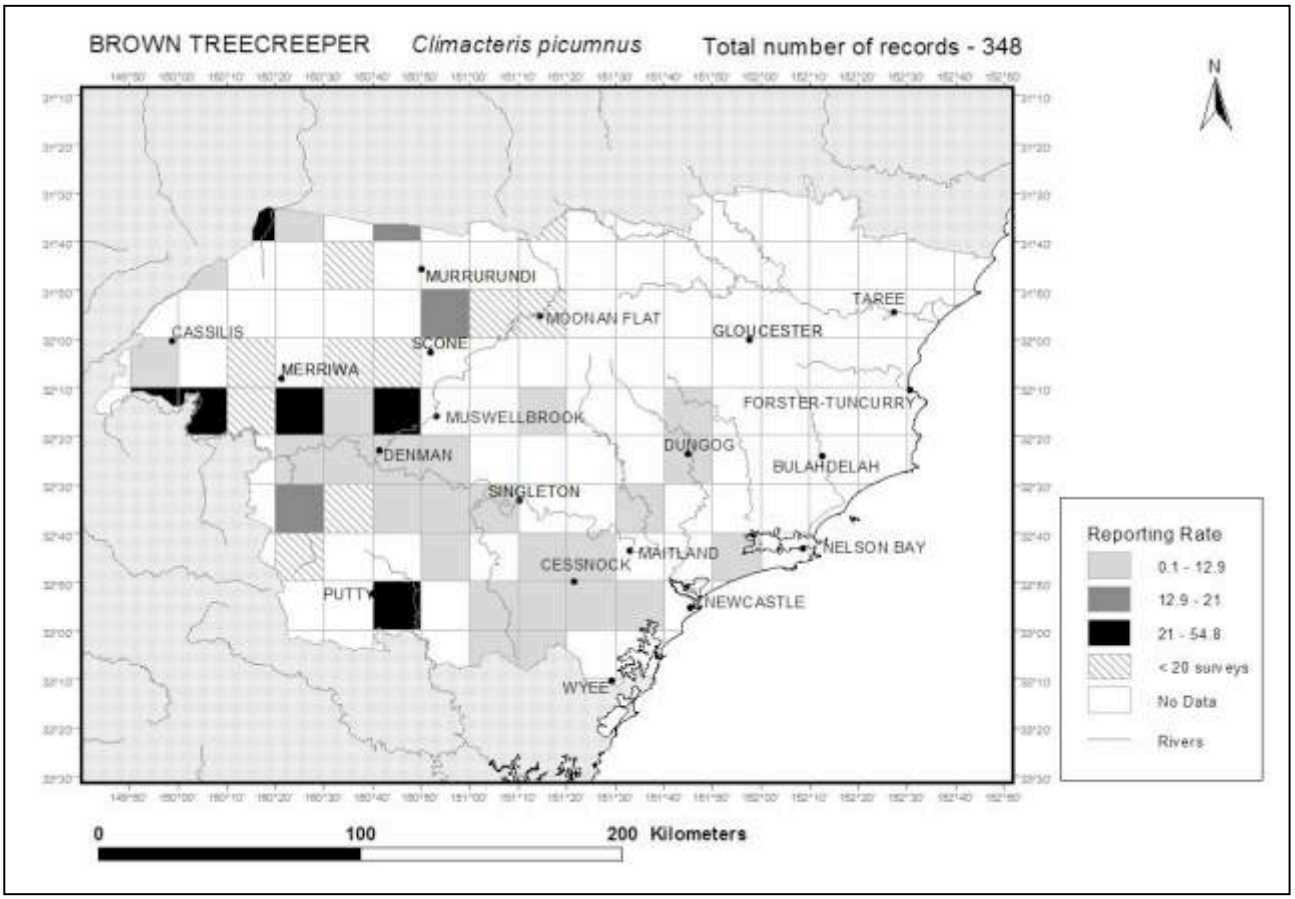
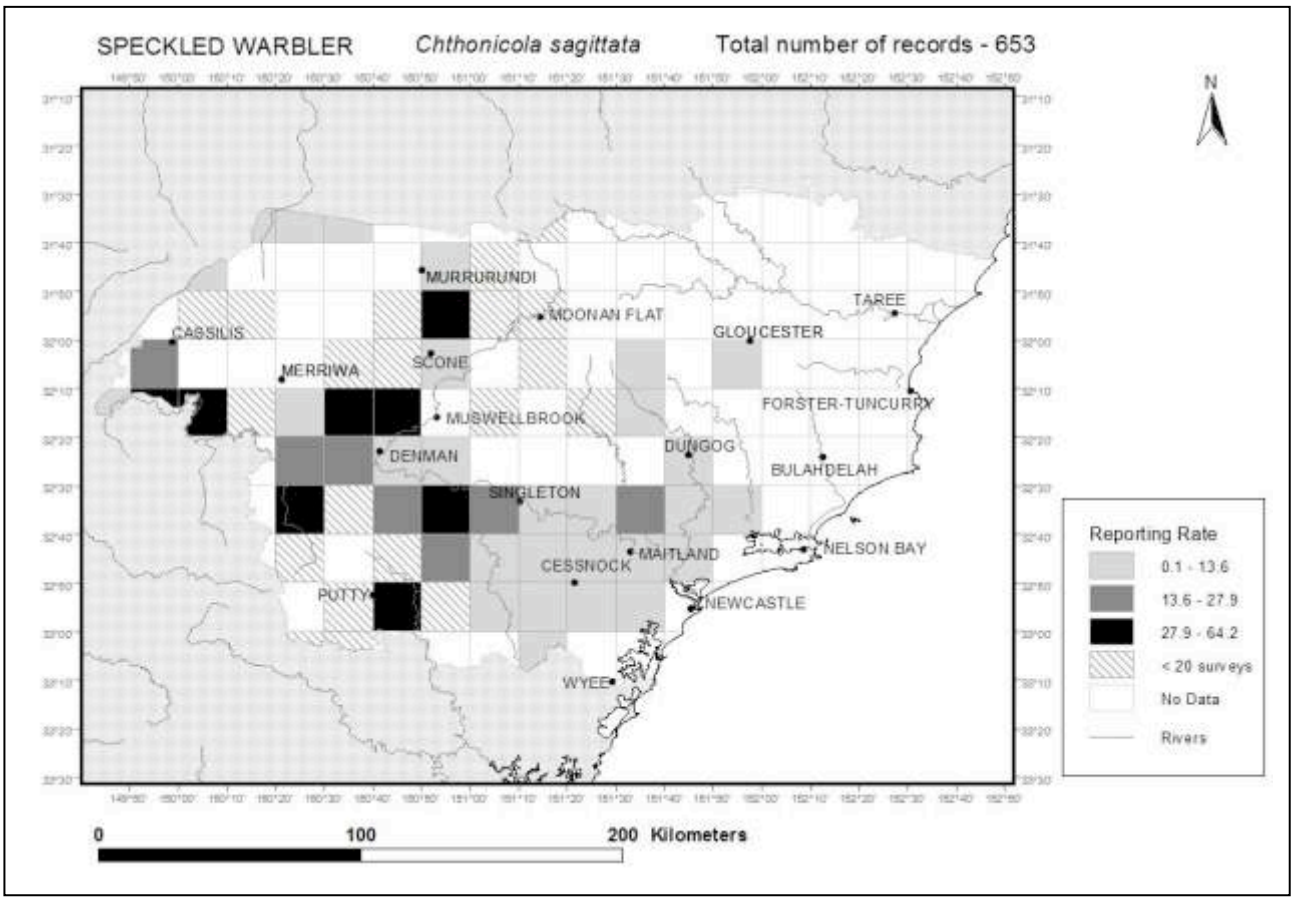
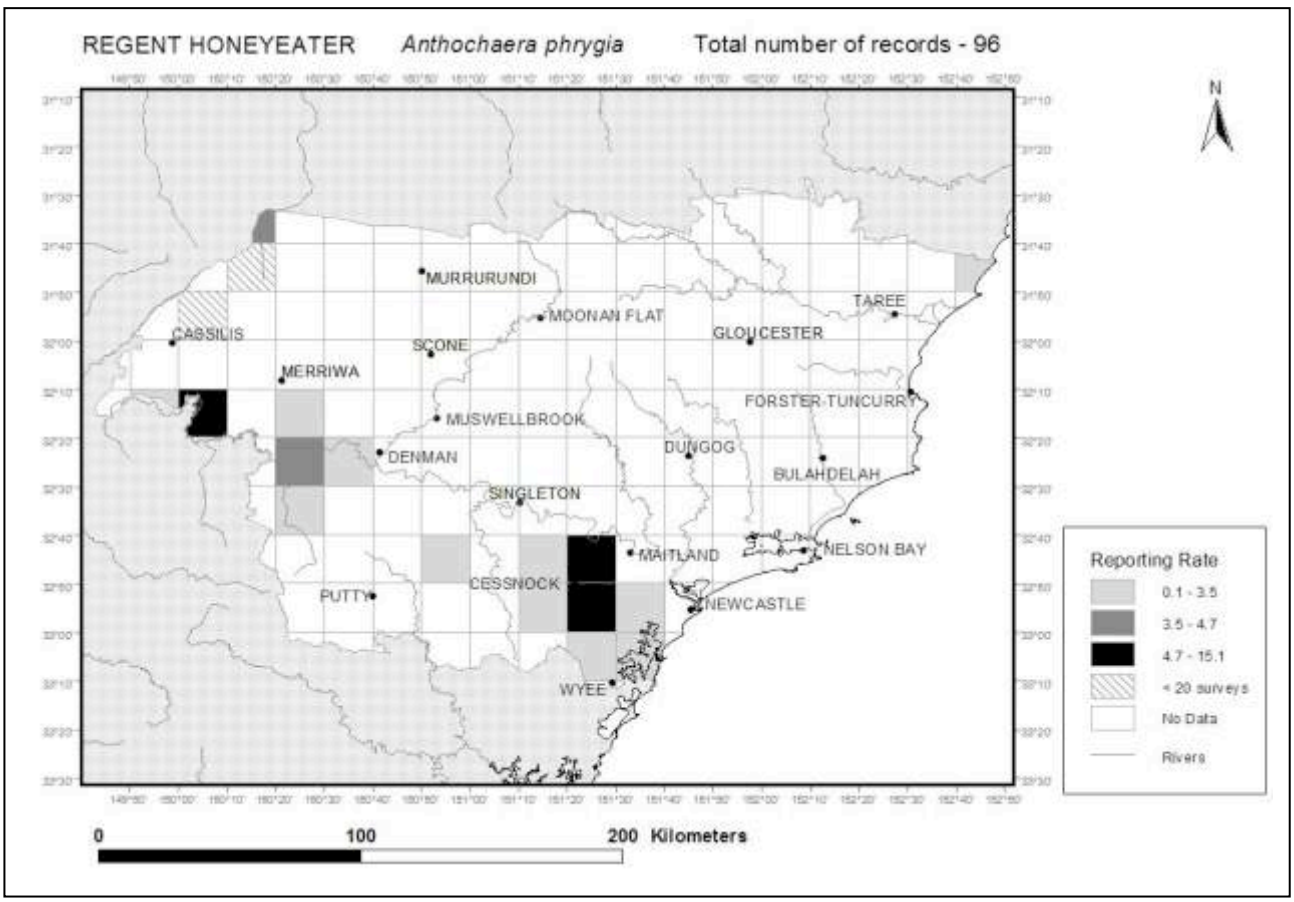
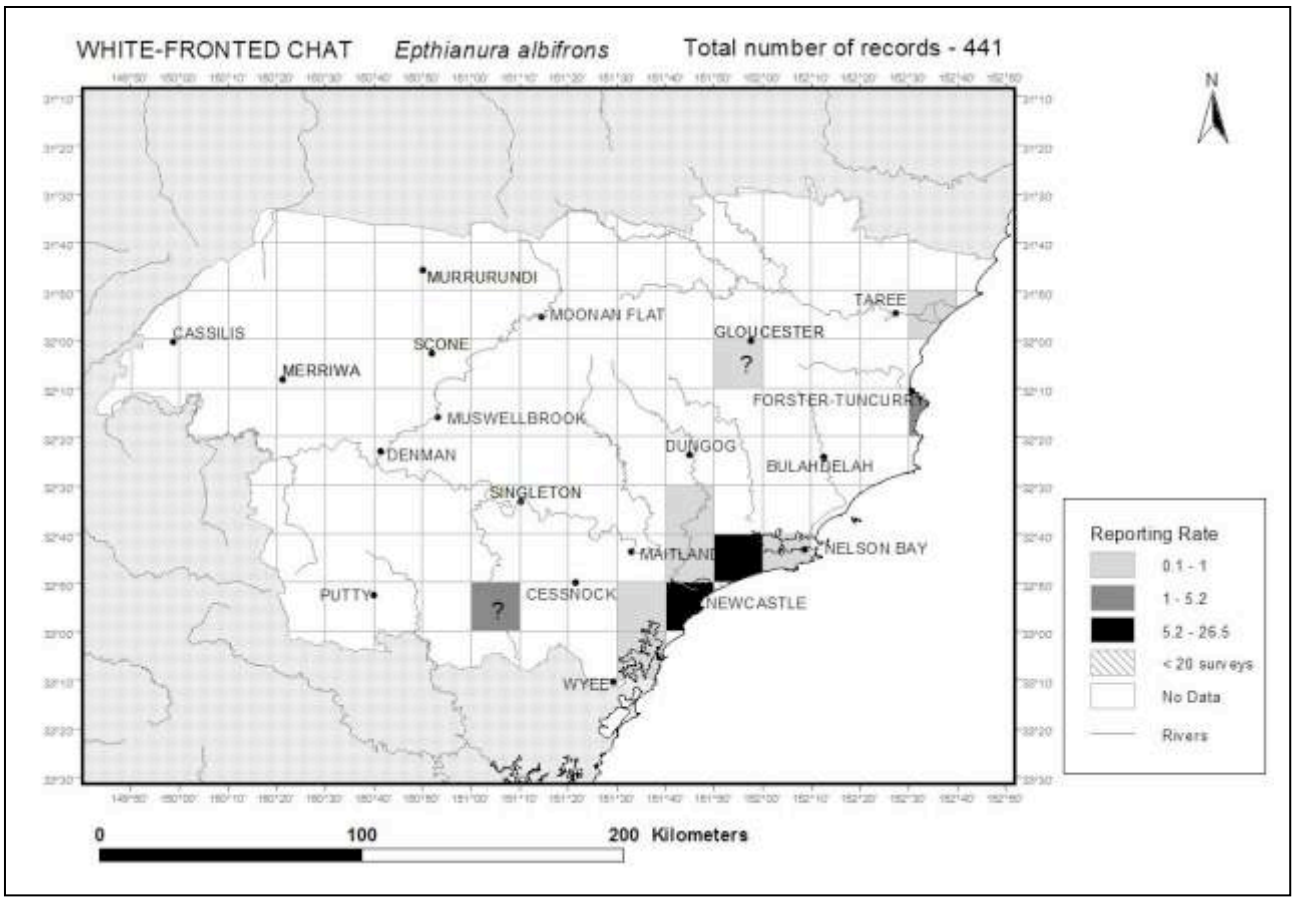
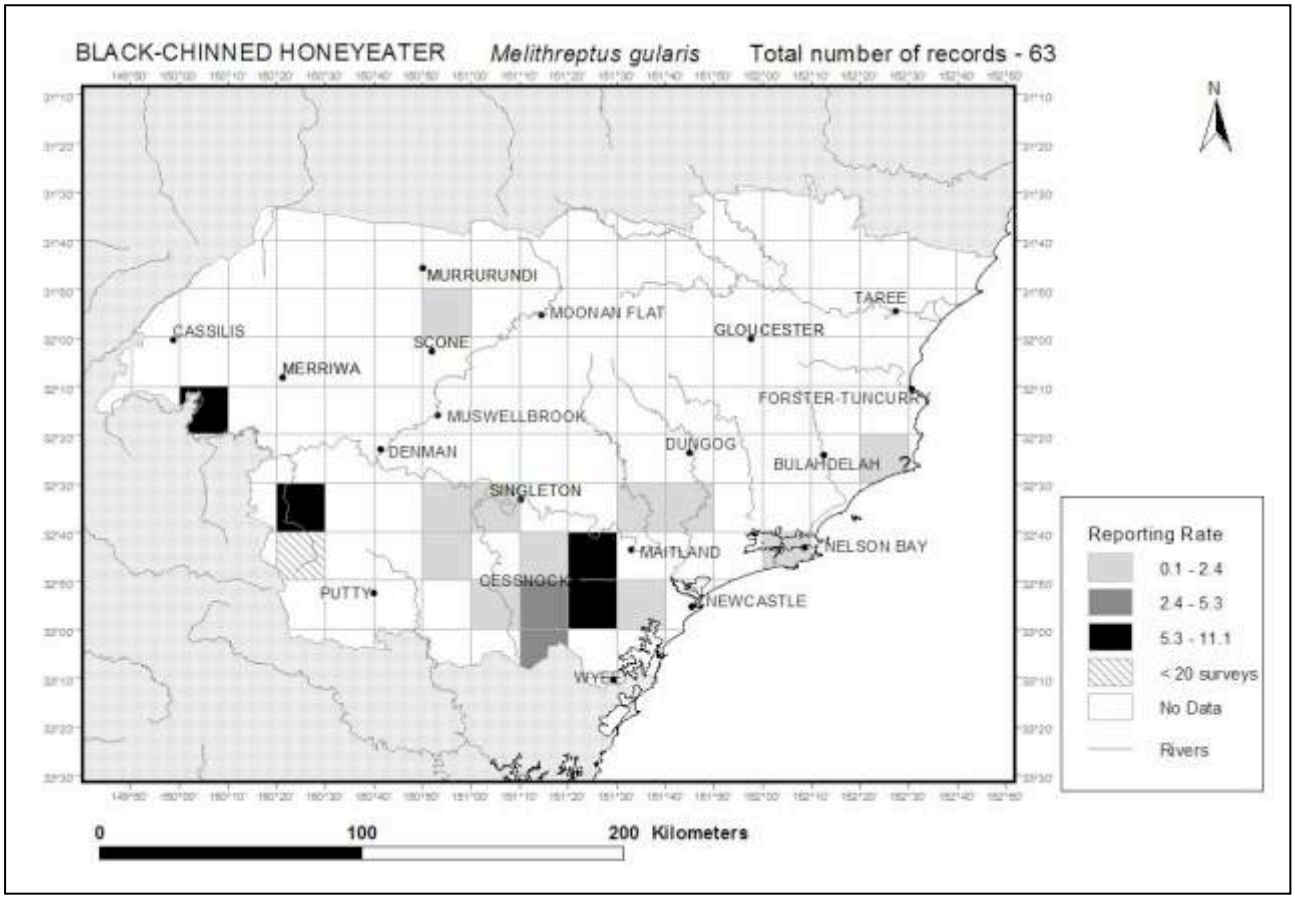
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.6
0.6 - 3.3
3.3 - 13.3
No Data
Rivers
0
100
200 Kilometers

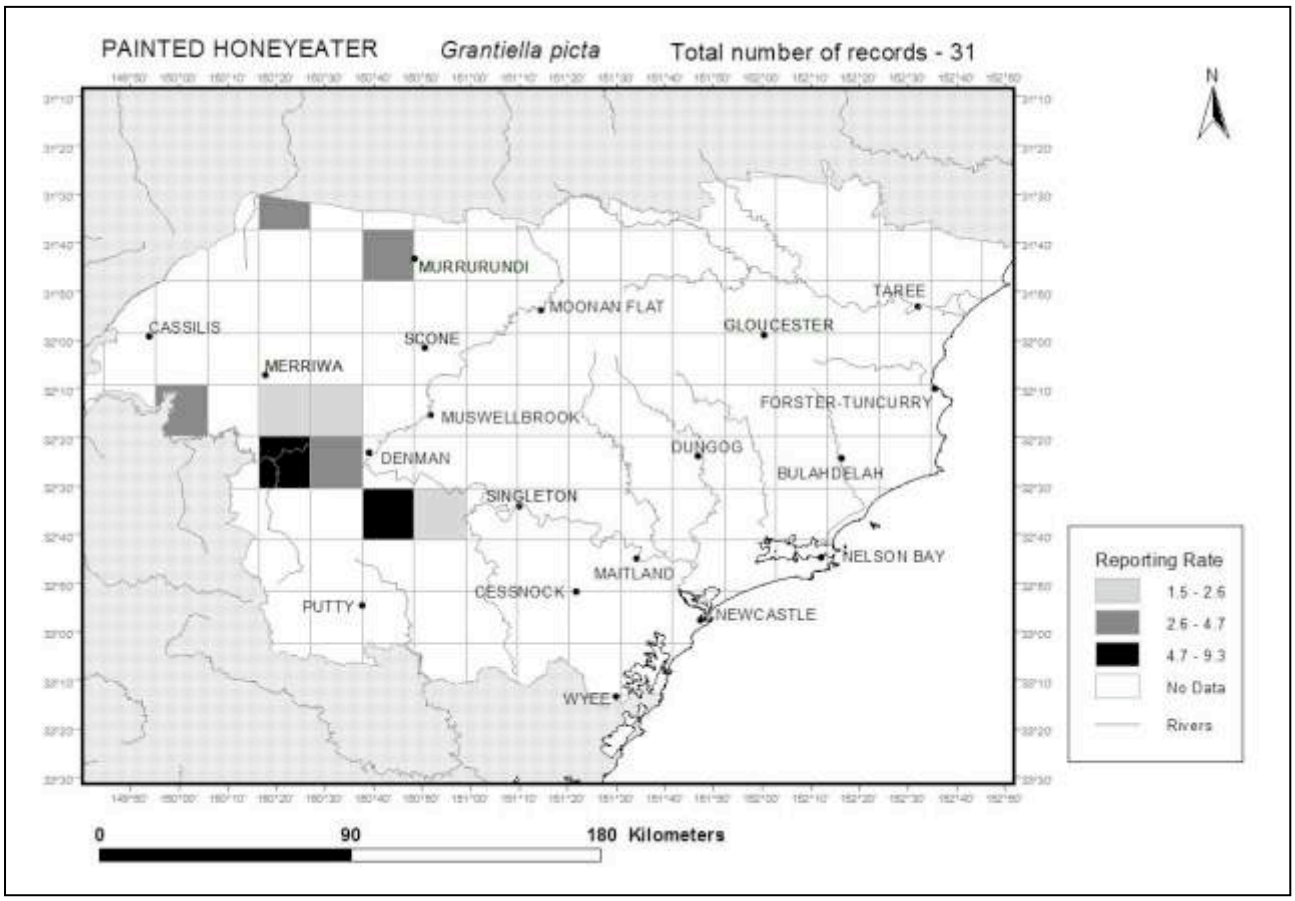

BROWN TREECREEPER
Climacteris picumnus
Total number of records - 348
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DENMAN
DUNGOG
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 12.9
12.9 - 21
21 - 54.8
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

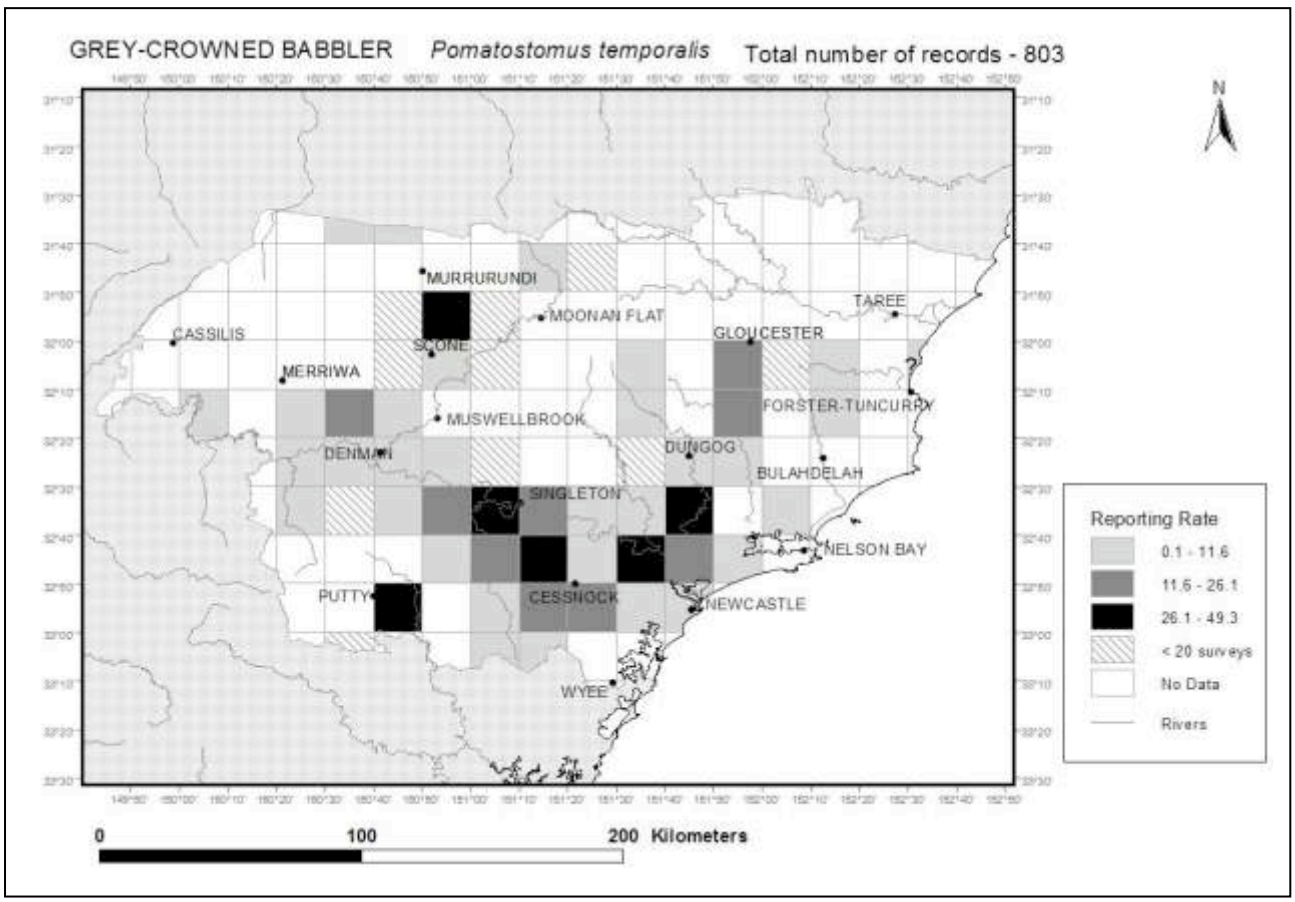

SPECKLED WARBLER
Chthonicola sagittata
Total number of records - 653
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
POTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 13.6
13.6 - 27.9
27.9 - 64.2
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

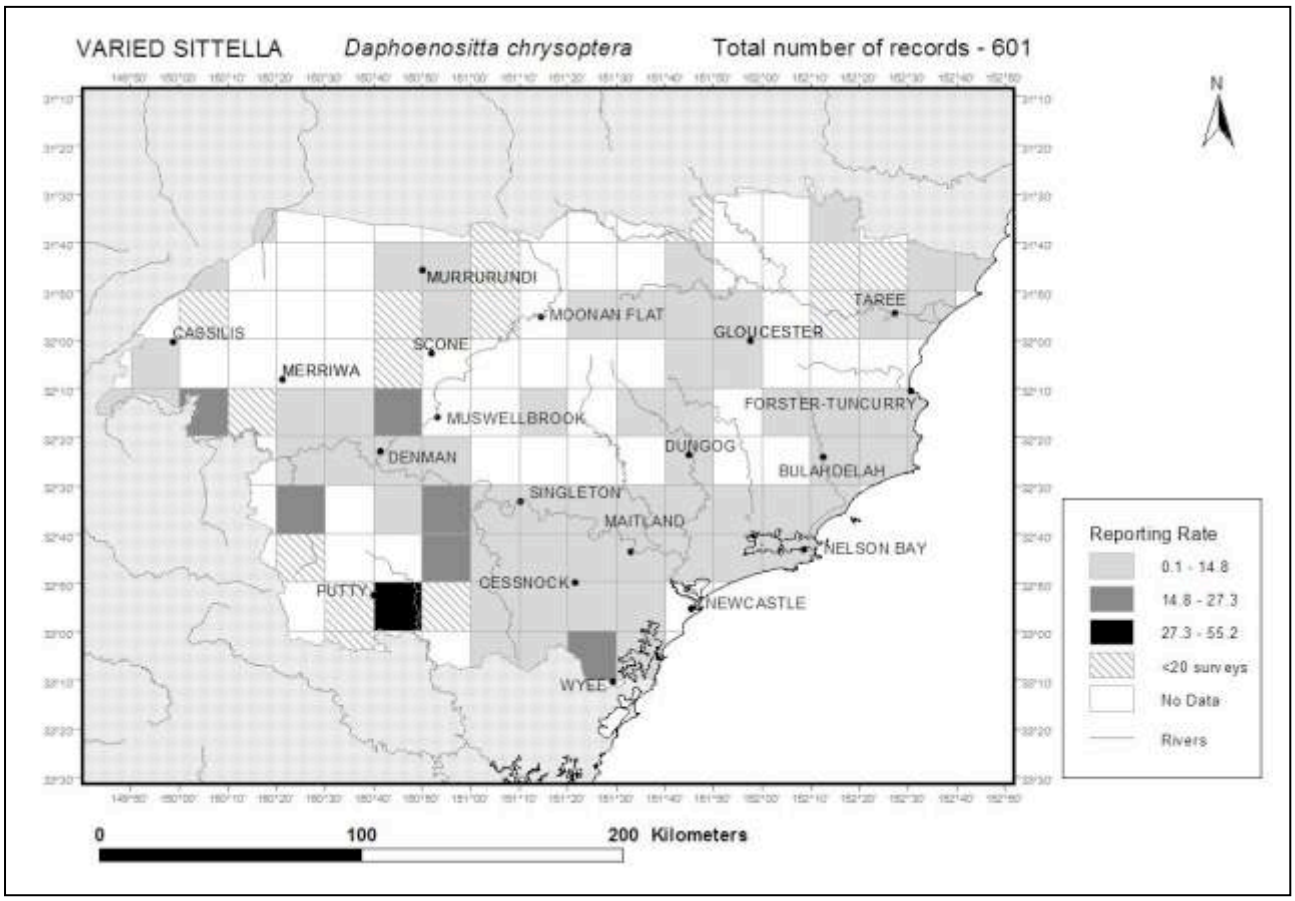

REGENT HONEYEATER
Anthochaera phrygia
Total number of records - 96
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
POTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 3.5
3.5 - 4.7
4.7 - 15.1
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

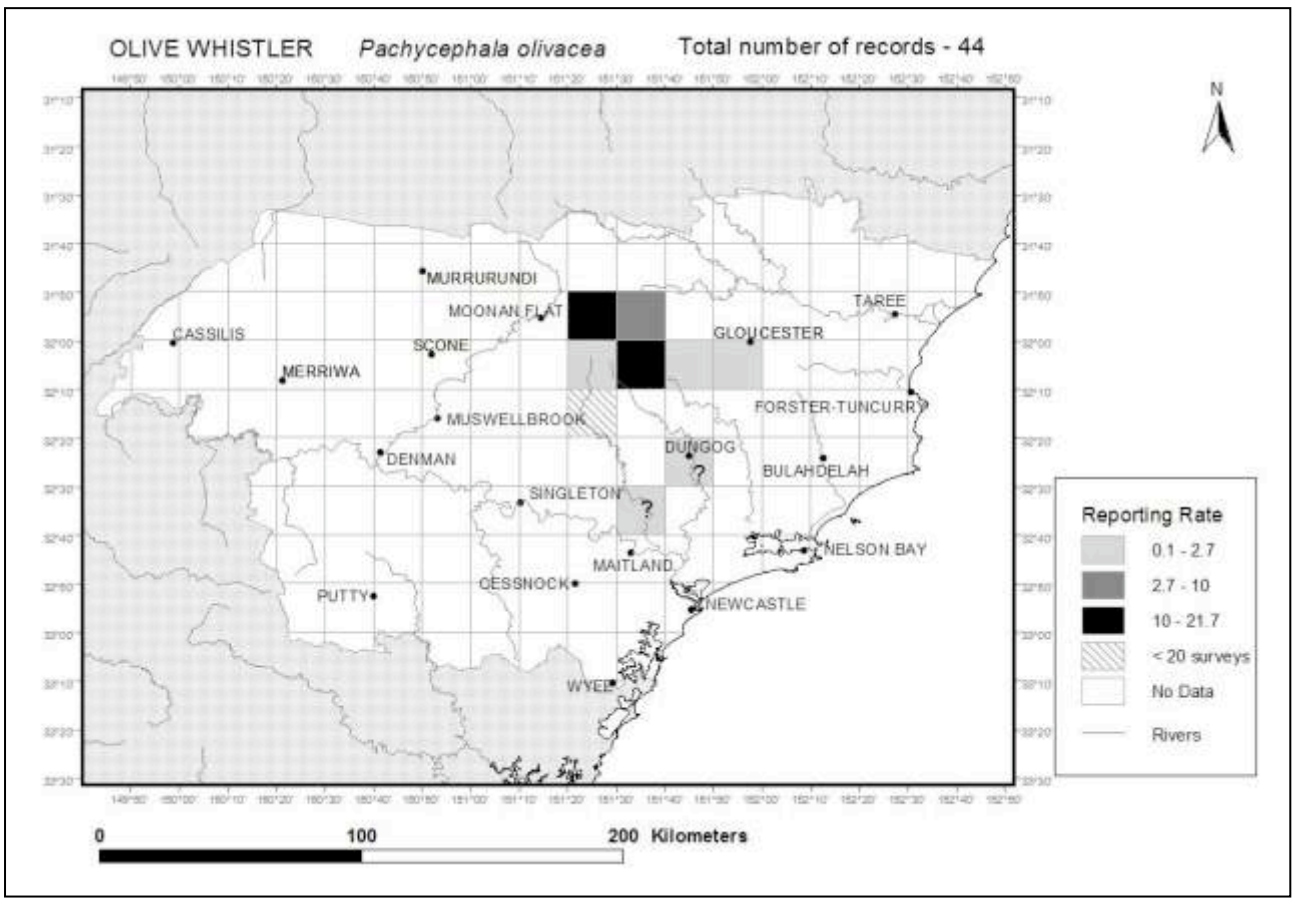

WHITE-FRONTED CHAT
Epthianura albifrons
Total number of records - 441
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 1
1 - 5.2
5.2 - 26.5
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

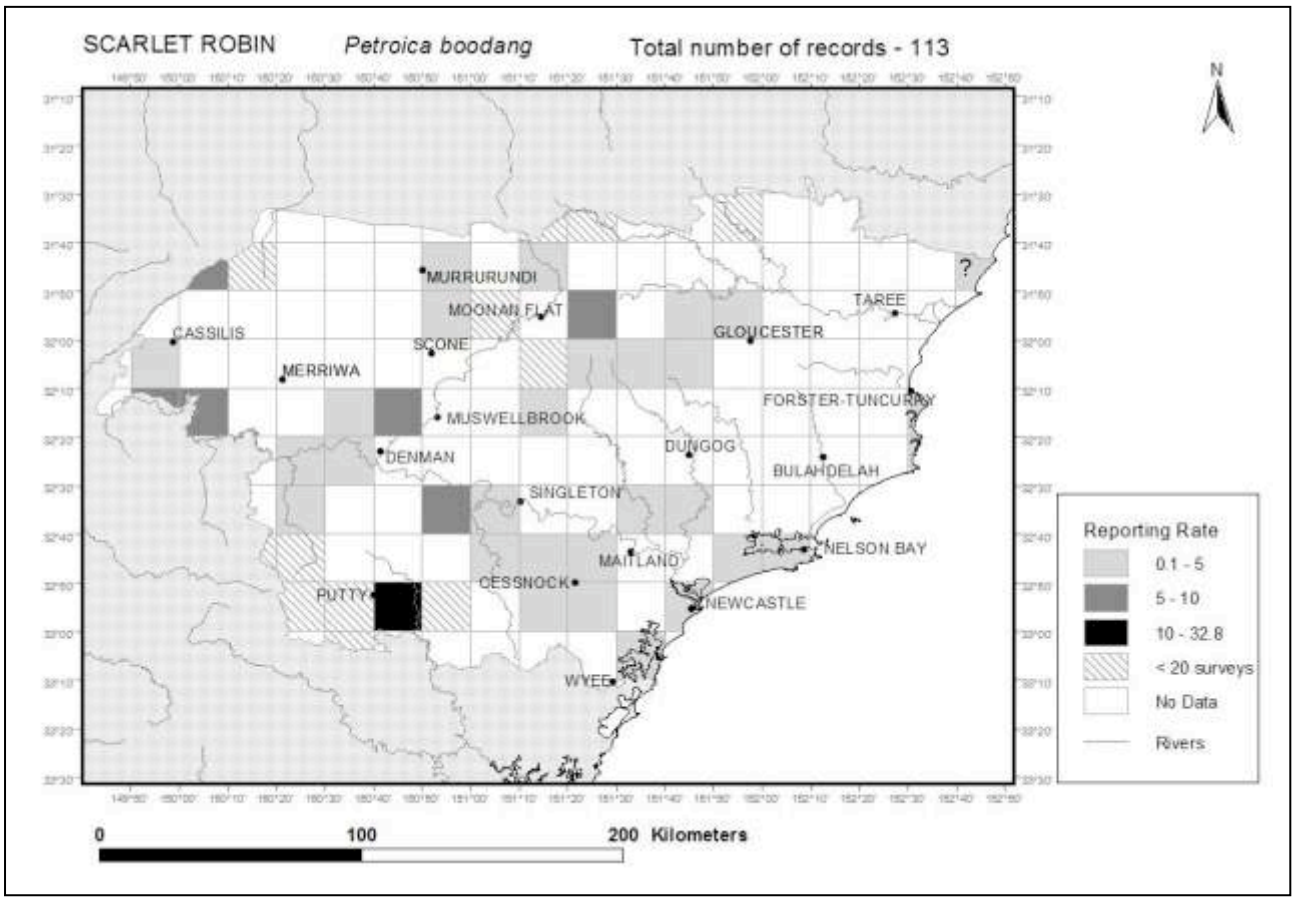

BLACK-CHINNED HONEYEATER
Melithreptus gularis
Total number of records - 63
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 2.4
2.4 - 5.3
5.3 - 11.1
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

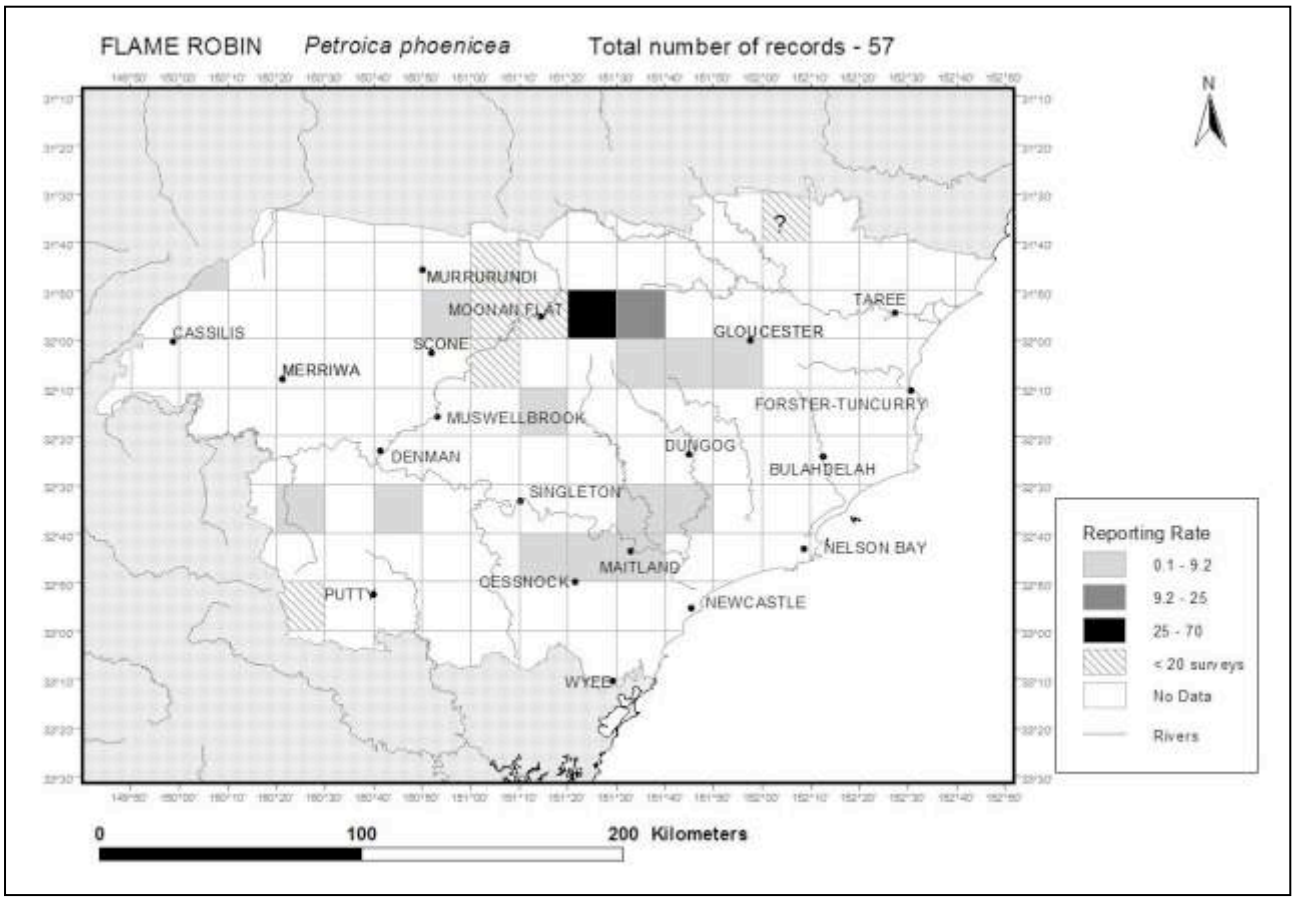

PAINTED HONEYEATER
Grantiella picta
Total number of records - 31
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
1.5 - 2.6
2.6 - 4.7
4.7 - 9.3
No Data
Rivers
0
90
180 Kilometers

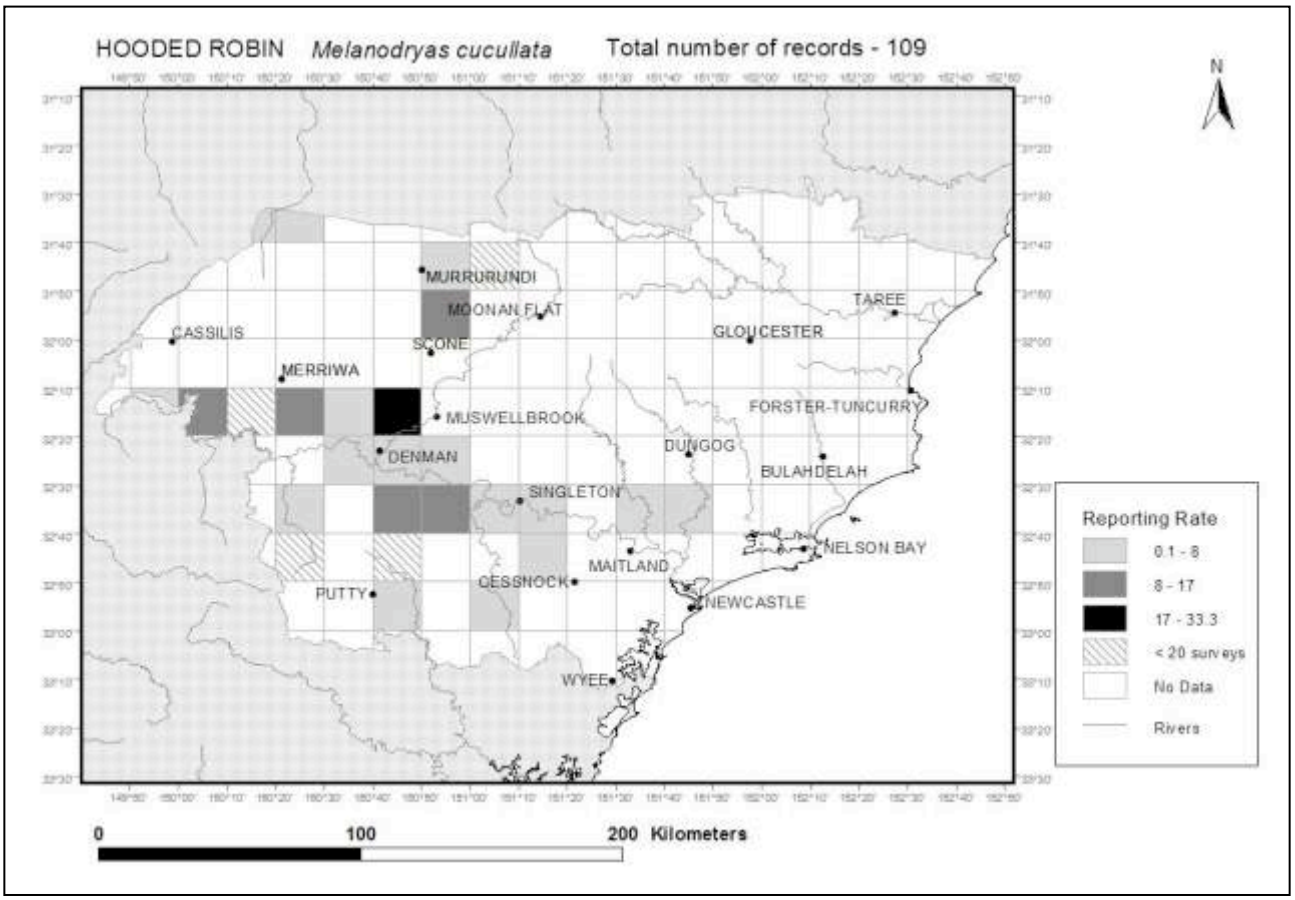

GREY-CROWNED BABBLER
Pomatostomus temporalis
Total number of records - 803
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
SCONE
GLOUCESTER
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
PUTTY
CESSNOCK
NEWCASTLE
WYEE
Reporting Rate
0.1 - 11.6
11.6 - 26.1
26.1 - 49.3
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

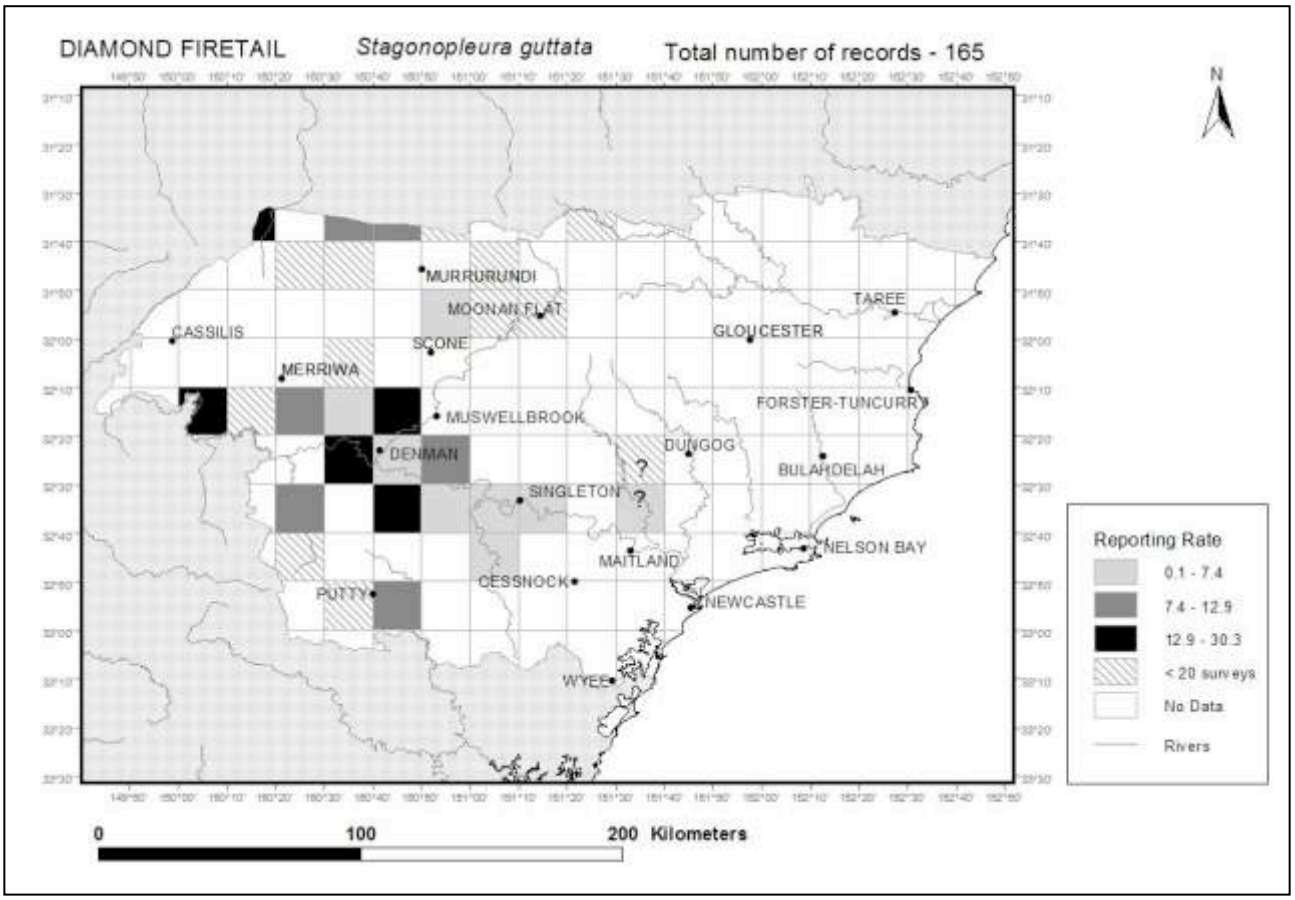

VARIED SITTELLA
Daphoenositta chrysoptera
Total number of records - 601
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
MAITLAND
NELSON BAY
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 14.8
14.8 - 27.3
27.3 - 55.2
<20 surveys
No Data
Rivers
0
100
200 Kilometers


OLIVE WHISTLER
Pachycephala olivacea
Total number of records - 44
N
MURRURUNDI
MOONAN FLAT
TAREE
CASSILIS
GLOUCESTER
SCONE
MERRIWA
FORSTER-TUNCURRY
MUSWELLBROOK
DUNGOG
DENMAN
?
BULAHDELAH
SINGLETON
?
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 2.7
2.7 - 10
10 - 21.7
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


SCARLET ROBIN
Petroica boodang
Total number of records - 113
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 5
5 - 10
10 - 32.8
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


FLAME ROBIN
Petroica phoenicea
Total number of records - 57
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
GLOUCESTER
TAREE
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 9.2
9.2 - 25
25 - 70
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


HOODED ROBIN Melanodryas cucullata
Total number of records - 109
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
TAREE
GLOUCESTER
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 8
8 - 17
17 - 33.3
< 20 surveys
No Data
Rivers
0
100
200 Kilometers


DIAMOND FIRETAIL Stagonopleura guttata
Total number of records - 165
N
MURRURUNDI
MOONAN FLAT
CASSILIS
SCONE
TAREE
GLOUCESTER
MERRIWA
MUSWELLBROOK
FORSTER-TUNCURRY
DUNGOG
DENMAN
BULAHDELAH
SINGLETON
NELSON BAY
MAITLAND
CESSNOCK
PUTTY
NEWCASTLE
WYEE
Reporting Rate
0.1 - 7.4
7.4 - 12.9
12.9 - 30.3
< 20 surveys
No Data
Rivers
0
100
200 Kilometers

Impacts on Speckled Warbler abundance in the Paterson area of NSW

Mike Newman

7 Glenurie Close, Woodville, NSW 2321

When the woodland at Green Wattle Creek near Paterson was lightly grazed Speckled Warblers *Chthonicola sagittata* were abundant, being present at densities which are probably exceptional for the Paterson area. Consequently this remnant woodland, with of the order of 80 hectares of suitable habitat, was an important refuge for the species. However, when cattle grazing ceased, the understorey and ground cover vegetation increased. This habitat change triggered a tenfold decrease in the abundance of Speckled Warblers. At this lower population density, the fringes of the woodland become important, particularly where they abut grazed areas. At Black Rock, another location in the Paterson area, there was evidence of a drought-related decline in Speckled Warbler abundance.

INTRODUCTION

The Speckled Warbler is listed as vulnerable under the *Threatened Species Conservation Act 1995* (NSW). The Action Plan for Australian Birds 2000 (Garnett & Crowley 2000) indicates the need to protect woodland habitat where Speckled Warblers are known to be resident and to undertake long-term monitoring of remnant sub-populations. This paper addresses those recommendations.

Speckled Warblers are resident at Green Wattle Creek 32°40'S 151°39'E, an area of remnant woodland approximately 100 hectares in size, situated on the edge of the Butterwick flood plain. This woodland was monitored monthly between April 1996 and December 2009 (Newman 2009). Variations in Speckled Warbler numbers at Green Wattle Creek are compared with its occurrence at other locations near Paterson in the Hunter Valley.

METHODS

The approach used involved a combination of four 20-minute fixed site surveys embedded in a four-hour fixed route area search (Figure 1). Surveys at Green Wattle Creek were conducted monthly and numbers of birds present were recorded. This survey approach was established during the Birds Australia (BA) Birds on Farms project. Although the fixed sites are nominally termed '2ha' in this paper and for BA Atlas reporting, their actual size is approximately 1.25ha as a smaller site size was used for the Birds on Farms project compared with the New Atlas of Australian Birds which used 2ha sites (Barrett *et al.* 2003). Further details of the study area, including habitat description are provided in a previous paper (Newman 2009). Similar long-term studies involving quarterly surveys were conducted on two farms in the Paterson – Allyn River Valley area of the Hunter Region (Newman 2007, Newman & Lindsey 2008). The results of other survey campaigns using a fixed route approach at Black Rock near Martins Creek 32°34'S 151°39'E and on the Yaraandoo property 32°38'S 151°40'E, both in the hinterland near Paterson, are also discussed.

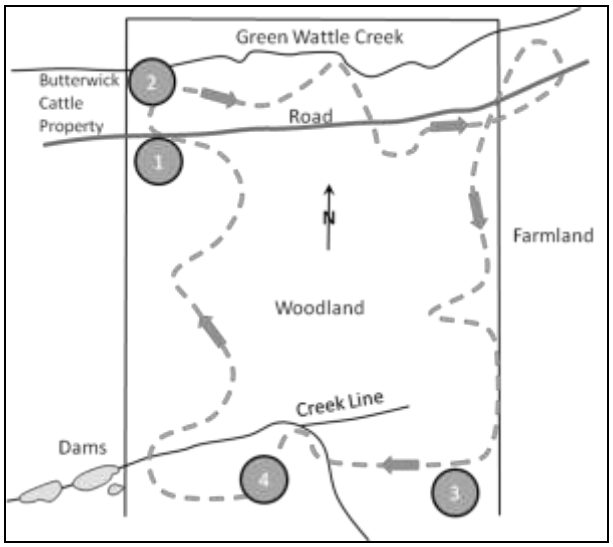


Figure 1. Survey route and 2ha survey sites at Green Wattle Creek woodland

RESULTS

Annual variations in the mean reporting rate (the frequency with which Speckled Warblers were present during a survey) and the mean number of Speckled Warblers observed during four-hour area surveys at Green Wattle Creek are shown in Figure 2. When systematic surveys commenced in 1996 Speckled Warblers were seen on every one of the 45 surveys conducted during the first four years and the reporting rate was 100%. However, during this initial period the number of birds fell, indicating the species had become less numerous. Subsequently the reporting rate fell until stabilising between 2001 and 2009, suggesting that the Speckled Warblers remain resident in the woodland, but at a much lower density.

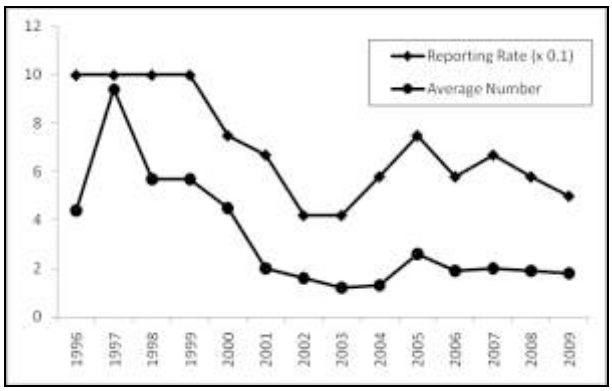


Figure 2. Variation in annual reporting rates and annual average numbers of Speckled Warblers at Green Wattle Creek

The rates of observation of Speckled Warblers are compared in Figure 3. The results suggest that, during the period between 1996 and 1999 when Speckled Warblers were plentiful, area searches were a more effective method of detecting Speckled Warblers than the fixed site surveys. Subsequently this advantage was less apparent.

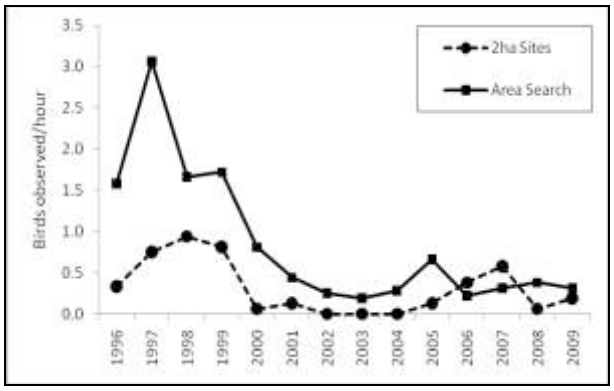


Figure 3. Annual variations in the rate of observation of Speckled Warblers at Green Wattle Creek

Peak sizes for the Speckled Warbler population at Green Wattle Creek were estimated using the 2ha site and fixed route survey data for 1998 (Figure 3). At the 2ha sites the mean rate of Speckled Warbler observation was 0.94 birds/hour in an area of 3.75ha (i.e. three sites each of 1.25ha surveyed in one hour). This equates to a mean Speckled Warbler density of 0.25 birds/ha and a total population of 20 birds, assuming that there is 80 hectares of suitable habitat at Green Wattle Creek. During the fixed route survey it was estimated that 2.5km of transect 50m wide was sampled in 2.7 hours (4.6 ha/hr). At an observation rate of 1.66 birds/hour this equates to a Speckled Warbler density of 0.35 birds/ha and a total population size of 28. These two estimates are of the same order of magnitude and the agreement is good given that the sizes of the areas surveyed are only known approximately.

Speckled Warblers were seen at all four of the 2ha sites with reporting rates for the 165 surveys ranging from 5% at site 2 to 9% at site 1. Most of the records at the 2ha sites (61%) were between 1997 and 1999. However during this period Speckled Warblers were seldom recorded during consecutive surveys suggesting they were foraging over a more extended range than the 2ha site. They were usually recorded as single birds (59%) and pairs (36%), with two instances of groups of four birds. There were no birds recorded at the 2ha sites between 2002 and 2004, but from 2005 Speckled Warblers were again occasionally recorded at sites 1 and 2. In contrast between 2001 and 2009 there was only one record from site 4 and none from site 3.

On the cattle property immediately adjacent to Green Wattle Creek the mean reporting rate for Speckled Warblers during 44 surveys of approximately 3 hours duration fell from 32% to 14% between the two halves of the 11-year study. At another cattle property, Warakeila 32°15'S 151°31'E, Speckled Warblers were only recorded twice, once before the surveys commenced in 1996 and during one of the 48 surveys similar to those conducted at Green Wattle Creek (Newman & Lindsey 2008). At Black Rock near Martins Creek, 81 surveys each of 2 hours or greater duration were made between 2000 and mid 2010. The reporting rate of Speckled Warblers during these surveys declined post 2006 as shown in Figure 4. However it should be noted that the survey effort was greater between 2000 and 2006 when 62 surveys were made with a Speckled Warbler reporting rate of 42% compared with 19 surveys between 2007 and mid 2010 at a 16% reporting rate.

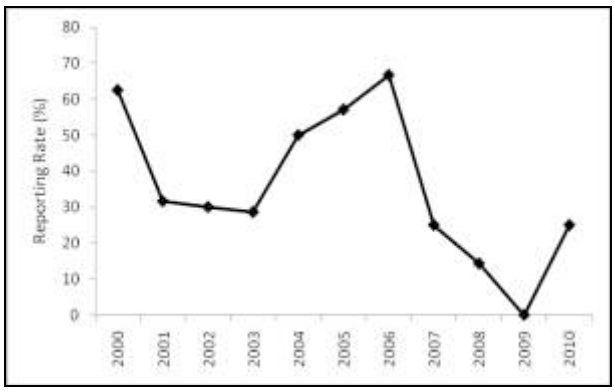


Figure 4. Variation in Speckled Warbler reporting rates at Black Rock, Martins Creek

In contrast, on the Yaraandoo property Speckled Warblers were recorded during six out of seven fixed route surveys each of around 2.5 hours duration conducted between August 2009 and January 2010. All but one of the Speckled Warbler records at Yaraandoo were made in two small commercial olive plantations. However these birds were absent during subsequent monthly surveys over autumn.

DISCUSSION

As shown in Figures 2 and 3, both the reporting rate and the abundance of Speckled Warblers at Green Wattle Creek decreased between 1999 and 2003, and the species remained relatively scarce until the end of 2009. Examination of Figure 3 shows that the peak mean annual observation rate in 1997 of approximately 3 birds/hour was an order of magnitude higher than the lowest rate, which occurred in 2003. It is suggested that increases in the density and height of understorey vegetation rendered the woodland less suitable habitat for Speckled Warblers, resulting in the population decline. It is proposed that the most important cause of the change in habitat and its decreased suitability for Speckled Warblers was the cessation of light grazing in the woodland about the time that these surveys commenced in 1996. The prolonged period of below-average rainfall between 2002 and 2006 may have exacerbated the situation. In contrast, at Black Rock, the post-2006 decline (Figure 4) is attributed to drought as there was no change in grazing intensity and understorey vegetation condition at that location.

The Atlas Bushcare analysis in the second Atlas Supplementary Report (Barrett *et al.* 2002) highlights the beneficial impact of ceasing to graze woodland habitat supporting Speckled Warblers, with maximum benefit occurring between two and ten years after stock are removed. However, after ten years the Speckled Warbler population declined and the initial benefit of removing cattle was lost. The results in this paper suggest that the decline is in fact more rapid and is essentially complete in six years based on the changes in abundance shown in Figure 3. The fact that the area had only been lightly grazed may have allowed accelerated rates of understorey recovery and growth. The Barrett *et al.* (2002) report also indicates that Speckled Warblers favour sites with fallen logs which are adjacent to grazed areas. Sites 1 and 2 at Green Wattle Creek (Figure 1) fit this description and these were the sites where Speckled Warblers continued to be recorded towards the end of the study in the period 2007 – 2009.

The changes in both the bird populations and habitat were more precisely characterised at the four 2ha sites than in the area searched along the survey route between these sites. The 2ha sites were selected to sample four different sub-habitats (Newman 2009). Between 1996 and 1999, Speckled Warblers were observed intermittently at all of these sites suggesting that the entire area, other than the very dense creek-side vegetation was suitable habitat for Speckled Warblers at that time.

The experiences at sites 3 and 4 are particularly insightful because they are typical of the two habitat types which represent the bulk of the woodland away from the creek. In 1998 Speckled Warblers were observed during four of the twelve surveys at site 3 compared with three observations at each of the other sites. However, after 1999 there was only one record in ten years involving 120 surveys. This is attributed to the growth of the shrub layer, which by 2009 had become sufficiently dense to attract species like the Regent Bowerbird *Sericulus chrysocephalus*. However, for much of that ten-year period Speckled Warblers were intermittently recorded on the fixed route survey at the edge of the woodland within 100m of site 3, and hence Speckled Warblers would have been expected to occur if site 3 was suitable. Interestingly, following increased rainfall and the removal of cattle, grass cover increased in the paddock near site 3 and the Speckled Warblers disappeared. This complements the experience at site 4 where native grasses provide almost total ground cover and there is little shrub layer. It is suggested that the ground cover increased post grazing, making this site unsuitable; in addition it

is the site most distant from grazed habitat surrounding the wood, which is known to be beneficial (Barrett *et al.* 2002).

The maximum reporting rate for the Speckled Warbler recorded in the New Atlas of Australian Birds (Barrett *et al.* 2003) was found in the 1° grid 32°S 150°E at similar latitude to Green Wattle Creek, but further west in much drier country. On this basis the Green Wattle Creek woodland is probably sub-optimal and its suitability requires measures like light grazing which limit the amount of understorey and ground cover vegetation. In this respect controlled burning might also be beneficial provided that it is conducted infrequently and in a manner which generates a mosaic of habitat with refuges for the core Speckled Warbler population. The need for the reduction of combustible fuel associated with the fire risk to adjacent residences make future burning at Green Wattle Creek a probability, which will provide an opportunity to monitor the impact of this management option on the Speckled Warbler population.

The high density of Speckled Warblers at Green Wattle Creek when it was lightly grazed attracted Black-eared Cuckoos *Chalcitis osculans*. In 1993 a number of pairs were fostering juvenile Black-eared Cuckoos for which the Speckled Warbler is a preferred host species. This is the only year that the Black-eared Cuckoo, which is locally rare, has been recorded breeding in the east of the Hunter Region (Newman 2009), which suggests that Speckled Warbler densities of this magnitude are exceptional in the Paterson area.

The studies at the cattle property adjacent to Green Wattle Creek (Newman 2007), at Warakeila (Newman & Lindsey 2008) and at Black Rock, Martins Creek all suggest that Speckled Warblers have declined during the last decade. The combination of the adjacent grazed property and the woodland at Green Wattle Creek appears to provide an important synergy which allows survival through periods of environmental stress like drought. At areas like Black Rock, where land use was virtually unchanged, other factors like drought appear to be of primary importance. Warakeila and immediately surrounding areas appear to lack sufficient remnant habitat to support an on-going Speckled Warbler population and the species seems to have become at least temporarily extinct at that site (Newman & Lindsey 2008).

The Speckled Warblers at Yaraandoo may provide a fascinating insight into the habitat requirements of the species in that maintenance of the two olive groves provides a combination of relatively bare ground under the olive trees surrounded by grazed pasture. Although the population size is very small, it warrants further investigation to determine whether their occurrence is seasonal. Recent results provide further support for this hypothesis.

CONCLUSIONS

When the woodland at Green Wattle Creek was lightly grazed Speckled Warblers were abundant, being present at densities which are high for the Paterson area. Consequently, this remnant woodland which held of the order of 80 hectares of suitable habitat was an important refuge for Speckled Warblers. However, when cattle grazing ceased, the understorey and ground cover vegetation increased. This habitat change triggered a tenfold decrease in the abundance of Speckled Warblers. At this lower population density the fringes of the woodland become important particularly where they abut grazed areas.

Throughout most of the Paterson area there appears to have been a decline in Speckled Warblers including areas where there is no obvious change in land use. At places like Black Rock drought appears to be a significant factor determining Speckled Warbler numbers.

It is apparent from this study that processes which reduce understorey and ground cover in the wetter coastal woodlands of NSW can be beneficial in providing the habitat balance which is essential to Speckled Warblers. Light grazing, perhaps intermittent, is an obvious option as is controlled burning to create vegetation mosaics with patches of relatively bare ground. Understanding the attributes of olive groves to Speckled Warblers may provide insights into how their habitat can be maintained and even created.

ACKNOWLEDGEMENTS

The owners of Warakeila, Yaraandoo and a cattle property at Butterwick are thanked for allowing access to their land. Andrew Silcocks' assistance in extracting information from the BA Atlas data base is greatly appreciated.

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Evidence for the decline of the Varied Sittella in the Hunter Region

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The Varied Sittella *Daphoenositta chrysoptera* was recently listed as vulnerable under the *Threatened Species Conservation Act 1995* (NSW). The following information was submitted in support of the listing.

Although the species continues to be moderately often recorded in the Hunter Region, and is probably best described as uncommon, there is evidence that it is continuing to decline as was indicated earlier by the results of the New Atlas of Australian Birds in 2003 (Barrett *et al.* 2003). Furthermore it is increasingly threatened by the progressive removal of its core woodland habitat and ongoing fragmentation of remnant vegetation. We draw upon the results of long-term bird monitoring studies in the Lower Hunter Region to support these claims.

One of the most comprehensive data sets for woodland birds in the Hunter Region is for an area of woodland at Green Wattle Creek, Butterwick (32º40´S 151º39´E) near Paterson. This study commenced in April 1996 and involves monthly surveys, typically of four hours duration, during which a census of all birds is made using a constant effort/fixed route approach based on Birds Australia's Birds on Farms Project protocols. Thirteen years of data involving 156 surveys have recently been analysed and published (Newman 2009). During these surveys the Reporting Rate (percentage of surveys Varied Sittellas were recorded) was 36 percent. To put this value into perspective, 136 species were recorded on the Green Wattle Creek surveys and the Reporting Rates for the most common species, the Superb Fairy-wren *Malurus cyaneus* and the Grey Fantail *Rhipidura fuliginosa*, were 100 percent. The Varied Sittella ranked well down the list based on its Reporting Rate. The Crested Shrike-tit *Falcunculus frontatus* and the White-bellied Cuckoo-shrike *Coracina papuensis*, two other species which are relatively uncommon in the Hunter Region, had Reporting Rates of 44 and 22 percent respectively.

There was a 25 percent fall in the Reporting Rate of the Varied Sittella between the periods 1997-2002 and 2003-2008 (72 surveys in each period). However a 50 percent decrease is necessary for the decline to be statistically significant at the $P<0.05$ level.

During the Green Wattle Creek surveys Varied Sittellas were usually encountered as a single flock. The records indicate its continuous presence for a number of months, including breeding, interspersed by prolonged periods of absence. Hence the impression is gained of a species which is locally nomadic rather than holding a fixed territory indefinitely. This view is supported by two similar parallel studies on farms in the lower Hunter with approximately 15 percent remnant vegetation where Varied Sittellas were also periodically present, but at lower Reporting Rates than at Green Wattle Creek (Newman 2007; Newman & Lindsey 2008). Collectively these studies support the view that connectivity of remnant woodland will become increasingly important as core habitat continues to be lost to development.

The habitat at Green Wattle Creek is approximately 150 hectares in extent, situated on the edge of the Paterson River floodplain. It is surrounded by farmland and has limited connectivity to similar woodland. It has not been burnt for over 20 years. Cattle grazed the area until shortly after the surveys commenced. Consequently, understorey and ground cover vegetation increased during the study. Narrow-leaved Ironbark *Eucalyptus crebra*, Spotted Gum *Corymbia maculata* and Grey Gum *Eucalyptus punctata* dominate the canopy vegetation which is typically 30m in height.

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The *Whistler* – Instructions to Authors

The *Whistler* is an occasional publication of the Hunter Bird Observers Club Inc. (HBOC), which is based in Newcastle. HBOC members are active in observing birds and monitoring bird populations in the Hunter Region. This journal-style publication is a venue for publishing these regionally significant observations and findings. The journal publishes three types of articles:

1. Contributed Papers
2. Short Notes
3. Book Reviews

The Whistler Sub-committee requests that authors consider the appropriateness of their study to this publication. The publication is suitable for studies geographically limited or related to the Hunter Region and papers attempting to address data and issues of a broader nature should be directed to other journals, such as Corella, Australian Field Ornithology and Emu. Contributed papers should include analyses of the results of detailed ecological or behavioural studies or syntheses of the results of bird monitoring studies and/or comprehensive annotated species lists of important bird areas and habitats. These data would then be available for reference or further analysis in the many important issues of bird conservation in the Hunter Region. Communication of short notes on significant bird behaviour is also encouraged as a contribution to extending knowledge of bird habits and habitat requirements generally. Reviews of bird books that members have enjoyed or disliked are also being solicited to provide a guide for other readers on their usefulness regionally and more broadly.

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- Manuscripts must be submitted electronically; please attach your manuscript to an email as a Microsoft Word document. Charts should be submitted as an Excel file.
- Introduce species using English and scientific names.

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- Manuscripts should be formatted as per the instructions below.
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- Methods describes the location of the study, citing map co-ordinates or including a map, how observations were made and data were collected and analysed.
- Results of the data analyses include description and/or analysis of data highlighting trends in the results, divided into subsections if more than one body of data is presented; use of photos, drawings, graphs and tables to illustrate these is encouraged.
- Discussion and Conclusions should indicate the significance of the results locally and regionally; comparison with national and international work is optional, as is the discussion of possible alternative conclusions and caveats with the study; suggestions for future extension of the work are encouraged.
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- Approximately 2 pages of critical assessment and/or appreciation.
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