

Australian Pest Animal Research Program



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Australian Government

Australian Bureau of Agricultural and
Resource Economics and Sciences

**National mapping of the abundance of established, new and emerging
pest animals to improve decision-making and the assessment of
government investment programs**

STAGE 2: INTRODUCED PEST BIRDS

FINAL REPORT

TO THE AUSTRALIAN BUREAU OF AGRICULTURAL AND RESOURCE ECONOMICS AND
SCIENCES, DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY

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Department of
Primary Industries



Invasive Animals CRC

Lead agency

The NSW Government – NSW Department of Primary Industries and the Invasive Animals Cooperative Research Centre (IACRC) coordinated this project with funding through the Australian Pest Animal Research Program (under Caring for our Country).

Cover page images

Myna bird (courtesy of M David); Helmeted guinea fowl (courtesy of P Fleming); European blackbird (courtesy of B Handke), Ring-neck parakeet (image source unknown)

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Data accessed in this project

A number of formalised datasets were accessed from organisations for this project including: Birds Australia Birddata Atlas courtesy of Birds Australia; the Tasmania Natural Values Atlas courtesy of the Tasmanian Department of Primary Industries, Parks, Water and Environment; Victorian Biodiversity Atlas courtesy of the Victorian Department of Sustainability and Environment; Queensland Annual Pest Distribution Survey, courtesy of Biosecurity Queensland; Atlas of NSW Wildlife, courtesy of the NSW Office of Environment and Heritage; data from the NSW Pest animals survey courtesy of NSW Department of Primary Industries; as well as records from the Canberra Indian Myna Action Group, Canberra Ornithological Group, and several databases managed by the Invasive Animals Cooperative Research Centre.

TABLE OF CONTENTS

1. PROJECT INFORMATION	4
1.1 Project Name	4
1.2 Details of Applicant	4
1.3 Collaborators / Third Parties	4
1.4 Period of Project	4
1.5 Project aims and objectives	5
1.6 Acknowledgements	5
1.7 Conclusions from this study	5
2. PROJECT DESCRIPTION	7
2.1 Background	7
2.2 Recommendations from previous work	8
2.3 Project outcomes	9
2.4 Introduced pest bird species addressed in this project	9
2.5 Species information	11
3. METHODOLOGY	14
3.1 Description of the project methodology	14
3.2 Reporting procedures for introduced pest bird datasets	15
3.3 Improved reporting scale of pest data	16
3.4 Geographic representation of these reporting scales	17
3.5 Delivery of information and mapping outputs to end-users	18
4. RESULTS	19
4.1 Collation of data on pest birds	19
4.2 Centralising data from databases containing pest bird records	19
4.3 Data imported to the project	20
4.4 Number of introduced pest bird species recorded	22
4.5 Occurrence of pest animals in each state/territory jurisdiction	23
4.6 Occurrence of introduced pest birds in each NRM region	28
4.7 Outputs at national, state/territory and regional scales	35
5. DISCUSSION OF RESULTS AND IMPLICATIONS	36
5.1 Adopted method of this project	37
5.2 Use of data, outputs and information at the regional and local scales to promote targeted surveillance, early detection, response and control of new bird species and expansions in established pest birds	38
5.3 Recommendations from this project	38
6. REFERENCES	40
APPENDICES	41

1. PROJECT INFORMATION

1.1 Project Name

National mapping of the abundance of established, new and emerging pest animals to improve decision-making and the assessment of government investment (STAGE 2: Introduced pest birds)

1.2 Details of Applicant

(a) Organisation Details

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1.3 Collaborators / Third Parties

This project involved collaboration between NSW Department of Primary Industries, the Invasive Animals CRC, and the Australian Government – Australian Bureau of Agricultural and Resource Economics and Sciences. Collection of data for this project involved many organisations and agencies administering databases and pest bird records. Assistance was provided by state and territory government agencies and regional groups with the provision spatial databases and Atlas systems. Birds Australia provided access to relevant datasets and assisted with identification of other data for nationally significant pest bird species. The project members worked closely with each state and territory agency to provide up-to-date records of introduced pest birds for this project.

1.4 Period of Project

Commencement date: 01 January 2010

Completion date: 31 December 2010 (extension granted to 31 October 2011)

1.5 Project aims and objectives

Base-line information on pest birds is required to evaluate the effectiveness of on-ground control activities, as well as government policy, programs, and investment.

The objectives of this project were to:

1. Implement nationally endorsed monitoring protocols (at a finer-scale) to collect, collate and report information for priority pest bird species throughout Australia (to complement existing datasets for terrestrial pest animal species being addressed in concurrent projects and government reporting initiatives)
2. Develop improved Australia-wide datasets for priority pest bird species for monitoring, evaluation, reporting and program improvement (MERI), to support regional NRM groups and land managers.
3. Centralise data for introduced pest bird species from available information, and producing consistent mapping and data products for relevant regional, state/territory and national authorities to complement government initiatives for pest species data reporting.
4. Deliver information products to relevant agencies, land managers, community-groups and regional NRM bodies, via government data libraries, portals, and web-sites.

1.6 Acknowledgements

This project involved many parties. State and Territory government and regional groups assisted with identification of and access to introduced pest bird data within existing databases and information systems. Birds Australia kindly assisted with providing access to the Birddata database. A range of other state-administered Atlas systems were accessed with permission of respective government custodians – a full list is provided in this report. Brian Lukins (NSW DPI) provided significant assistance with data processing and formatting tasks. The Spatial Information Unit (NSW DPI) assisted with various data management activities and supply of data.

1.7 Conclusions from this study

This project sought to collect and collate geospatial data for 32 introduced pest bird species in Australia from various spatial databases and Atlas-style systems under administrative control of state/territory government and national organisations like Birds Australia. A total of 94 individual species datasets were identified and used in this project to report spatial trends in introduced pest bird species across Australia and its 56 NRM regions. A total of 30 introduced pest species were found within the various databases identified in this project. The most commonly occurring species across Australian NRM regions include species that are known to have significant agricultural and environmental impacts as well as cause damage to social amenity and infrastructure, including feral pigeons, cattle egret, house sparrows, common starlings, mallard/northern mallard and Spotted turtle dove. Other species of

concern include Indian myna and European blackbird that currently occupy large areas of Eastern Australia and are spreading in association with human habitation and development. The greatest number of species in any single NRM region was in Port Phillip-Westernport NRM and surrounding NRM regions, as well as many NRM regions in eastern NSW. These areas contain significant records for introduced bird species.

This project has provided insight into the range and scope of existing databases and Atlas-style systems for managing introduced bird data gathered at the local scale. Many outputs from the project can increase the value of data at local/regional, state/territory and national scales, and support prevent, early detection, response to and control of pest birds at the local scale if improved facilities can be developed for local reporting and data management.

The project team propose the following recommendations to build on outcomes from this project relating to introduced pest bird data:

- Disseminate outputs and information products from this project to NRM regional groups, as well as local government to raise awareness of pest birds in each respective area, and increase capacity of local authorities to identify and respond to pest birds locally.
- Build on datasets developed as part of this project and known information layers from existing database systems, and further consult regional and local groups (e.g. local ornithological organisations and volunteer groups) to raise awareness of the need to record priority introduced pest birds species. Detection of new incursions (including escaped aviary species) in small numbers may be reliant on dedicated groups such as ornithological groups at the local scale.
- Improve facilities and procedures for reporting of introduced bird data that captures pest bird records from existing databases and large Atlas system information systems (such as Birds Australia). This would provide a means of responding to the detection of pest birds via ornithological and community groups, by relevant pest management authorities. This would have value to early detection, response and control of new incursions and expanding pest bird populations.
- Provide a centralised location or web-portal for reporting of pest bird data from local ornithological groups and community groups, including new species (such as escaped birds) detected in the wild by local community groups/clubs/societies. The system should communicate with local authorities for any necessary control/eradication efforts. For detection of new incursions, responding to escaped aviary species and local coordination of any necessary control at the local scale, there is reliance on local community groups and ornithological societies/clubs as they represent the greatest single group on the ground.
- Further examine data on introduced birds gathered in this project (across classes for likely threat to agricultural production and food security) with

known and forecast land use classifications across Australia (via National Land use Mapping datasets). This could be used to identify agricultural production industries at current and future threat from spreading or expanding pest species, such as horticulture and crop production.

- Consider adoption of future National Data Standards for Reporting of Pest Animals – currently under development by the Joint AWC/VPC National Indicators Working Group. This could permit consistent reporting of pest bird data across all management areas in alignment with other pest animal reporting.

2. PROJECT DESCRIPTION

2.1 Background

Australia has many wide-ranging pest animals that threaten the viability of agriculture, primary production industries and natural resources'. The impacts of pest animals have previously been estimated at over \$1 billion per annum. Pest birds (consisting of native and introduced species) are implicated with over \$300 million damage per annum to horticulture and viticulture industries alone (Tracey et al. 2007), and the damage caused by pest birds to other industries are largely unquantified at the national scale.

Information on introduced pest birds across Australia is largely managed by state and territory governments and nationally coordinated organisations like Birds Australia. Data are stored in many formats (with a variety of core attribute data fields) and across a number of agencies including environment and primary industries state government agencies. Data are managed in geo-databases, atlas systems, and spreadsheets.

While most databases gather and store records in a consistent format, the data fields vary substantially. In some cases the format of data are also not directly comparable, and rely on a process of bringing data together to compare and assess the extent of a species, and trends across landscapes and management areas.

A range of pest bird data is also held and managed by localised ornithological groups (such as field naturalist groups) gathered through local surveys and coordinated bird watching activities. While the priority for these groups is not often the detection of introduced species, invariably observations of introduced pest birds are often made and recorded. Some of these datasets are periodically reported to centralised repositories (such as Birds Australia atlas), however the frequency and extent of reporting from local groups is not very well understood. In addition, some historical records are also not necessarily readily available within online databases and atlas systems, preventing that information on historical records from being used in the current project.

Introduced pest birds are increasingly causing damage to agricultural productivity, biodiversity and ecosystems, and urban landscapes. Centralising and updating baseline information from as many sources as possible on the extent of individual pest bird species will help to detect new incursions, assess species extent and abundance, evaluate species range against changing land-use patterns, prioritise areas for

targeted surveillance activities, evaluate the effectiveness of on-ground control activities, and help to disseminate valuable resources or deploy control techniques to targeted areas.

Base-line information on pest birds is also required for the purposes of developing appropriate policies and procedures for preventing species from spreading into new areas, detection of expanding species or new incursions (ie, accidentally introduced birds, migrant species that have been known to cause problems elsewhere such as Canada Goose, and liberated aviary species such as Indian ring-neck parakeet), and responding to incursions or range expansions that threaten agricultural and natural resources.

This project aimed to centralise available introduced pest bird data from within existing atlas systems, databases and incidental records held by smaller groups to report introduced pest bird information in a single location. This information can be added to other datasets for pest species to support a process of assessing the way we manage pest species and their impacts at a landscape, catchment or management area scale, to agricultural productivity, natural resources, human health and society. Information collated in this project has value at national, state/territory, regional and local government scales.

Key issues this project addresses:

- Pest birds impact on horticulture, viticulture and agricultural cropping industries causing damage estimated at hundreds-of-millions per annum throughout Australia.
- Land management agencies and landholders require access to up-to-date and accurate information on the extent and abundance of introduced pest birds in their region to address their impacts in a strategic and efficient way.
- Reporting on pest birds in a nationally consistent format will complement national data for other terrestrial pest animals and enable a whole-of-system approach to pest and natural resource management.
- Delivery of pest bird information from this project will support regional and local authorities with detection and response to incursions of introduced pest birds, monitoring of populations, and deployment of best-practice control techniques.

2.2 Recommendations from previous work

At an APARP funded monitoring and reporting workshop held in Canberra in 2009, participating VPC representatives, state and territory government representatives, as well as the Australian Government agencies (DAFF and DEWHA) provided recommendations for improving datasets and data layers for pest species nationally. The workshop participants recommended further development of improved national information at a finer scale for many species (including nationally significant pest birds). The workshop also recommended the provision of greater information products to stakeholders at regional, state/territory and national scales (NLWRA 2007).

The current project builds on the achievements of previous mapping work, and directly addresses the recommendations of the workshop to improve national data and information on established, new and emerging pest bird species that impact on agriculture, horticulture, viticulture industries across Australia. It provides a centralised national dataset on a wide range of bird species throughout Australia to as a benchmark to assess the effectiveness of projects, investment and programs.

2.3 Project outcomes

This project collects, collates and centralises datasets for a wide range of introduced pest bird species managed in multiple formats and across a number of agencies including state government databases, atlas systems, Bird Australia (Birdata) and in localised ornithological group data sets (such as field naturalist groups)

The key outputs of this project include:

- An improved occurrence information database (and abundance information where available) and maps for introduced pest birds throughout all NRM regions, states/territories and nationally in a consistent format and reporting scale.
- Centralised national datasets and maps for priority pest bird species to complement other nationally significant pest animal species.
- Improved national baseline data for pest birds in a consistent format to improve monitoring and reporting activities at region levels, as well as on-ground activities by community groups/societies and local government.
- An Australia-wide inventory of priority pest birds for all 56 regional NRM groups, state and territory governments, and the Australian Government to accompany datasets developed and reported for terrestrial pest animal species under concurrent programs. Outputs are prepared in consistent format for future integration with other pest animal data for use in national information systems.

2.4 Introduced pest bird species addressed in this project

This project addressed a set of nationally significant introduced pest bird species including established, new and emerging pest birds species, as recommended by the BRS Pest Bird Guidelines, respective state and territory jurisdictions, and the VPC. Species that lack consistent national datasets addressed in this project are listed below. VPC and APARP advice was sought on a final list for this project. The pest bird species addressed in this project are introduced species to Australia. Some present significant threat to agricultural productivity, food security, biodiversity and human infrastructure, while others may present a risk for exotic disease, such as H5N1 avian influenza.

While this project was tasked with developing a centralised set of data for 12 priority pest bird species listed in the original project outline, this project also addressed an additional 20 introduced bird species that were also considered either new, emerging or established species of potential concern to agricultural industries and the environment. The species addressed in this project are listed in table 1 and 2.

While the impacts or threat posed by some of the additional species to agricultural production or environmental values is not well known, the value of identifying these

datasets, centralising the data and reporting information back to end-users was considered to be of value for this project. These additional species datasets can be used in combination with the 12 priority species (table 1) and used to evaluate total pest bird pressure on landscapes, help to identify new incursions, assist local control actions and inform pest management groups about targeted surveillance priorities.

Table 1: First set of introduced pest bird species addressed in project

Common name(s)	Scientific name
Indian / common myna	<i>Acridotheres tristis</i>
Common starling / Starling	<i>Sturnus vulgaris</i>
House sparrow	<i>Passer domesticus</i>
European blackbird	<i>Turdus merula</i>
Rock dove/feral pigeon	<i>Columbia livia</i>
Spotted turtle dove / Spotted dove	<i>Streptopelia chinensis</i>
European goldfinch	<i>Carduelis carduelis</i>
European greenfinch	<i>Carduelis chloris</i>
Eurasian skylark	<i>Alauda arvensis</i>
Song thrush	<i>Turdus philomelos</i>
California quail	<i>Callipepla californica</i>
Tree sparrow or Eurasian tree sparrow	<i>Passer montanus</i>

Table 2: Secondary set of introduced bird species addressed in project

Common name(s)	Scientific name
Indian house crow	<i>Corvus splendens</i>
Muscovy duck	<i>Cairina moschato</i>
Senegal/ laughing turtle dove	<i>Streptopelia senegalensis</i>
Domestic goose	<i>Anser anser domesticus or Anser cygnoides</i>
Helmeted guinea fowl	<i>Numida meleagris</i>
Pacific black duck / mallard hybrid	<i>Anas superciliosa x Anas platyrhynchos</i>
Mallard or northern mallard	<i>Anas platyrhynchos</i>
Red whiskered bulbul	<i>Pycnonotus jocosus</i>
Indian peafowl or peacock	<i>Pavo cristatus</i>
Mute Swan	<i>Cygnus olor</i>
Cattle egret	<i>Ardeola ibis</i>
Ostrich	<i>Struthio camelus</i>
Red jungle fowl	<i>Gullus gullus</i>
Canada goose	<i>Branta canadensis</i>
Indian ringneck parakeet	<i>Psittacula krameri</i>
Common pheasant	<i>Phasianus colchicus</i>
Nutmeg mannikin	<i>Lonchura punctulata</i>
Eurasian collared dove	<i>Streptopelia decaocto</i>
Wild turkey	<i>Meleagris gallopavo</i>
Weka	<i>Gallirallus australis</i>

2.5 Species information

Indian (common) Myna

An aggressive bird with expanding distribution in Australia across many state/territory regions and known to cause impacts to agriculture, biodiversity and human amenity. Introduced from India and SE Asia to Australia in 1862. Known to scavenge outdoor eating areas.

Common starling

An introduced bird known to cause serious impacts to agriculture (horticulture, viticulture and crops), biodiversity and human amenity. Range expanding across Australia and known to occur in most state/territory regions. Known to feed on grains, seeds and scavenge outdoor eating areas.

House Sparrow

Introduced to Australia from Britain in 1863. A bird that predominately occurs in towns and cities and expanding into rural and agricultural production areas where they may damage crops and grains. Occur in most states/territories and cultivated areas. Known to scavenge in outdoor eating areas.

European blackbird

Introduced to Australia in the 1950s. Often found in urban areas and known to be expanding range. Widespread throughout south-eastern Australia . Spreads seeds of exotic weeds and causes damage in urban areas. Damages orchards, parks, gardens and vegetable crops.

Rock dove/ feral pigeon

Introduced species predominately occurring in urban and built up areas. Widespread throughout its range and found in all states and territories. Known to scavenge in urban areas, deface buildings, and spread bird mites with human health consequences.

Spotted turtle dove

Introduced to Melbourne in 1860s from Asia and now widespread throughout Australia. Largely confined to urban towns and cities, farmland. May displace native species. Known to feed on grains, seeds and scavenge outdoor eating areas.

European goldfinch

Introduced to Australia in 1860s from Europe. Predominately occurs in SE Australia in urban areas, farmlands, roadsides, orchards and along railway lines. Feeds on seeds and grains. Can be a pest in orchards.

European greenfinch

Introduced to Australia from Europe. Predominately occurs in SE Australia in farmlands, open areas and orchards. Can be a pest in orchards and can damage fruit and flowers.

Eurasian skylark

Introduced prior to 1850 from Europe. Found across south-eastern Australia in open areas, pastures and grasslands.

Song thrush

Introduced to Australia from Europe between 1850 and 1880. Largely confined to SE Australia and occurs in parks, gardens and woodlands. Reported to occur in localised populations.

California quail

Introduced to Australia as a game bird in mid 1800's. Origin north America. Restricted to Tasmania / islands.

Tree sparrow (Eurasian tree sparrow)

Introduced to Australia from Europe and possibly Japan and now occurs in SE states. Occurs in cities and towns and some agricultural areas.

Indian house crow

Common throughout SE Asia and has limited range in Australia. Vagrant and occasionally ship-assisted incursion. Scavenges around towns and urban areas. Previously been found in shipping ports.

Muscovy duck

Limited range in Australia but occur in many states/territories. Most kept in captivity with some escapees. Of limited agricultural concern. Some records herein may be domestic birds.

Senegal / laughing turtle dove

Introduced species from Africa in 1890s. Largely restricted to Western Australia. Occurs in urban areas, parks, gardens, open spaces. Feed on grains, seeds and garden plants.

Domestic goose

Limited range in Australia but occur in many states/territories. Most kept in captivity with some escapees. Of limited agricultural concern. Some records herein may be domestic birds.

Helmeted guinea fowl

Introduced species. Some populations on barrier reef islands. Limited agricultural concerns. Restricted range in Australia. Some records herein may be domestic birds.

Pacific black duck – Mallard hybrid

Pacific black ducks are native to Australia but hybridisation with introduced Mallards is a problem. Collectively widely distributed species throughout Australia.

Mallard / Northern mallard

Native to Europe, Asia and North America. A feral duck that can breed with Pacific Black Ducks. Minimal agricultural impacts.

Red whiskered bulbul

Introduced to Sydney and Melbourne from southern Asia in 1880's and 1900 respectively. Restricted range in Australia but spreading. Occur in parks, gardens, open spaces, and along creeks.

Indian peafowl (Peacock)

Native to southern Asia. Semi-feral species in some locations in Australia, and found in close proximity to human habitation. Mainly occur in parks and garden areas.

Mute swan

White swan introduced to Australia from Europe and Asia. Restricted range in Australia and only in small numbers.

Cattle egret

Introduced to Australia from Europe, Africa and Asia. Widely distributed throughout all states/territories of Australia. May be valued by farmers for reducing insect pests and ticks.

Ostrich

Native to Africa. Introduced to Australia for ostrich farming industries. Small populations occur in wild in Australia that may have escaped or been released from farms. Some small groups seen in the wild in Australia in recent years.

Red jungle fowl

Hybridised member of the pheasant family. Domesticated in Asia and commonly kept for meat and eggs. Some records herein may be domestic birds.

Canada goose

Introduced species. Major pest in New Zealand. Known populations in Australia have largely been controlled. Some records herein may be of controlled populations.

Indian ring-necked parakeet

Introduced to Australia from Africa and Asia. Commonly kept aviary bird with potential to establish wild populations. Small isolated birds known to occur in wild. High potential to establish in the wild and cause agricultural and environmental damage.

Common pheasant

Introduced species native to Asia. Common hunting bird in other parts of the world. Small number of records of wild populations in Australia.

Nutmeg mannikin

Also known as Spice Finch. Native to SE Asia. Introduced to Australia and now mainly found from north Queensland to coastal NSW. Known to be expanding its range in Australia and displaces native birds.

Eurasian collared dove

A known invasive species. Reported to occur in some areas of Australia. This study did not reveal any data for this species in Australia.

Wild turkey

Native to North America. Reported to occur in some areas of eastern Australia.

Weka (Woodhen)

Native to New Zealand. Reported to occur in some areas of Australia. This study did not reveal any data for this species in Australia.

3. METHODOLOGY

3.1 Description of the project methodology

This project aimed to collect, collate, centralise and report up-to-date information on the extent and abundance of introduced pest birds across all jurisdictions of Australia by:

1. Implementing nationally endorsed monitoring protocols (at a finer-scale) for priority pest bird species throughout Australia
2. Developing improved Australia-wide datasets for priority pest bird species
3. Centralising data for introduced pest bird species from available information, and producing consistent mapping and data products
4. Delivering information products to relevant land management groups.

To address these aims, this project involved 5 key activities:

Activity 1 **Engagement and consultation** – This stage involved an initial out-of-session paper to VPC for endorsement of the project approach, followed by subsequent discussion with VPC representatives regarding species and methods. A scoping task was also undertaken to review current information databases and datasets, across state/territory governments, and independent ornithological organisations. This involved discussion with each state/territory lead agency regarding available spatial databases and Atlas systems containing introduced pest bird records with the goal of centralising core attribute data from those disparate datasets into a central location for this project.

Activity 2 **Data collection, collation and aggregation** – Each state and territory lead agency for pest management was consulted regarding available data on pest birds and how that data is managed. All available data was collected and collated from databases and Atlas systems and centralised in a single ESRI GIS database of records. Data access licenses were signed with some groups as needed for access of data. As data on pest birds is managed by many groups, information was sought from a wide range of sources. A full list is provided in the Results section. Data was also sought from Australia-wide sources.

Regional meetings proposed for this stage of the project were deemed unnecessary as the best available datasets were identified under the administrative management of state/territory governments and Australia-wide organisations (namely Birds Australia). Discussions with Birds Australia were undertaken regarding current practices of reporting of data to Birds Australia from relevant state/territory and regional groups. This was used to determine the sources of data within Birds Australia databases and additional sources of data for this project.

Activity 3 **Reporting of available datasets at fine scale** – Whilst a previously agreed reporting scale of 0.5 degree was implemented nationally for pest animals (see West, 2008), reporting outputs at that scale were not of great value for many end-users of pest data. As a result, recommendations for reporting at a finer scale were promoted. This project adopted a finer reporting data of 1/8th degree (equivalent to approximately 12.5km x 12.5km grid array) – as described in the next section.

Point and polygon data from available databases systems were projected across the array and all corresponding reporting units classified according to the occurrence of data records for each species.

A single dataset containing all introduced pest bird occurrence reports was prepared, and individual datasets for each species was also produced.

Activity 4 **Development of datasets and information for national, state/territory and region NRM groups** – Data for each pest bird species was prepared at 3 scales as follows:

- National dataset – 1 dataset containing all pest bird records
- State/Territory datasets – 7 datasets were prepared containing all pest bird occurrence records
- NRM regional datasets – 56 datasets were prepared containing all pest bird occurrence records for dissemination to NRM regional groups via the Invasive Animals CRC NRM engagement officer.

Activity 5 **Preparation of pest bird maps at national, state/territory and regional scales** – Information products (data and maps) are readily available for supply to relevant agencies, land managers, community-groups and regional NRM bodies. The following mapping outputs are being distributed to relevant NRM bodies and pest management agencies:

- National maps of the occurrence of each pest bird species, and a cumulative tally of pest birds known to be present in each reporting unit.
- State/Territory maps – 7 sets of maps containing all pest bird occurrence records
- NRM regional maps – 56 sets of species maps reporting pest bird occurrence records for dissemination to NRM regional groups via the Invasive Animals.

3.2 Reporting procedures for introduced pest bird datasets

The national pest animal extent and abundance reporting protocol (previously endorsed by the Vertebrate Pests Committee and Australian Government) for regional, state/territory and national assessments recommended the collection,

collation and reporting of existing data and information, in combination with capturing local knowledge from field-based staff and expert authorities (NLWRA 2007). The protocol recommended a data-driven method for classification of land units according to:

- Pest occurrence – Where are they?
- Pest distribution – What is their spatial pattern in a given area?
- Pest abundance – How many are there in a given area?
- Trend in pest abundance - How are numbers changing?
- Pest data quality – How reliable is underpinning information?

The agreed reporting scale for that method was 0.5 degree (equivalent to approximately 50km x 50km) producing a seamless national data layer grid across the 1: 100 000 map sheet series for Australia and its coastal islands. This project reviewed this method for application to pest birds and included recommendations of a monitoring and reporting workshop held in September 2009 (West, 2010)

Concurrent work from the Joint AWC/VPC National Indicators Working Group is aiming to develop national data standards for future pest animal and weed reporting, and provide clear recommendations for data management at state/territory and national levels. As these standards had not been finalised during the term of this current project, previously endorsed protocols were used as a guide. Recommendations from the above-mentioned workshop were adopted.

Reporting in this project follows the agreed method of reporting against:

- Pest occurrence – confirmed and no confirmed evidence
 - Known occurrence records (data present)
 - No known occurrence records (no recorded data)
- Pest distribution – Total distribution of the species in a given area.

Individual species data provide a measure of the number of records in a given area, and a measure of spatial pattern of data across management jurisdictions.

3.3 Improved reporting scale of pest data

The most relevant recommendation for reporting of known pest species information identified during previous mapping initiatives, and identified at the national workshop was to improve the reporting scale of mapping outputs. Previous initiatives have reported pest data at 0.5 degree scale (matched to the 1:100 000 Australian map-sheet tiles) equivalent to 50km x 50km. This standard has also been adopted for weeds reporting but has subsequently been modified.

This project adopted the recommendation and produced data at the scale of 1/8 degree, equivalent to approximately 12.5km x 12.5km (reported against an array developed on the 1:100 000 Australian map-sheet tiles (see Table 3). The original agreed national reporting scale of 0.5 degree was not considered a suitable reporting scale for introduced birds, and was not expected to accurately reflect variation in a species geographic range and subtleties of data across landscape.

The project team agreed to adopt a finer scale reporting unit consistent with the national reporting format to allow better data to be collected and managed, without reducing the ability of the data to be up-scaled to a nationally agreed seamless 0.5 degree layer if that was ultimately determined as suitable national reporting scale for pest birds.

This refined scale allows for data from this project to be aggregated up to the 1:100 000 scale if that is the future recommendation of the Joint AWC/VPC National Indicators Working Group.

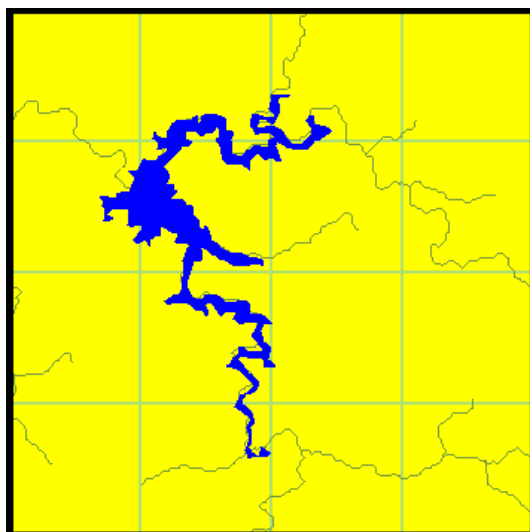
Table 3. Improved scale adopted during this project for reporting data

Data reporting description	Data reporting scale	Original of format
Former scale of data reporting under previous national mapping activities.	1/2 degree (0.5 degree) equivalent to 50km x 50km grid array	Based on Australian map sheet grid
Reporting scale implemented under current project.	1/8th degree (0.125) equivalent to 12.5km x 12.5km grid array	Based on Australian map sheet grid

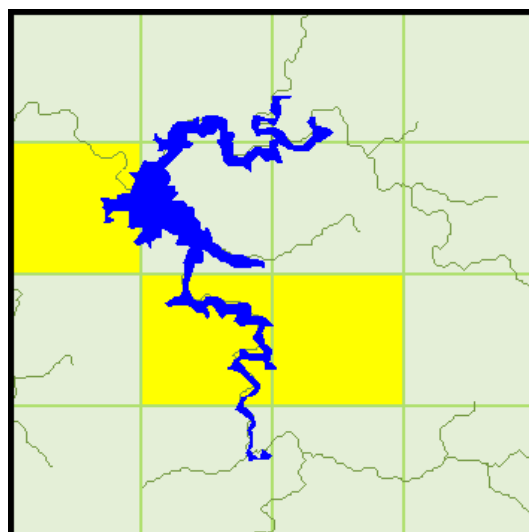
Note: Reporting at the scale of 1/8th degree significantly increases the spatial resolution of reporting outputs and increases their value to end-users. Previously applied methods report 1 value per 50km x 50km, whereas the improved 1/8th degree scale allows reporting of 16 values per 0.5 degree map sheet area. This refined procedure improved reporting scale of data 16 x that previously applied.

3.4 Geographic representation of these reporting scales.

Original 1/2 degree reporting unit



Refined 1/8th degree grid reporting unit



This project has collected, collated and reports data for pest birds in Australia to produce:

- Improved occurrence information (and abundance information where available) and maps for introduced pest birds throughout all NRM regions, states/territories and nationally in a consistent format and reporting scale.
- Centralised national datasets and maps for priority pest bird species to complement other nationally significant pest animal species.
- Improved baseline data for pest birds in a consistent format to improve monitoring and reporting activities at region levels, as well as on-ground activities by community groups/societies and local government.
- An Australia-wide inventory of priority pest birds for all 56 regional NRM groups, state and territory governments, and the Australian Government to accompany datasets developed and reported for terrestrial pest animal species under concurrent programs. Outputs are prepared in consistent format for future integration with other pest animal data for use in national information systems.

3.5 Delivery of information and mapping outputs to end-users

Final project outcomes will be reported to APARP, the Caring for our Country initiative, Australian Government (DAFF and SEWPaC), states and territories government agencies, and relevant NRM regional groups. National information will be made available via the Feral.org.au information portal and PESTMAPS website (located at www.feral.org.au).

National information will be made available via relevant web-portals (such as Australian Natural Resources Data Library, respective state/territory government portals, and for national initiatives such as the Atlas of Living Australia (under the National Collaborative Research Infrastructure Program) and associated web-sites.

The national inventory of pest birds known to occur in each NRM region will be supplied to each NRM regional body to accompany mapping outputs produced as part of this project.

4. RESULTS

4.1 Collation of data on pest birds

A total of 12 introduced pest bird species and 20 additional introduced bird species were addressed as part of this project (see Figure 1). Data were collated from a total of 9 independent datasets across each state/territory jurisdiction including records from the Birds Australia 'Birddata database' containing data from the Australian Bird and Bat Banding Scheme (see table 4). Some datasets were not obtainable during this project due to resourcing issues of the database administrators and where data were not readily available in digital format.

All data were imported to a GIS project and centralised in a single dataset. Figure 1 reveals the concentration of records for all species addressed in this project in the states of Victoria, New South Wales, Queensland, South Australia and Tasmania, and the ACT. By far the highest concentration of records was identified in Victoria.

This trend reflect a high concentration of data for birds in southern states and may be broadly correlative with habitat suitability and also the length of time many introduced bird species have been in Australia.

Many rural and remote areas lack many records of introduced birds, despite the occurrence of many in rural towns, along roadsides and around agricultural production centres. Some data in remote areas, such as southern NT and northern SA clearly follow known roadways and travelling routes. The original of many bird records in respective databases is from ornithological groups and societies.

4.2 Centralising data from databases containing pest bird records

A total of 94 individual species datasets were imported into GIS for this project. Of the original 32 species targeted for this project, data were retrieved for a total of 30 species. Despite reports of wild populations of Weka and Eurasian Collared Dove, no data were identified from existing databases and Atlas systems for these species. All species occurrence records were centralised within a single GIS dataset. Reporting in this project follows the agreed method of reporting against:

- Pest occurrence – confirmed and no confirmed evidence
 - Known occurrence records (data present)
 - No known occurrence records (no recorded data)
- Pest distribution – Total distribution of the species in a given area.

Individual species information were managed in separate GIS layers to provide a measure of the number of records in a given area, and a measure of spatial pattern of data across management jurisdictions. These data are included in individual species data layers.

4.3 Data imported to the project

As many as 8 datasets were located and imported for some species (such as Common Starlings), and as few as 1 dataset were found for other species (such as Senegal / Laughing Turtle Dove).

The number of records detected per species varied from as few as 1 to as many as 6500. The cumulative species records can be seen in Figure 1.

Of the data gathered and centralised for this project on pest bird species, almost all was in the format of point observations from available databases and Atlas systems . A small proportion of data were located for Indian/common myna and common starlings in polygon format and these related to small geographic areas only. Utilising point and polygon data is of value especially for reporting known occurrence, and relative abundance data.

Figure 1: Introduced pest bird species records gathered from database for this project.

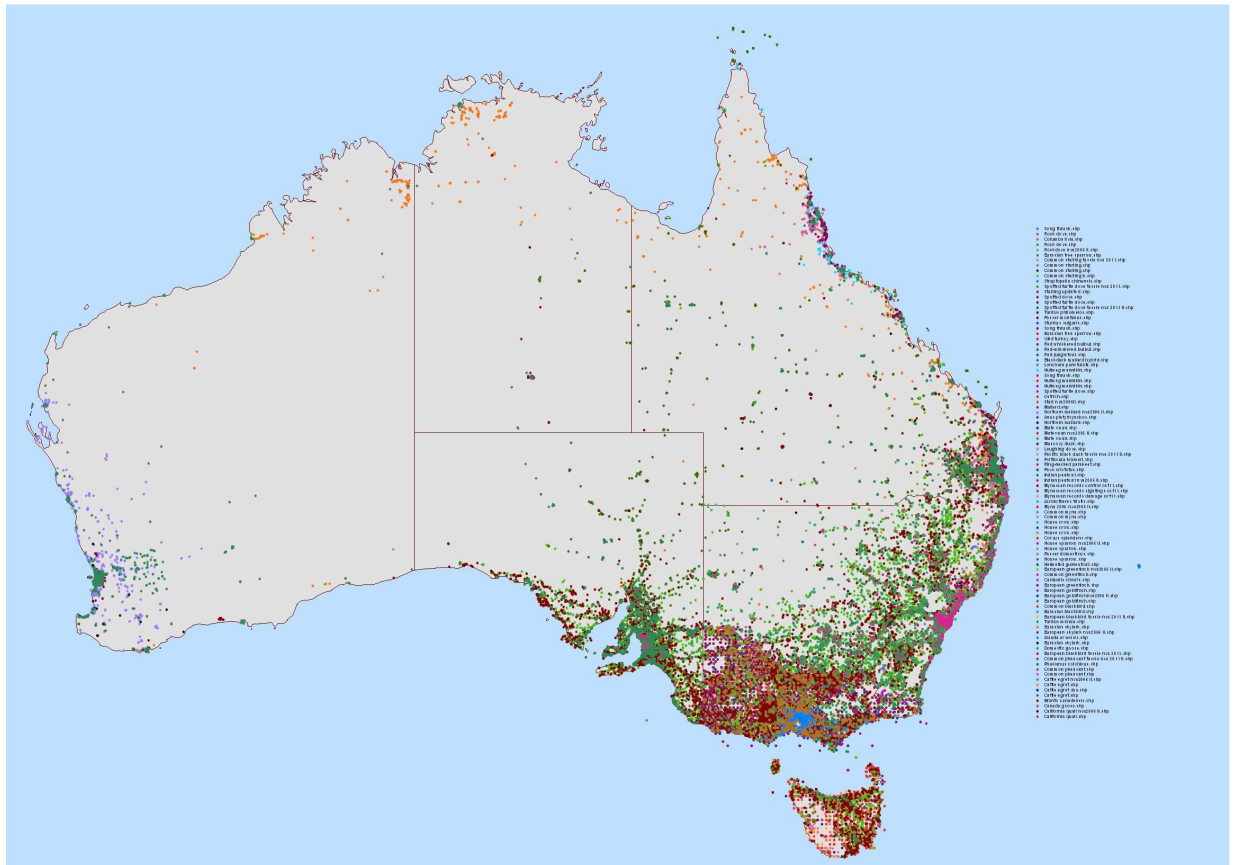


Table 4: Databases identified during project contain pest bird records

	Database accessed for this project
New South Wales	• Office of Environment and Heritage- Atlas of NSW Wildlife – licensed data.
	• NSW Pest Animal Survey 2006-09 outputs from NSW Department of Primary Industries
	• Invasive Animals CRC - Feralscan data outputs at September 2011 for Indian (common) myna sightings.
	• Birds Australia Birdata Atlas records - licensed data
	• Assessment of invasive animals 2006 NLWRA
Tasmania	• Natural Values Atlas 2011 – Department of Primary Industries, Parks, Water and Environment. – NVA data licence.
	• Birds Australia Birdata Atlas records - licensed data.
	• Incidental data compiled by Invasive Animals CRC
	• Invasive Animals CRC - Feralscan data outputs at September 2011 for Indian (common) myna sightings.
	• Assessment of invasive animals 2006 NLWRA
Queensland	• Annual pest distribution survey 2008/09 myna birds
	• Birds Australia Birdata Atlas records - licensed data.
	• Incidental data compiled by Invasive Animals CRC
	• Invasive Animals CRC - Feralscan data outputs at September 2011 for Indian (common) myna sightings.
	• Assessment of invasive animals 2006 NLWRA
Victoria	• Victorian Biodiversity Atlas (VBA) Atlas of Wildlife 25 and 100. Department of Sustainability and Environment (DSE) licensed data.
	• Birds Australia Birdata Atlas records - licensed data.
	• Incidental data compiled by Invasive Animals CRC
	• Invasive Animals CRC - Feralscan data outputs at September 2011 for Indian (common) myna sightings.
	• Assessment of invasive animals 2006 NLWRA
Northern Territory	• Birds Australia Birdata Atlas records - licensed data.
	• Assessment of invasive animals 2006 NLWRA
Western Australia	• Birds Australia Birdata Atlas records - licensed data.
	• WA museum ornithology data – no data extracted due to limitations of Western Australia Museum.
	• Assessment of invasive animals 2006 NLWRA
South Australia	• Birds Australia Birdata Atlas records - licensed data.
	• Assessment of invasive animals 2006 NLWRA
Australian Capital Territory	• NSW Pest Animal Survey 2006 and 2009 outputs from NSW Department of Primary Industries
	• Birds Australia Birdata Atlas records - licensed data.
	• Canberra Ornithological Group (COG)
	• Invasive Animals CRC - Feralscan data outputs at September 2011 for Indian (common) myna sightings.
	• Canberra Indian Myna Action Group data records
	• Assessment of invasive animals 2006 NLWRA

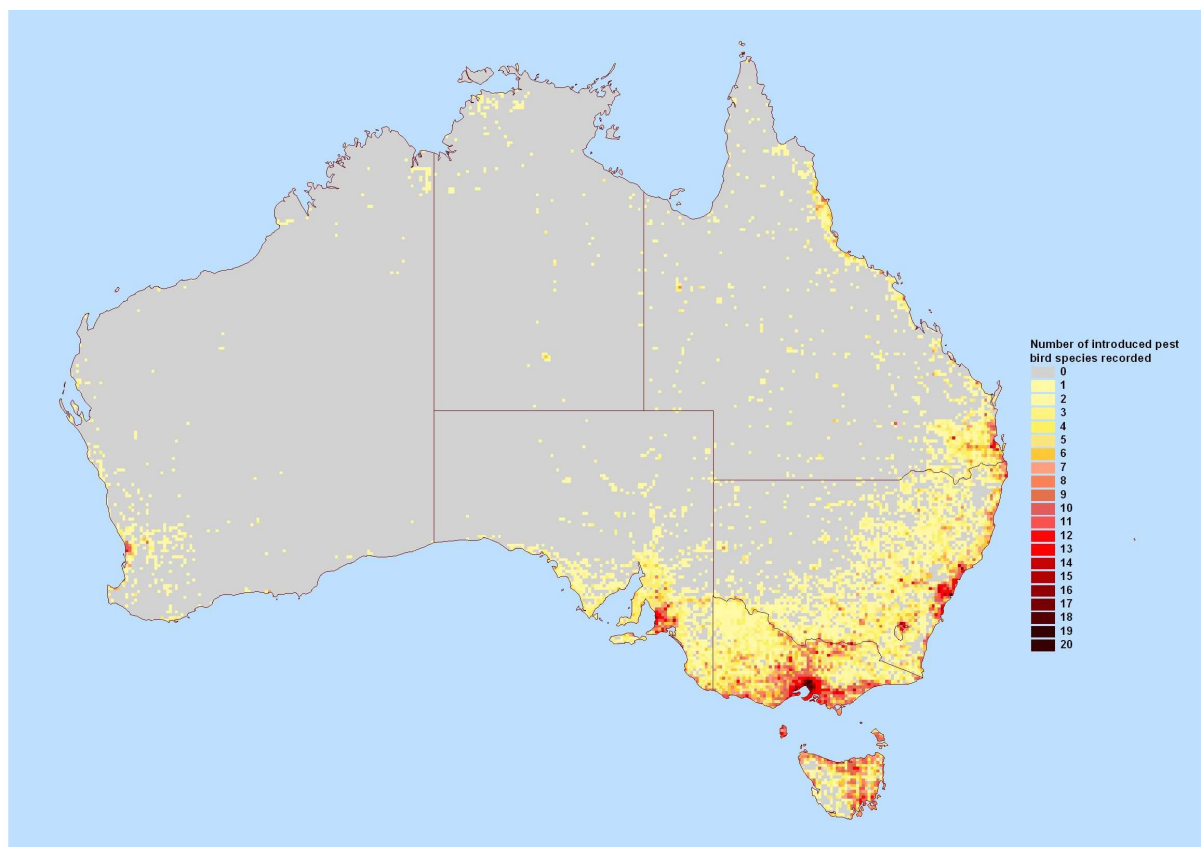
4.4 Number of introduced pest bird species recorded

A total of 30 species were found to have been recorded within the various databases identified in this project. These data were centralised and displayed in figure 1. When a sum of all species known to occur in a reporting unit (1/8th degree – equivalent to 12.5km x 12.5km) was examined, it was determined that there was high variation in the number of species reported to occur across the range that introduced bird inhabit in Australia. In other words, some areas contain substantially high number of species than other areas. A maximum of 20 species were reporting in any given area. Figure 2 contains an overview of the number of introduced pest bird species in each reporting unit across Australia.

Other trends identified from the data include:

- Large areas of central and rangelands district contain between 1 and 5 introduced bird species
- Many areas across food production zones in Victorian, NSW and southern Queensland contain between 6 and 14 species
- Many areas of Tasmania contained between 6 and 12 introduced bird species.
- Some areas around the metropolitan areas of Melbourne, Adelaide and Sydney contained between 14 and 20 introduced bird species.
- Many remote and isolated areas seem to contain isolated populations of introduced birds.

Figure 2: Number of pest bird species recorded in each reporting unit



4.5 Occurrence of pest animals in each state/territory jurisdiction

Data compiled in this project provides the opportunity to examine data across the States/Territories of Australia. This project presents data consolidated from known databases and known occurrence record in all state and territory jurisdictions. Table 5 shows a breakdown of species occurrences in each state/territory jurisdiction.

Of the 30 species assessed in this project, a maximum of 27 species were reported to occur in NSW, followed by 25 in Victoria (table 5). The least number of species reported to occur in a state/territory was 10 in the Northern Territory.

Table 5 also shows the number of species detected per state/territory region. Seven species were recorded to occur in all state and territory jurisdictions, namely common starlings, house sparrows, European blackbird, rock dove/feral pigeon, spotted turtle dove, Muscovy duck, and hybrid of pacific black duck and introduced mallard.

These data are also presented spatially in figures 3 – 8. The largest number of data records gathered through this project were reported within Victoria and New South Wales – see figures 3 and 4. In these states, a high number of records occur in rural and agricultural zones and around built-up urban and metropolitan areas (figures 3 and 4). Similarly in South Australia and Tasmania, pest bird records were concentrated throughout the agricultural production areas and around urban developed landscapes (see figures 5 and 6). In Queensland data were concentrated in the south-east and along coastal margins in the north (figure 7). In Western Australia, data were concentrated in the south-west (figure 8). The least number of records and species were reported in the Northern territory (see figure 9). Remotes areas in all states/territories contained the least data, but this may have been a by-product of limited survey effort.

Table 5: Data identified for introduced pest bird species in each State/Territory

State / Territory	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	
New South Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	27
Victoria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25
Queensland	✓	✓	✓	✓	✓	✓	✓			✓				✓		✓	✓	✓	✓	✓			✓		✓		✓	✓	✓				19
South Australia	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓			✓		20
Western Australia		✓	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓			✓	✓				✓	✓					16
Tasmania	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓				✓	✓		✓	✓	✓					✓			✓		18
Northern Territory		✓	✓	✓	✓	✓								✓		✓	✓	✓					✓										10
Australian Capital Territory	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓		✓	✓	✓	✓				✓		✓		✓						18
Number of jurisdictions	6	8	8	8	8	8	7	5	5	3	3	4	2	8	3	7	7	8	7	3	3	3	7	1	4	2	6	6	3	0	2	0	

Figure 7: Number of introduced bird species recorded in Queensland

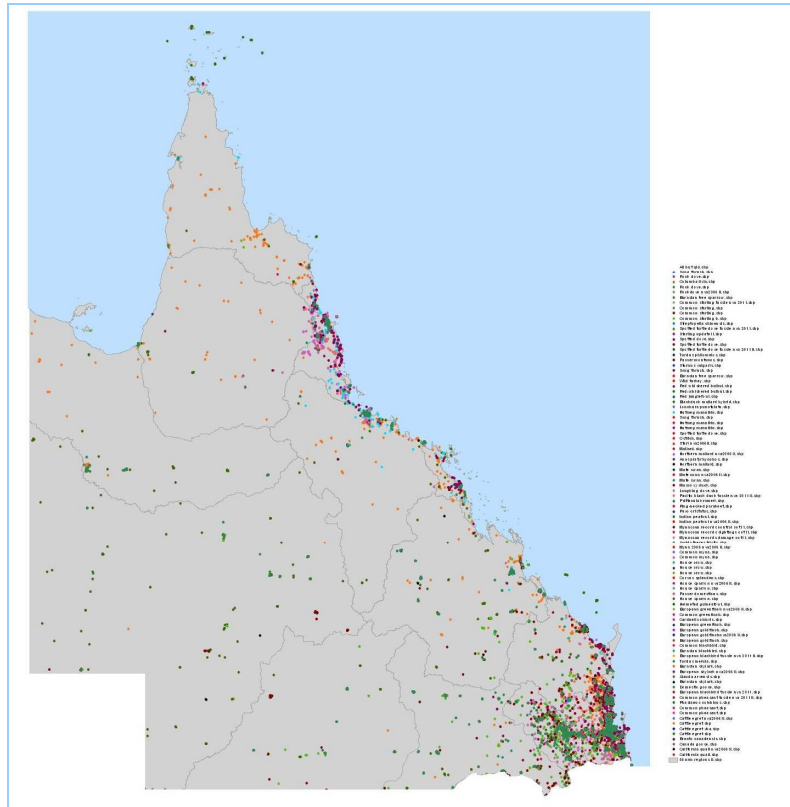


Figure 8: Number of pest bird species recorded in Western Australia

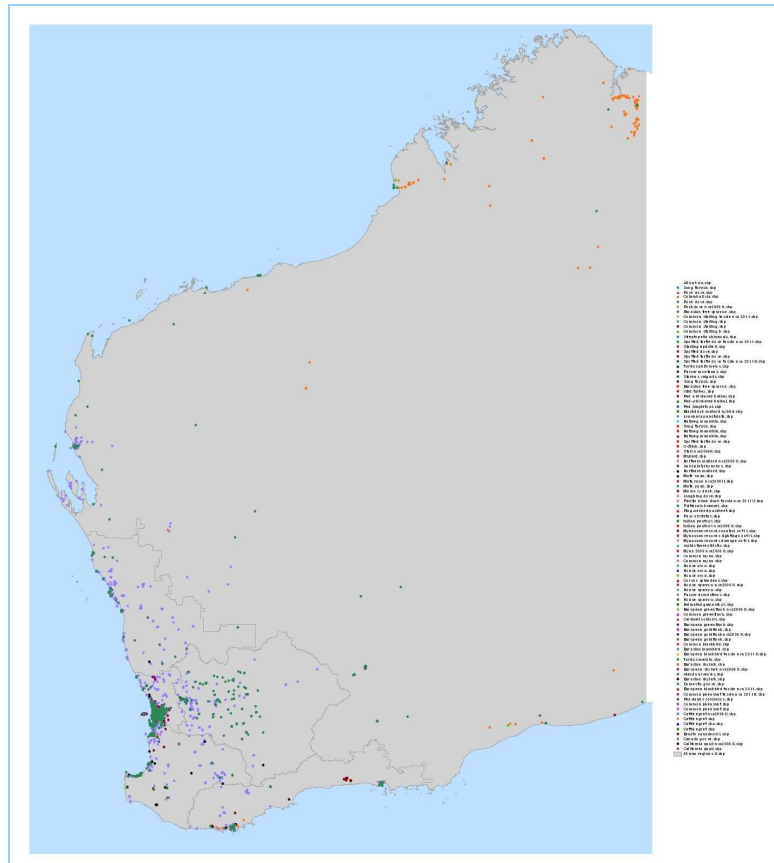


Table 6: NRM DATA INVENTORY - Data identified for introduced pest bird species in each NRM region.

Note: Occurrence data represents the presence of one or more observations of the species in each region, or data reported in polygon format.

State / Territory	NRM region / catchment	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sparrow	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species	
NSW	Border Rivers-Gwydir	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	11	
NSW	Central West	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗	✓	✗	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	16
NSW	Hawkesbury-Nepean	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✗	✓	✓	✗	✗	✗	21	
NSW	Hunter-Central Rivers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✗	✓	✓	✗	✗	✗	24	
NSW	Lachlan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	17	
NSW	Lower Murray Darling	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	14	
NSW	Murray	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	16	

State / Territory		NRM region / catchment																																	
		Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sparrow	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species	
NSW	Murrumbidgee	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	17
NSW	Namoi	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	11	
NSW	Northern Rivers	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	19
NSW	Southern Rivers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗	✓	✓	✓	✓	✓	✗	✗	✗	22
NSW	Sydney Metro	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✗	✗	✓	✓	✗	✗	✗	21	
NSW	Western	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✗	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	9	
VIC	Corangamite	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	18	
VIC	East Gippsland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	14	
VIC	Glenelg Hopkins	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	16	

State / Territory	NRM region / catchment	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sparrow	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species	
VIC	Goulburn Broken	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✗	✓	✓	✗	✓	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	18	
VIC	Mallee	✗	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	12
VIC	North Central	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	16
VIC	North East (VIC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	15
VIC	Port Phillip and Westernport	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	25
VIC	West Gippsland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	18
VIC	Wimmera	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	15
QLD	Burdekin	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	10
QLD	Burnett Mary	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	14

State / Territory	NRM region / catchment	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sparrow	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species	
QLD	Cape York	✓	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	7	
QLD	Condamine	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	14
QLD	Desert Channels	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	7
QLD	Fitzroy	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	13
QLD	Mackay	✓	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✗	✗	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	11
QLD	Whitsunday	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	16
QLD	South East QLD	✗	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	8
QLD	South West QLD	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	10
QLD	Southern Gulf	✓	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	7	
QLD	Torres Strait	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	14
QLD	Wet Tropics	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓	✗	✗	✓	✗	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗	14

State / Territory	NRM region / catchment	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sparrow	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species
QLD	Border Rivers Mar-Balonne	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	12
QLD	Northern Gulf	✓	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	10
SA	Alinytjara Wilurara	✗	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	3
SA	Eyre Peninsula	✗	✓	✓	✗	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	11
SA	Kangaroo Isl.	✗	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	11
SA	Adelaide & Mount Lofty	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	16
SA	Northern and Yorke	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✗	✗	✓	✗	✗	✗	✗	✗	16
SA	SA Arid Lands	✗	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	10
SA	SA Murray Darling Basin	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	16

State / Territory	NRM region / catchment	Indian / common myna	Common starling / Starling	House sparrow	European blackbird	Rock dove/feral pigeon	Spotted turtle dove / Spotted dove	European goldfinch	European greenfinch	Eurasian skylark	Song thrush	California quail	Tree sparrow or Eurasian tree sp	Indian house crow	Muscovy duck	Senegal/ laughing turtle dove	Domestic goose	Helmeted guinea fowl	Pacific black duck / mallard hybrid	Mallard or northern mallard	Red whiskered bulbul	Indian peafowl or peacock	Mute Swan	Cattle egret	Ostrich	Red jungle fowl	Canada goose	Indian ringneck parakeet	Common pheasant	Nutmeg mannikin	Eurasian collared dove	Wild turkey	Weka	Number of species	
SA	South East (SA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	15
WA	Avon	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	9
WA	Northern Agricultural	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	7
WA	Rangelands	✗	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	6
WA	South Coast	✗	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	9
WA	South West	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	11
WA	Swan	✗	✗	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	15
TAS	North (TAS)	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✓	✓	✗	✓	✓	✓	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗	17
TAS	North West	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✓	✗	✓	✗	✓	✓	✗	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	18
TAS	South (TAS)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✓	✓	✗	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	17
NT	NT	✗	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	10
ACT	ACT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✗	18

4.7 Outputs at national, state/territory and regional scales

This project has produced a centralised dataset for introduced pest birds in Australia from known sources and information systems under administrative control of many independent groups. The data have been centralised for the purposes of single reporting process and examination of data across all state/territory management areas. We have chosen to produce a series of informative introduced pest bird maps based on occurrence records developed as part of this project that will be uploaded to specialised pest animal websites including www.feral.org.au and web portals, data libraries and websites.

This project produces outputs at national, state/territory and regional/local scales as follows:

- Reporting of a single national database of known occurrence records from existing information systems and databases. [*Data is classified for 'known occurrence records' and 'no known occurrence records', allowing future re-classification under agreed data standards and protocols currently being independently developed by the joint AWC/VPC National Indicators Working Group.*]
- Reporting of a series of national introduced pest bird maps reporting occurrence records at 1/8 degree reporting units.
- State/territory reporting of a database of known occurrence records from existing information systems and databases.
- Reporting of a series of state/territory maps reporting occurrence records at 1/8 degree reporting units, combining information from many sources for comparison with existing state/administered datasets.
- Table of species with known occurrence records in each state/territory.
- Regional/local reporting (across all 56 NRM regions) of a database of known occurrence records from existing information systems and databases at the 1/8 scale.
- Reporting of a series of regional and local maps (across all 56 NRM regions) reporting occurrence at 1/8 degree reporting units. This scale may provide little for local groups, but may illustrate the extent of species across the landscape and species outside local areas that groups may use in local surveillance activities.
- Table of species with known occurrence records in each NRM region (for all 56 NRM regions).

5. DISCUSSION OF RESULTS AND IMPLICATIONS

A total of 94 individual species datasets were identified and used in this project to report spatial trends in introduced pest bird species across Australia and its 56 NRM regions. A total of 30 introduced pest species were found within the various databases identified in this project. The most commonly occurring species across Australian NRM regions include species that are known to have significant agricultural and environmental impacts as well as cause damage to social amenity and infrastructure, including feral pigeons, cattle egret, house sparrows, common starlings, mallard/northern mallard and Spotted turtle dove. Other species of concern include Indian myna and European blackbird that currently occupy large areas of Eastern Australia and are spreading in association with human habitation and development. The greatest number of species in any single NRM region was in Port Phillip-Westernport NRM and many NRM regions in NSW. These areas contain significant records for introduced bird species.

The methods of this project involved gathering of introduced bird data from a wide range of sources. As a consequence, significant time was spent reformatting and centralising 94 individual datasets. Where duplicate records were identified, they were removed. However this was not common in this project as many of the data are managed independently by local organisations.

The process of gathering and centralising data from a variety of sources has some implications for data interpretation. During the course of this project we were unable to identify records that represented species where local control may have eradicated a species, for instance Canada Goose in NSW. The method also didn't allow for discrimination between birds recorded in areas where they may or may not have been domesticated, semi-domesticated or wild populations. Therefore, some data within the original source datasets may represent domesticated animals. The Muscovy duck is an example of this. They are commonly kept domestic bird, but are also reported to occur in wild population. To differentiate between these records and overcome this small anomaly, advice could be sought from local authorities for species that this may apply to (such as local government and NRM regional groups) as well as bird watching groups (see appendices) for validation where appropriate. Regardless of these anomalies within the data, the large majority of data examined as part of this project was undertaken to relate to wild populations only. Local validation is also suitable for species under active control, and for species where local control may have resulted in eradication. This is a suitable approach to take for species such as Starlings along the southern coastline of WA, or species in other areas where local eradication actions have taken place.

The outputs of this project include a national inventory of available database and Atlas systems containing introduced pest bird data, as well as a national inventory of introduced pest birds per State/Territory and NRM region. These outputs provide respective management authorities with an up-to-date information layer to support management of introduced bird species, coupled with a seamless dataset across all management zones. Outputs also include geospatial datasets, spreadsheet data,

maps, and tabular information for 30 introduced bird species to Australia at the national, state/territory and regional/local scales. These outputs are considered of value for promoting the development of policies and practices for the prevention, early detection, response to and control of introduced bird populations that pose a threat or impact on agricultural productivity, natural resources, social amenity and cultural assets. Dissemination of outputs to NRM regions via CD-Rom provides information direct to managers of each NRM region and associated groups. The Invasive Animals CRC is working closely with NRM regions to prioritise pest species that occur in each region, and assign suitable management recommendations for each area. The data prepared in this project significantly add to this process with respect to pest birds and their known impacts, as well as promoting detection of introduced birds in remote areas.

5.1 Adopted method of this project

At the time of this project, concurrent work by the Joint AWC/VPC National Indicators Working Group aimed at developing improved reporting procedures for pest animal information nationally. During the course of this project, national data standards and reporting protocols had not been fully developed and agreed to. As a result, this project was reliant on referring to previous reporting guidelines (monitoring and reporting protocols) and recommendations of the National Monitoring and Reporting Workshop (West, 2010). These recommendations included refined data reporting and reporting of species occurrence where information on other population attributes was lacking.

Outputs of this project were considered in discussion with members of a national workshop on monitoring and reporting, NRM regional bodies, Australian Government representatives, and members of the Invasive Animals CRC in light of recommendations listed above, and following the adoption of the former Monitoring and Reporting Protocol under the national assessment of invasive animals by the National Land & Water Resources Audit.

The reporting scale adopted in this project was also discussed with members of the Joint AWC/VPC National Indicators Working Group and participants of the above-mentioned monitoring and reporting workshop.

The reporting scale applied in this project increases the value and usefulness of reporting outputs by 16 times that applied in the former method. Therefore, the refined reporting scale provides benefits with respect to:

- Accurate reporting of the current status of introduced pest birds at national, state/territory and regional/local levels,
- Increased value of available data to guide management decisions at all levels,
- Improved capacity to target areas for pest bird surveillance and control, as well as target areas for data gathering where information may be less-well-developed,
- Improve the value of cross-jurisdictional data for development of policies and practices to prevent further incursions, expansion of established pest birds, response procedures, and control at local scales to reduce introduced bird problems/damage, and

- Increase capacity to use the data in education, communication and awareness raising among local government groups, local community groups/societies, and local pest control groups.

Data produced in this project at a finer scale than previously gathered for pest animals also provides an opportunity to better use available data for comparison with other pest animal information to evaluate invasive species pressure at the landscape scale. Information provided herein can also help to evaluate the effectiveness of management decisions in reducing pest bird damage to agricultural systems, natural resource's, social amenity and human health.

5.2 Use of data, outputs and information at the regional and local scales to promote targeted surveillance, early detection, response and control of new bird species and expansions in established pest birds.

For detection of new incursions, responding to escaped aviary species and local coordination of any necessary control at the local scale, there is presently significant reliance on local community groups and ornithological societies/clubs as they represent the greatest single group on the ground. This means that these groups are responsible for data gathering and may not necessarily be well coordinated across the landscape or management areas.

Providing local community groups and ornithological societies/clubs with a subset of spatial datasets from this project and from existing sources under agreement with data custodians (such as Birds Australia) for non sensitive species (pest birds) will help to promote early detection of species incursions (such as aviary bird liberation) at the local scale by local community groups/clubs/societies. Furthermore, providing a central location for reporting of new species (such as escaped birds) to local authorities upon detection in the wild is important for responding to those incursions or range expansions.

It is our understanding that current procedures for reporting are disjointed and do appear to result in any management alert messages to local authorities to act on reported data. In other words, data reporting to existing database and Atlas systems rarely results in management authorities being aware of those reports. Ideally, data reported from local ornithological groups on introduced bird species (especially those that present a biosecurity risk) should result in a report to local authorities to instigate necessary local control/action. This process does not seem to occur in any systems identified in this project, thereby reducing the ability of authorities to act on data gathered.

5.3 Recommendations from this project

This project has provided insight into the range and scope of existing databases and Atlas-style systems for managing introduced bird data gathered at the local scale. Many outputs from the project can increase the value of data at local/regional, state/territory and national scales.

The project team propose the following recommendations from this project to build on outcomes relating to introduced pest birds data:

- Disseminate outputs and information products from this project to NRM regional groups, as well as local government to raise awareness of pest birds in each respective area, and increase capacity of local authorities to identify and respond to pest birds locally.
- Build on datasets developed as part of this project and known information layers from existing database systems, and further consult regional and local groups (e.g. local ornithological organisations and volunteer groups) to raise awareness of the need to record priority introduced pest birds species. Detection of new incursions (including escaped aviary species) in small numbers may be reliant on dedicated groups such as ornithological groups at the local scale.
- Improve facilities and procedures for reporting of introduced bird data that captures pest bird records from existing databases and large Atlas system information systems (such as Birds Australia). This would provide a means of responding to the detection of pest birds via ornithological and community groups, by relevant pest management authorities. This would have value to early detection, response and control of new incursions and expanding pest bird populations.
- Provide a centralised location or web-portal for reporting of pest bird data from local ornithological groups and community groups, including new species (such as escaped birds) detected in the wild by local community groups/clubs/societies. The system should communicate with local authorities for any necessary control/eradication efforts. For detection of new incursions, responding to escaped aviary species and local coordination of any necessary control at the local scale, there is reliance on local community groups and ornithological societies/clubs as they represent the greatest single group on the ground.
- Further examine data on introduced birds gathered in this project (across classes for likely threat to agricultural production and food security) with known and forecast land use classifications across Australia (via National Land use Mapping datasets). This could be used to identify agricultural production industries at current and future threat from spreading or expanding pest species, such as horticulture and crop production.
- Consider adoption of future National Data Standards for Reporting of Pest Animals – currently under development by the Joint AWC/VPC National Indicators Working Group. This could permit consistent reporting of pest bird data across all management areas in alignment with other pest animal reporting.

6. REFERENCES

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West, P (2008). *Assessing invasive animals in Australia 2008*, National Land & Water Resources Audit and Invasive Animals Cooperative Research Centre, Canberra.

West, P (2010). National workshop for development of improved pest animal monitoring and reporting procedures for Australia-wide application. Final report to the Australian Pest Animal Research Program, Australia Bureau of Agricultural and Resource Economics and Sciences, 2010. Report by the Invasive Animals Cooperative Research Centre, Canberra.

APPENDICIES

Appendix 1: Report on other contributions and intellectual property to the project

Appendix 2: Summary Ornithological groups that could be consulted in future activities and targeted surveillance for introduced pest bird species across the states/territories of Australia

Appendix 3: Collated and centralised point and polygon data for each introduced bird species and reported occurrence against fine-scale seamless national 1/8th degree grid.

Appendix 1: Report of other contributions and intellectual property to the project

This project has involved a large number of state/territory collaborators, staff within the NSW Department of Primary Industries Vertebrate Pest Research Unit, the Invasive Animals CRC, members of the Joint AWC/VPC National Indicators Working Group and community bird groups, including the national Birds Australia office.

Technical support was provided by staff within the NSW Department of Primary Industries Vertebrate Pest Research Unit, and Spatial Information Unit for GIS data management and exporting.

A large number of geospatial data obtained for this project were provided under license agreement with respective state/territory and national bird organisations and remain the property of those respective groups. Subsequent reporting within this project relates to species not considered to constitute sensitive data and can be readily accessed with due acknowledgment of data original and original contributors. This project acknowledges the contributions of all data suppliers.

All project material created or arising during the period of the project will be returned to APARP as appropriate, or retained within the Vertebrate Pest Research Unit and will be available on request if the need arises.

No assets were created or acquired as part of this project.

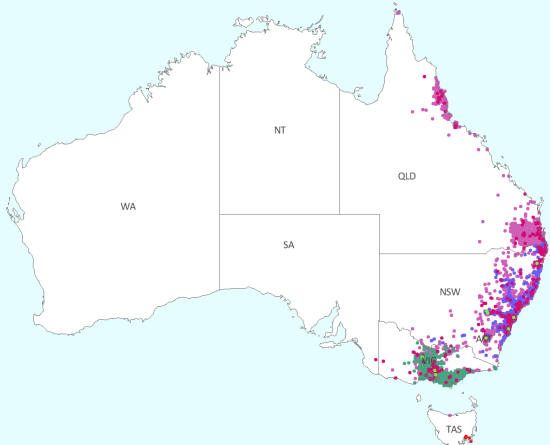
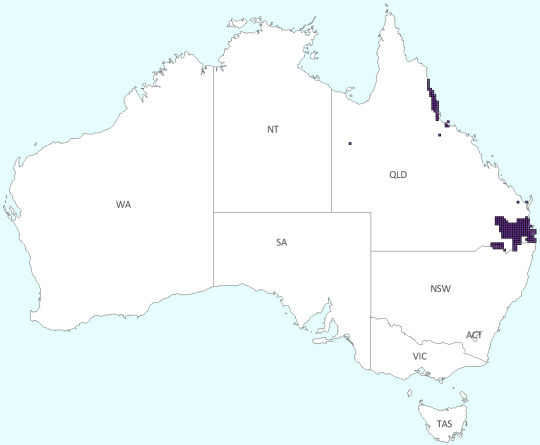
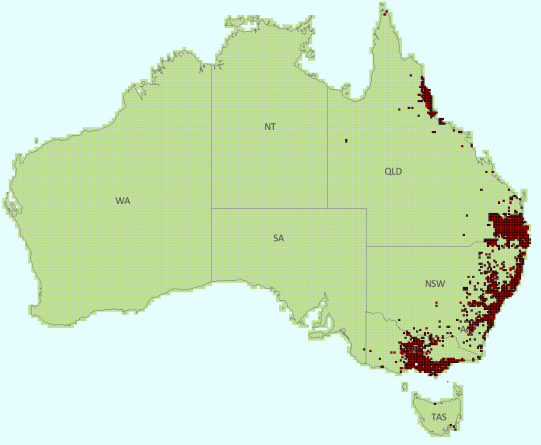
Appendix 2: Ornithological groups that could be consulted in future activities and targeted surveillance for introduced pest bird species across the states/territories of Australia.

STATE/TERRITORY	Ornithological associations
South Australia	South Australian Ornithological Association (SAOA) , also known as Birds SA Adelaide Ornithologists Club The Field Naturalists Society Of South Australia Birding in South Australia Field Naturalists Society of SA Conservation Council of SA, list of member groups
Victoria	The Field Naturalists Club of Victoria Inc (1880 -) Field Naturalists Club of Victoria Field Naturalists Club of Geelong Environment Victoria, Group Members network Victorian Wader Study Group South-east Australian Naturalists' Association Bendigo Field Naturalists Club Inc. Victorian Field Naturalists' Club Mathoura bird observatory(VIC) Rotamah Island Bird Observatory, Victoria Castlemaine Field Naturalists Victorian Ornithological Research Group
Western Australia	West Australian Field Naturalists The Toodyay Naturalists Club Broome Bird Observatory, Western Australia Eyre Bird Observatory, Western Australia
Northern Territory	NT Field Naturalists (Darwin) Alice Springs Field Naturalists Club NT Field Naturalists Club
Queensland	Gympie and Districts Field Naturalists Club Queensland Wildlife Preservation Society, 20 branches through the state. Stanthorpe Field Naturalists Queensland Naturalists' Club Toowoomba Field Naturalists Birdwatching Australia group Queensland Ornithological Society Inc
ACT	FIELD NATURALISTS' ASSOCIATION OF CANBERRA INC. Canberra Ornithologists Group The Canberra Indian Myna Action Group Inc (CIMAG)
New South Wales	Goulburn Field Naturalists Society NSW Field Ornithologists Club Dubbo Field Naturalist & Conservation Society Murrumbidgee Field Naturalists Barren Grounds Bird Observatory, New South Wales Northern Rivers Indian Myna group
Tasmania	Burnie Field Naturalists Club Launceston Field Naturalists Club Tasmanian Field Naturalists Club

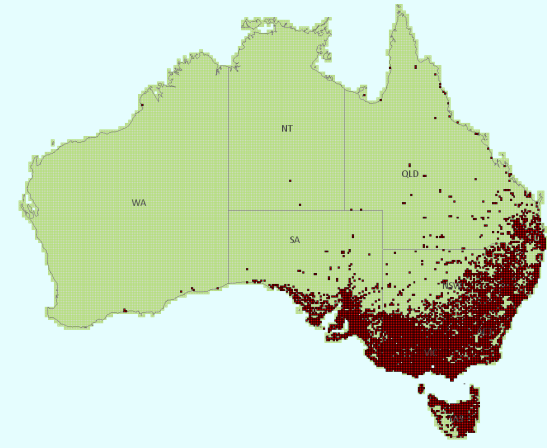
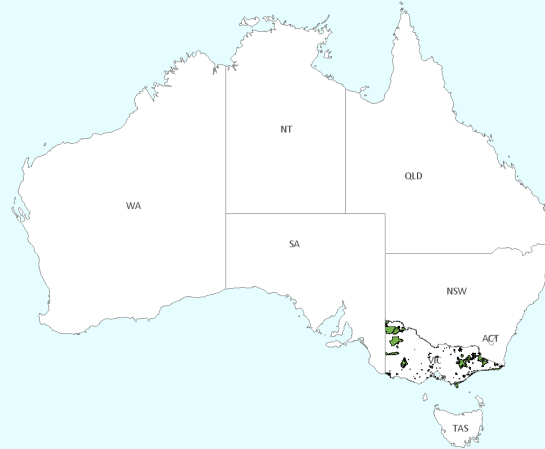
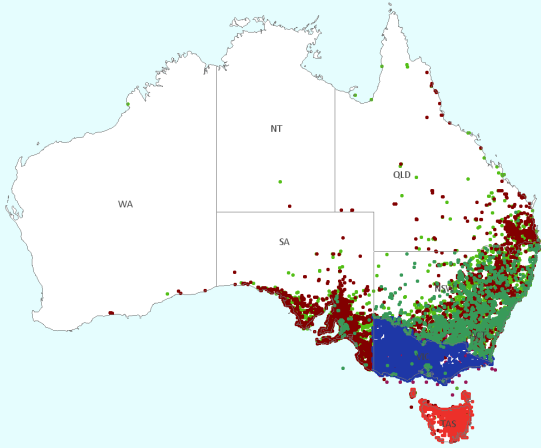
Australia-wide or national.

- Tasmanian Field Naturalists Club Inc (1904 -)
- Tasmanian Field Naturalists' Club
- Bird Observers Club of Australia
- Wildlife Preservation Society of Australia
- Australian Bird Study Association
- Birds Australia Bird Observatories
- Bird Observation and Conservation Australia (BOCA) boca.org.au
- Royal Australasian Ornithologists Union
- Australian Bird and Bat Banding Scheme
- Australasian Raptor Association
- Australasian Wader Studies Group

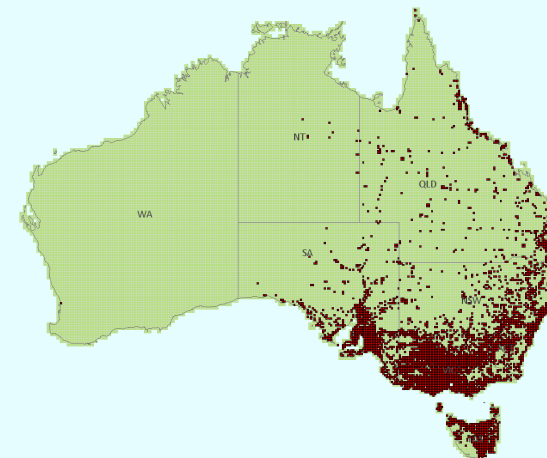
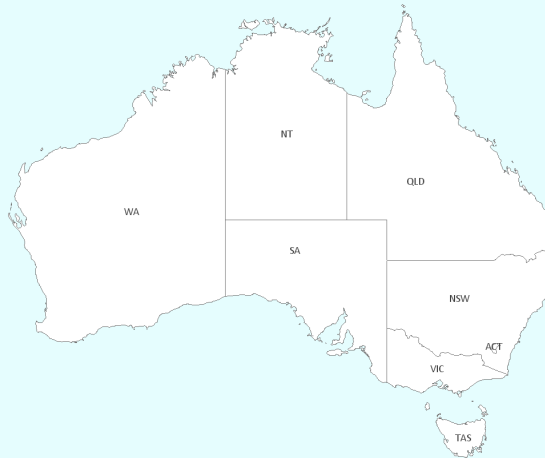
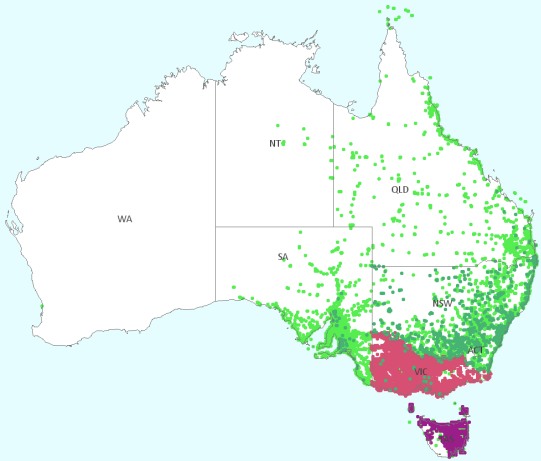
Appendix 3: Collated and centralised point and polygon data for each introduced bird species and reported occurrence against fine-scale seamless national 1/8th degree grid.

<p>Map 1 Collated and centralised occurrence records in point format from all identified database and Atlas systems for introduced bird species in this project.</p>	<p>Map 2 Collated and centralised occurrence data in polygon format from all identified database and Atlas systems for introduced bird species in this project.</p>	<p>Map 3 Reported occurrence of species using a seamless datasets at the scale of 1/8th degree reporting unit.</p>
<p>Indian / common myna</p> 		

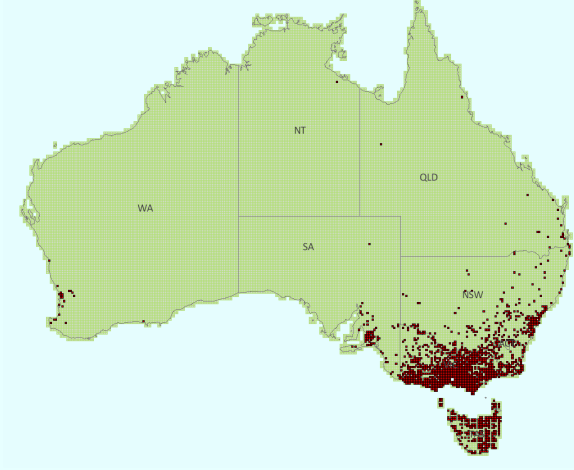
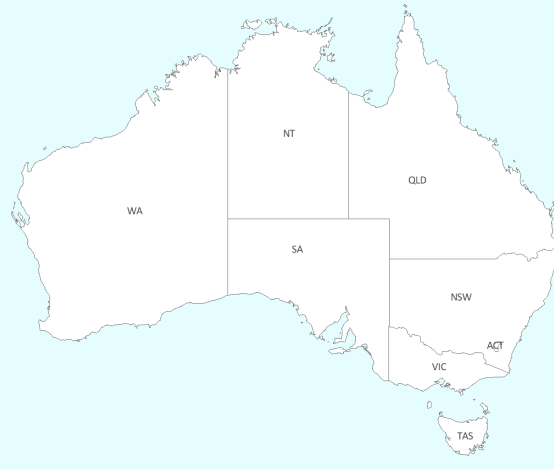
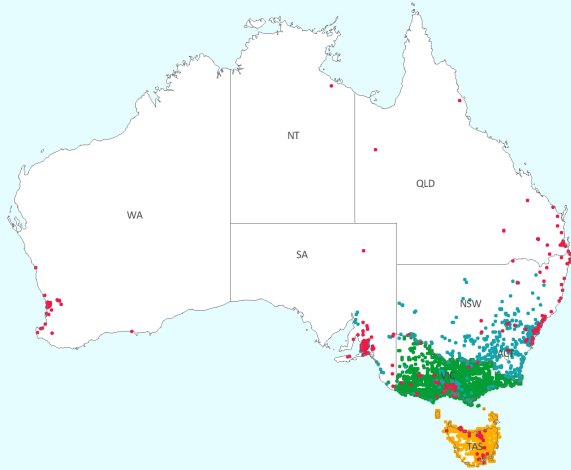
Common starling / Starling



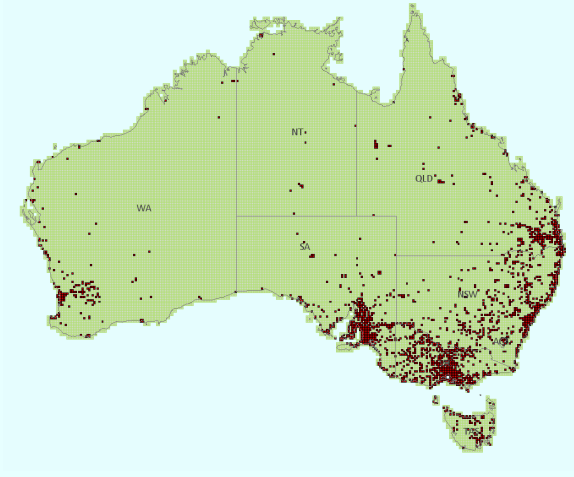
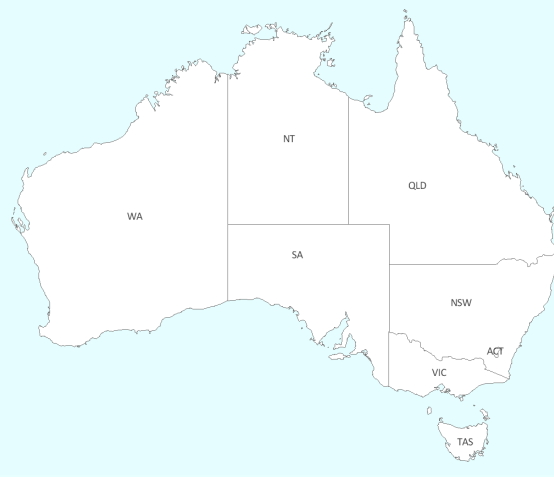
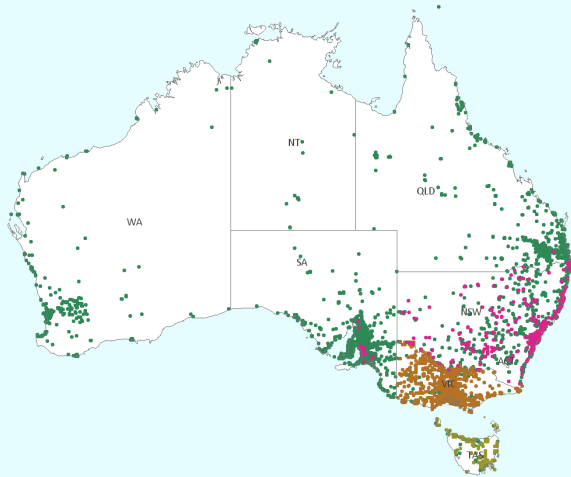
House sparrow



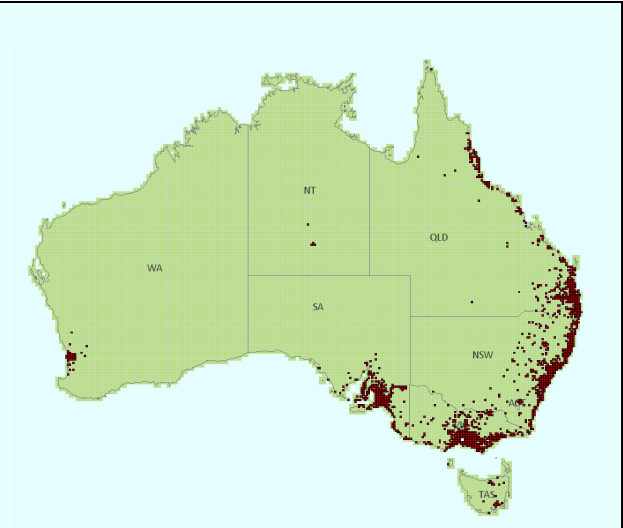
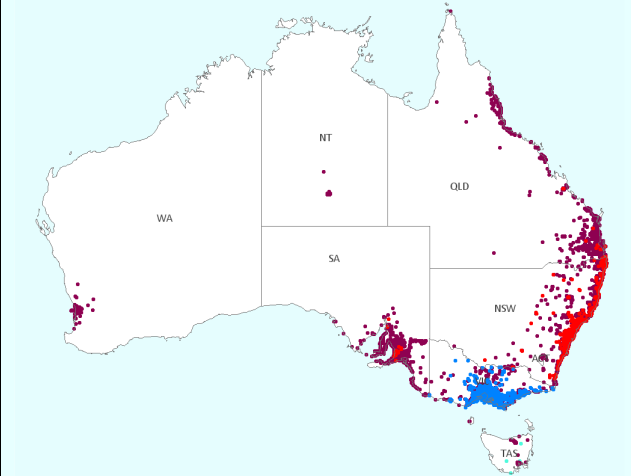
European blackbird



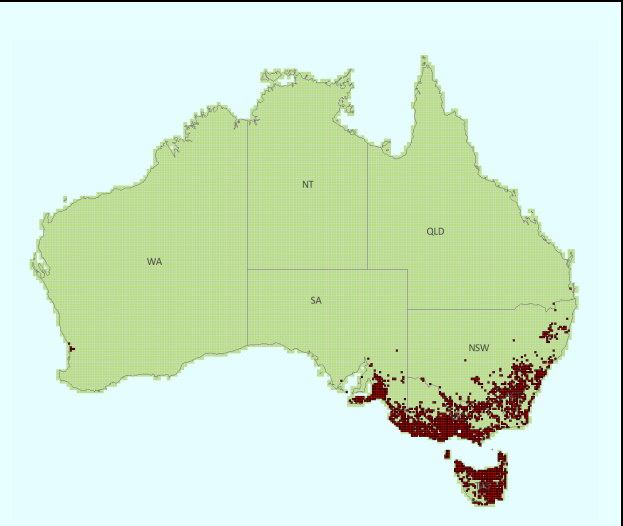
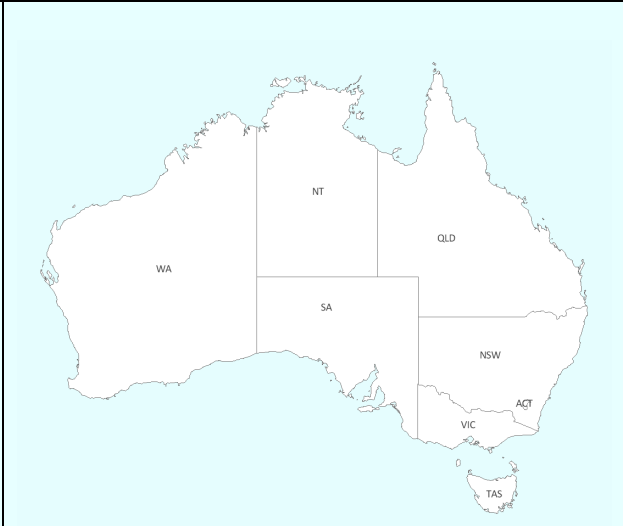
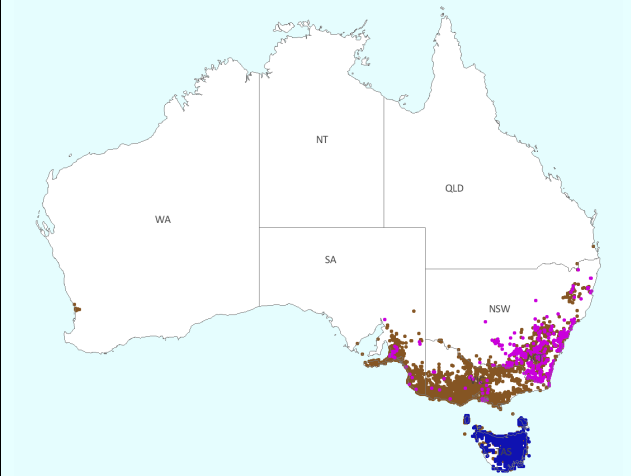
Rock dove/feral pigeon



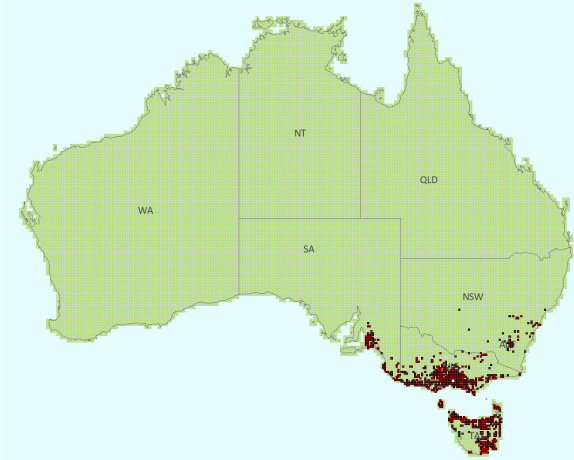
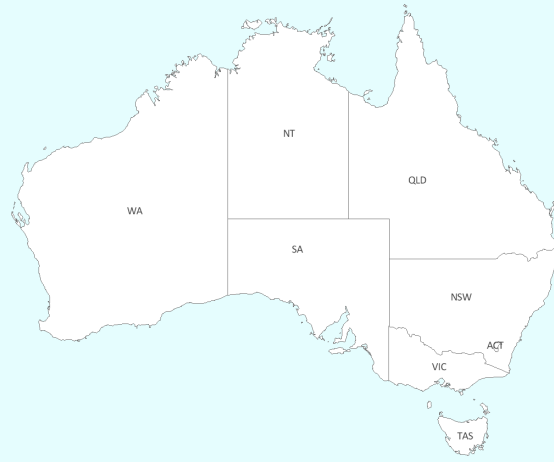
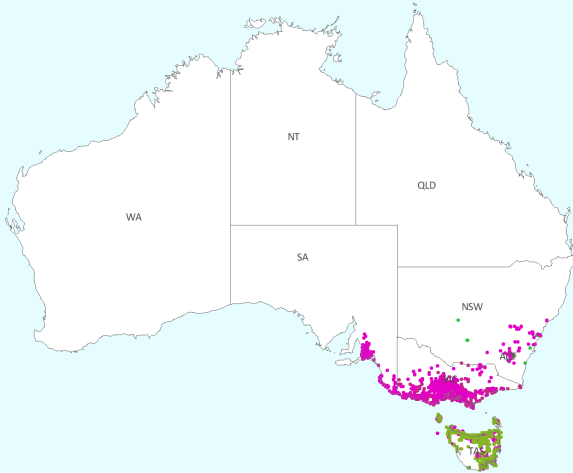
Spotted turtle dove / Spotted dove



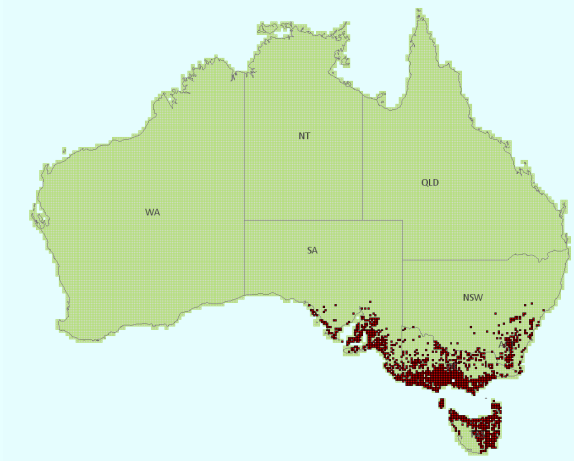
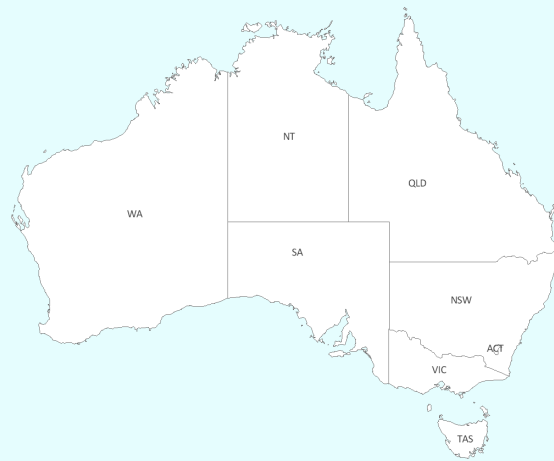
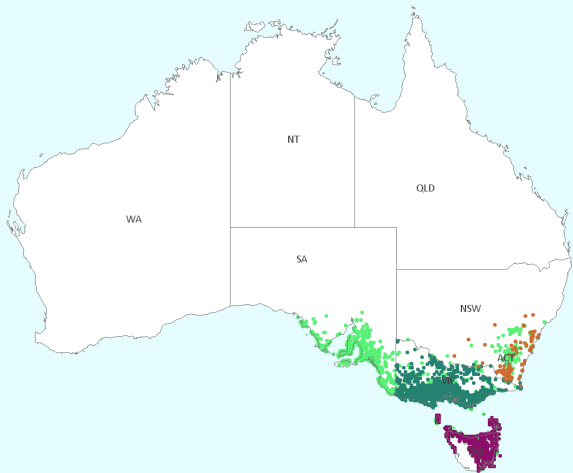
European goldfinch



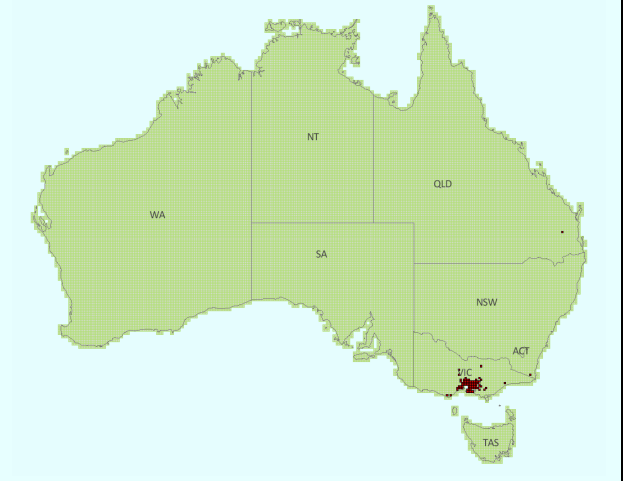
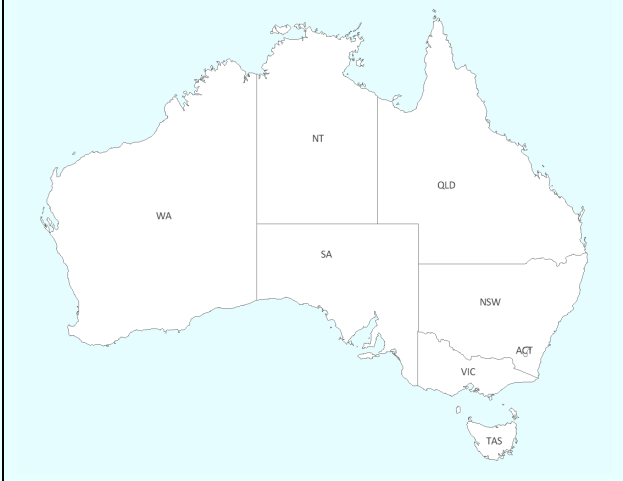
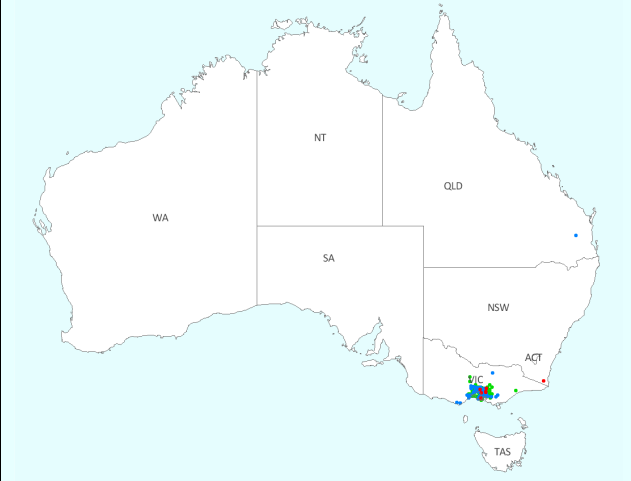
European greenfinch



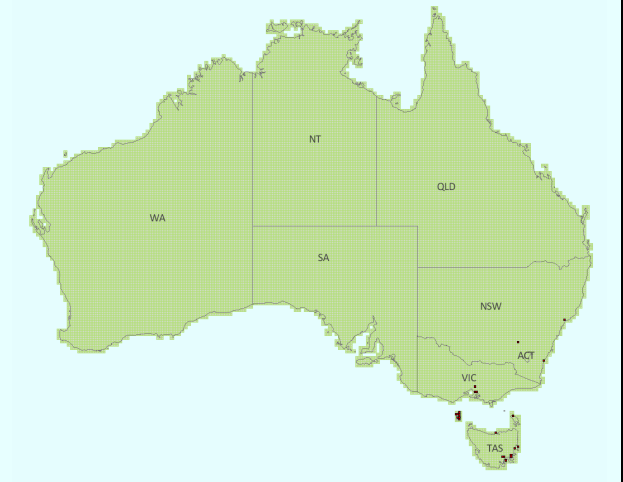
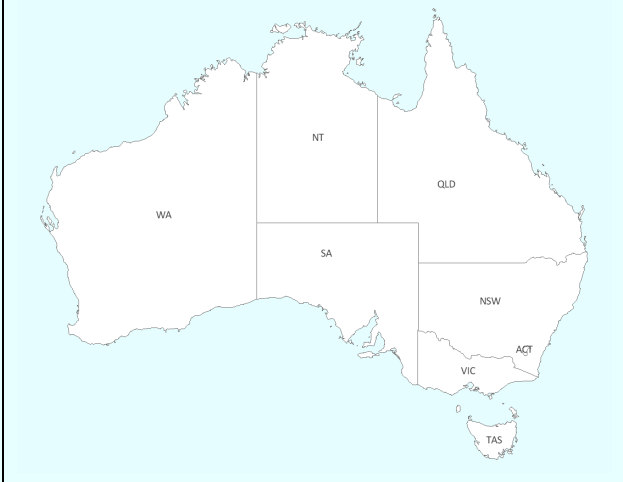
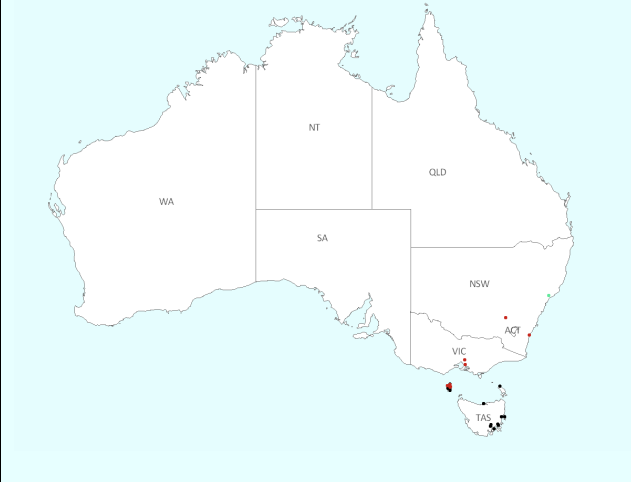
Eurasian skylark



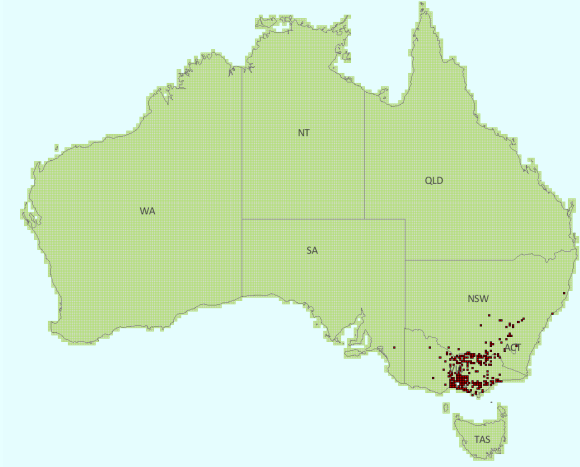
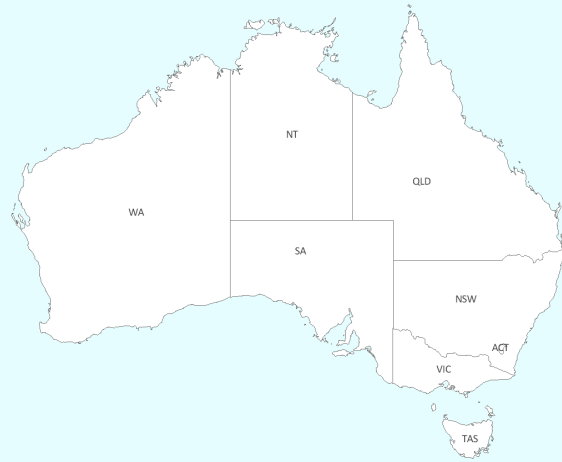
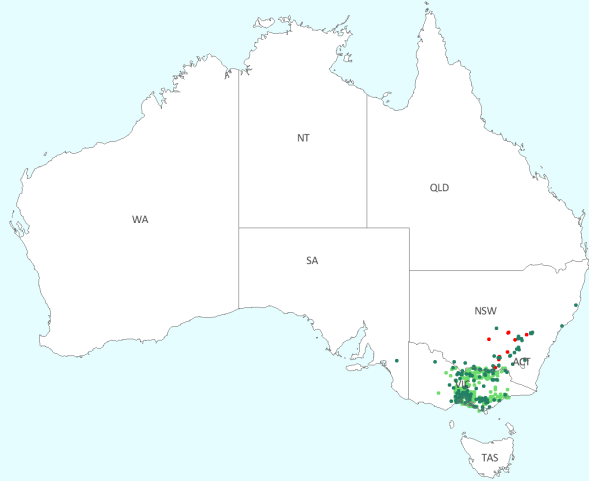
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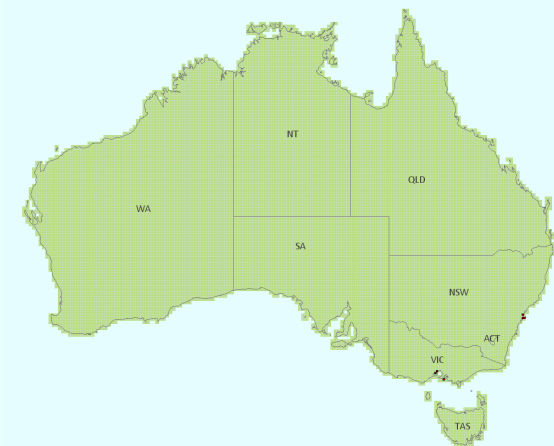
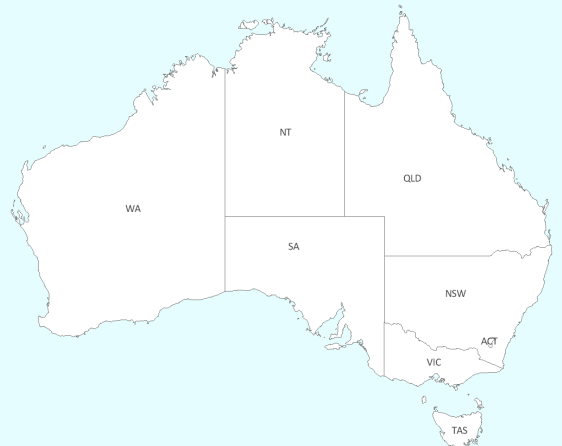
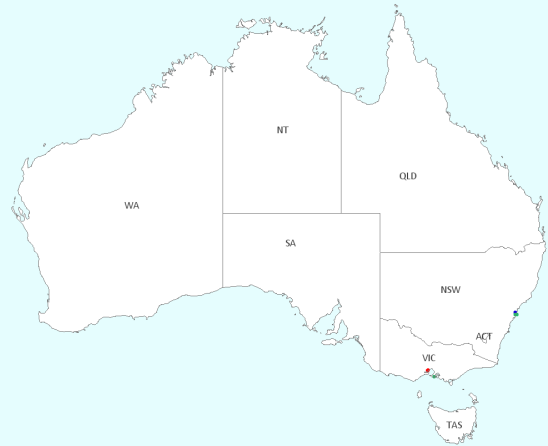
California quail



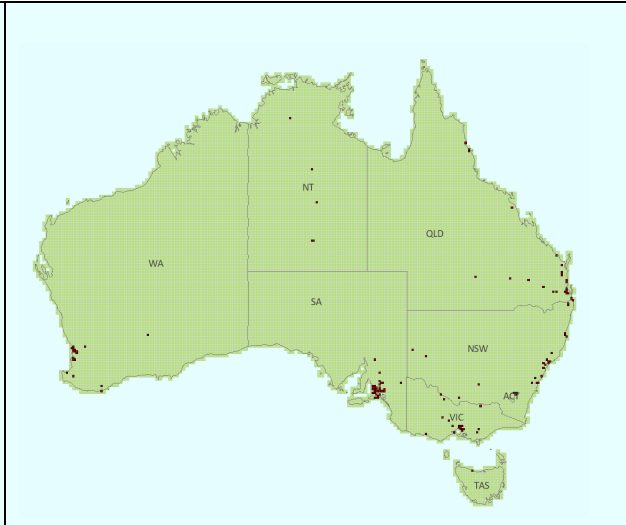
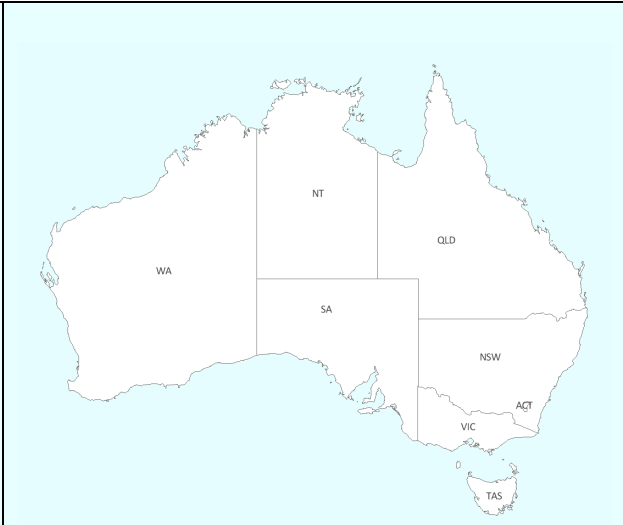
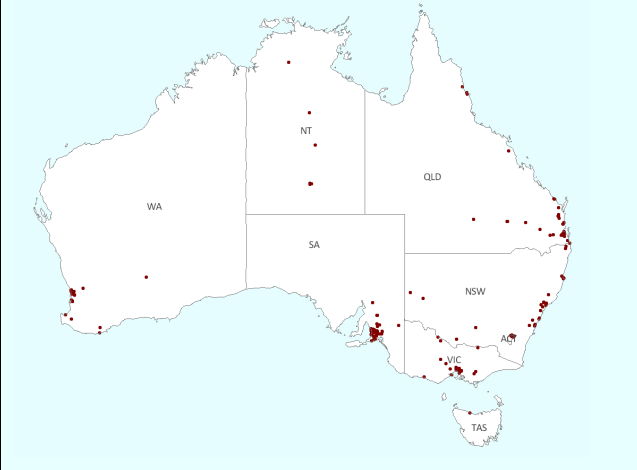
Tree sparrow or Eurasian tree sparrow



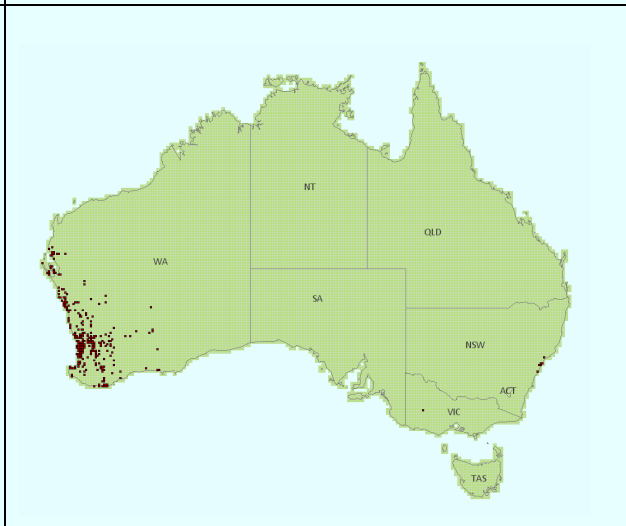
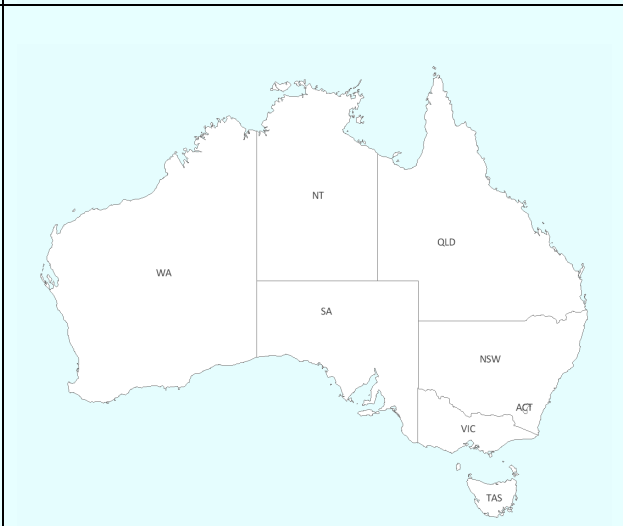
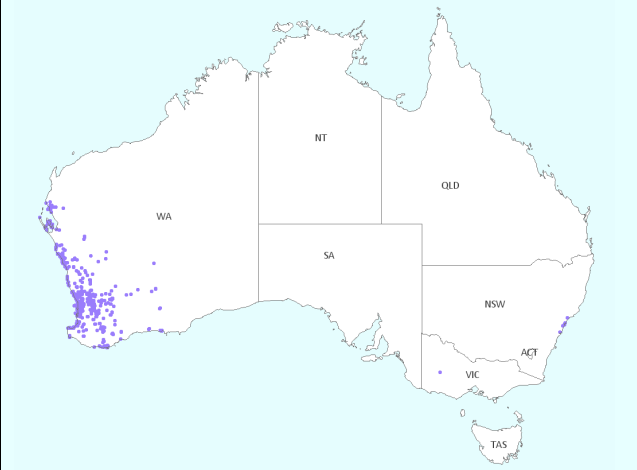
Indian house crow



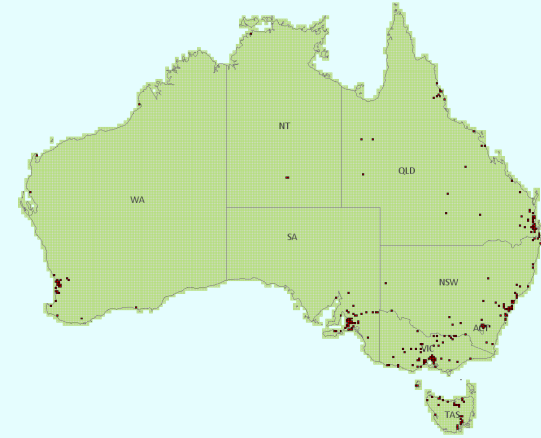
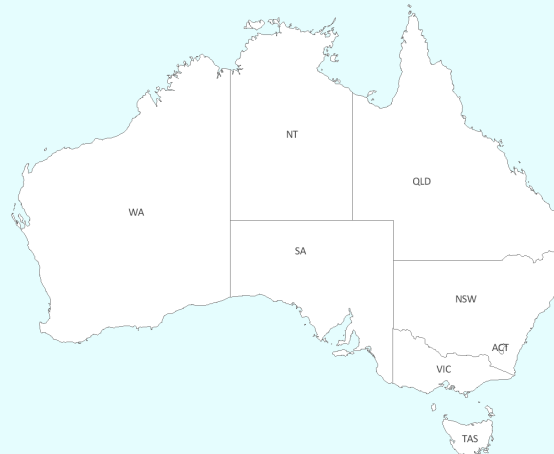
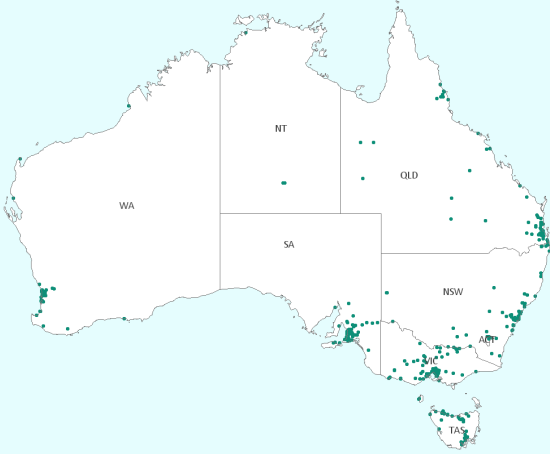
Muscovy duck



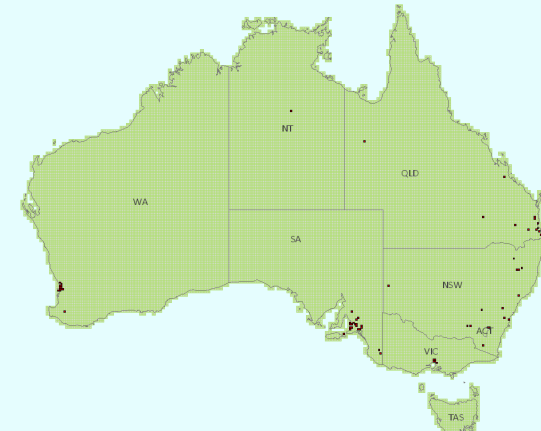
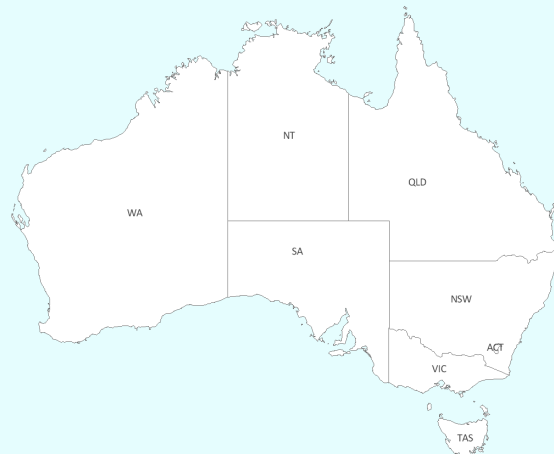
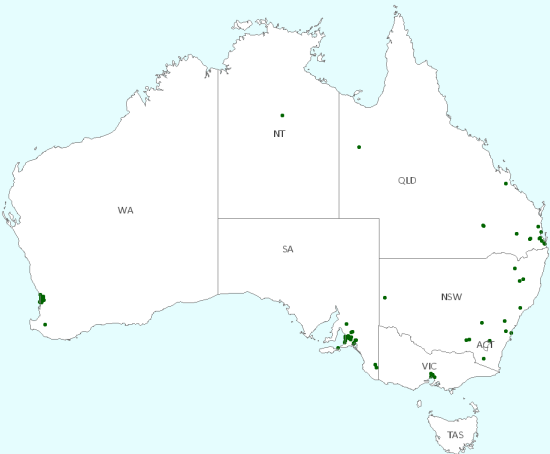
Senegal/ laughing turtle dove



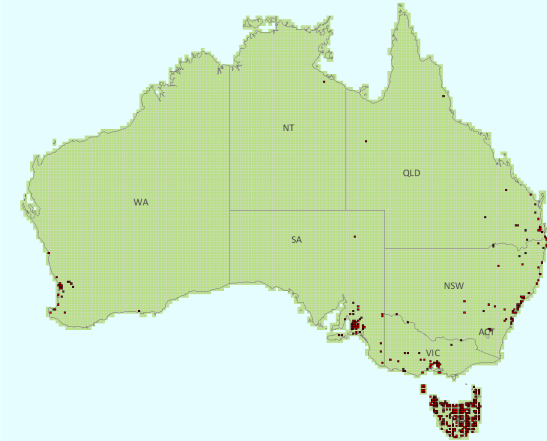
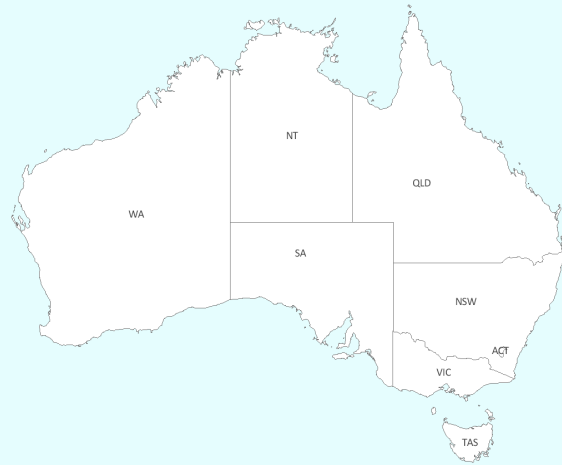
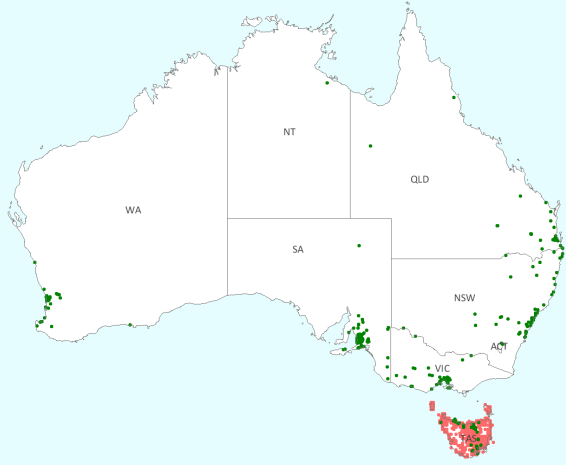
Domestic goose



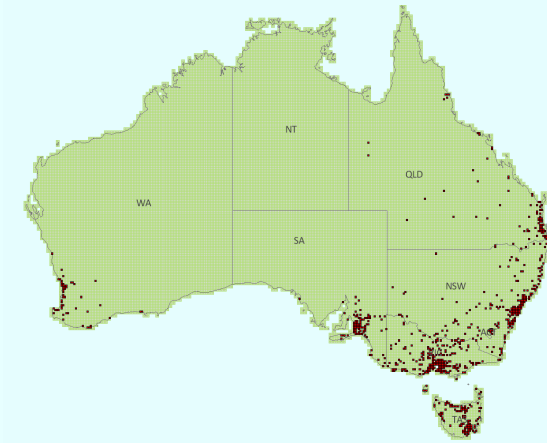
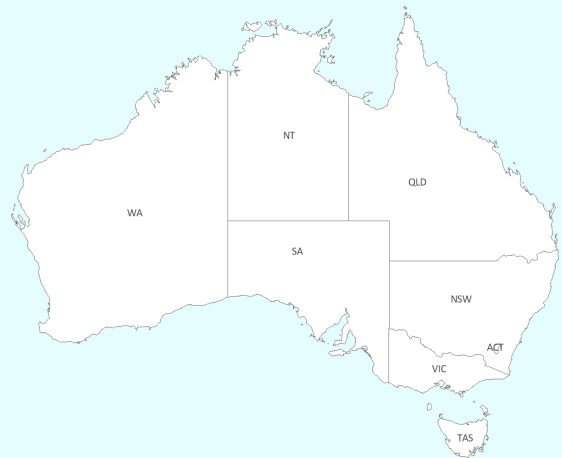
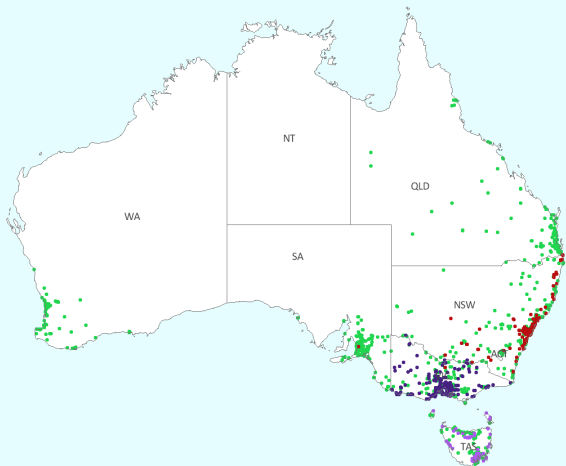
Helmeted guinea fowl



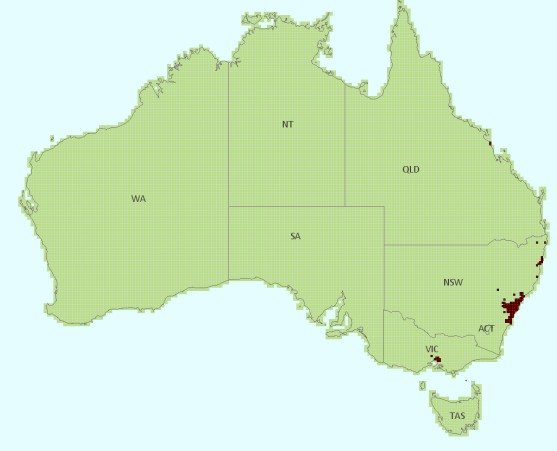
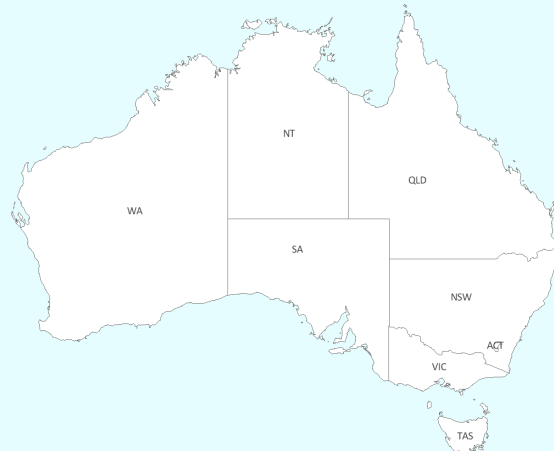
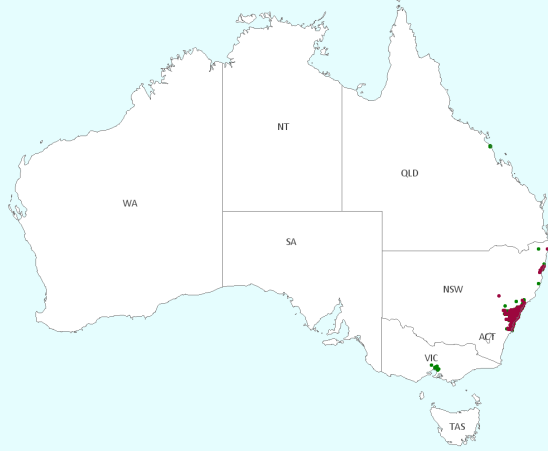
Pacific black duck / mallard hybrid



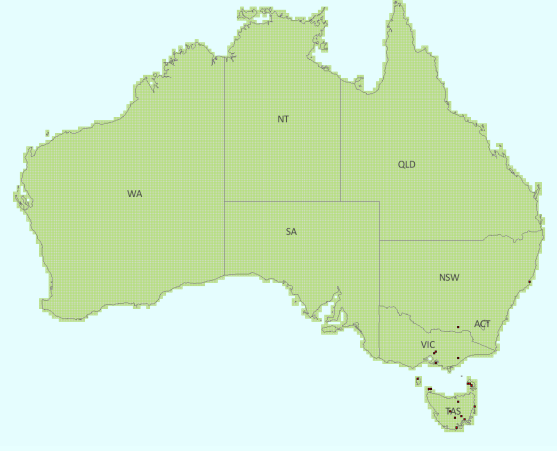
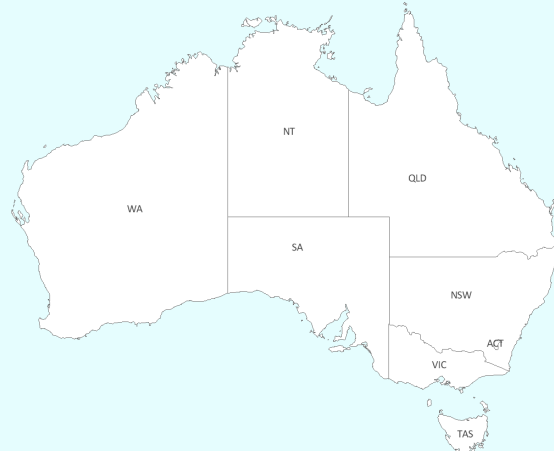
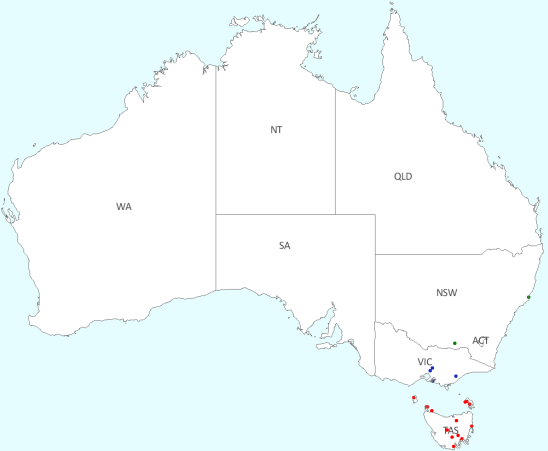
Mallard or northern mallard



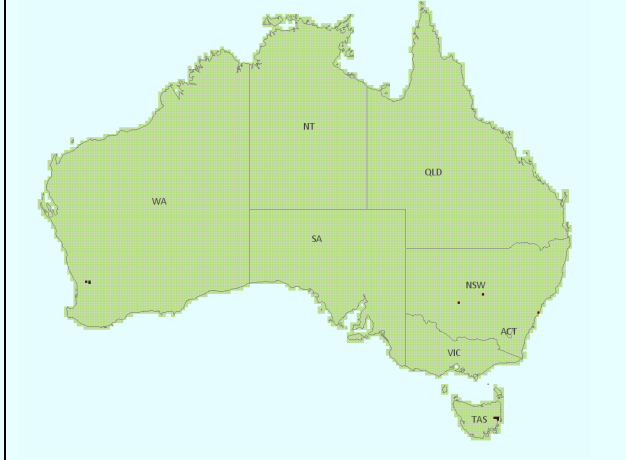
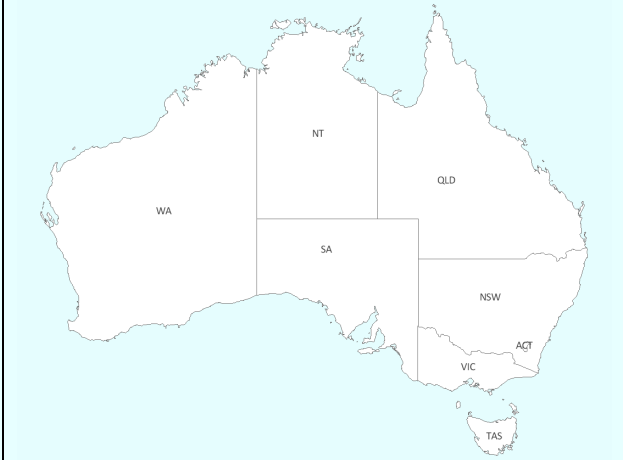
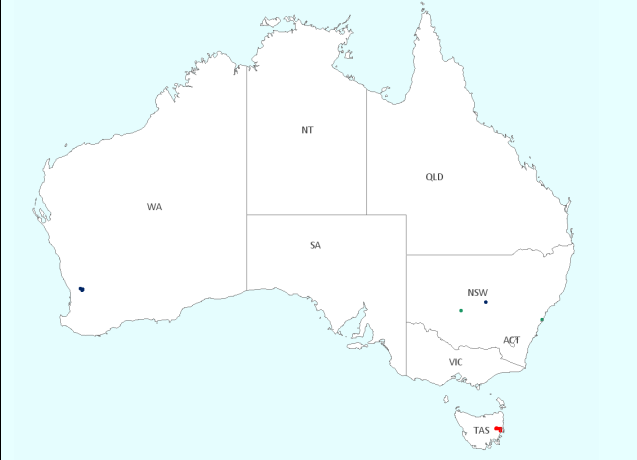
Red whiskered bulbul



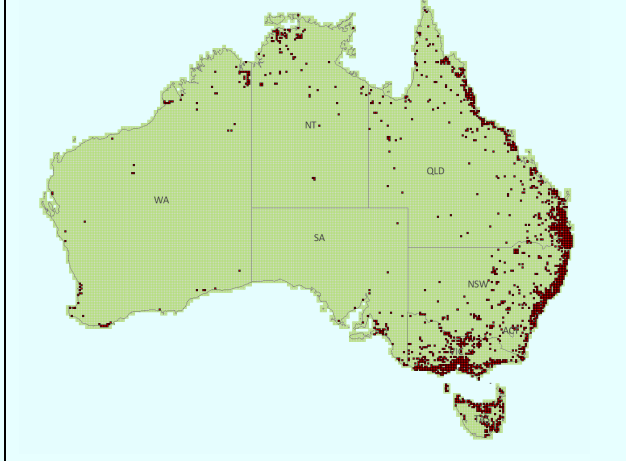
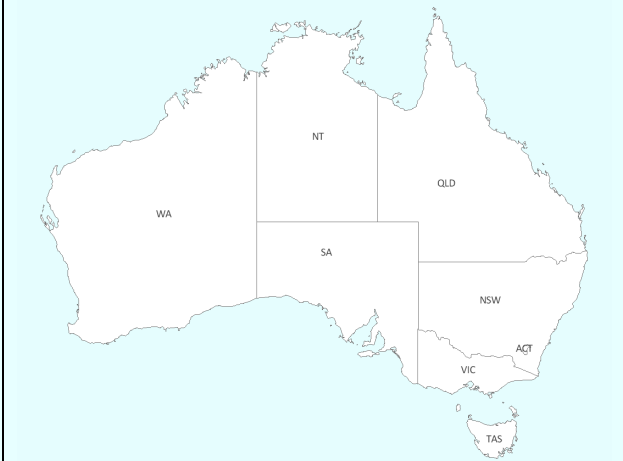
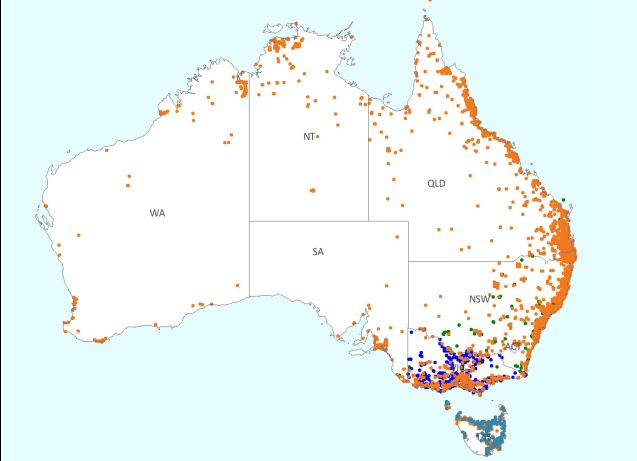
Indian peafowl or peacock



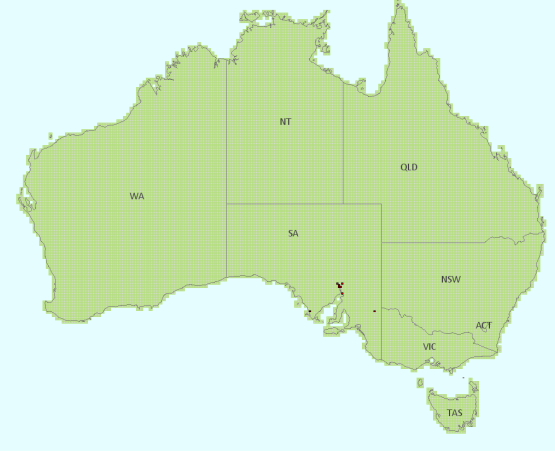
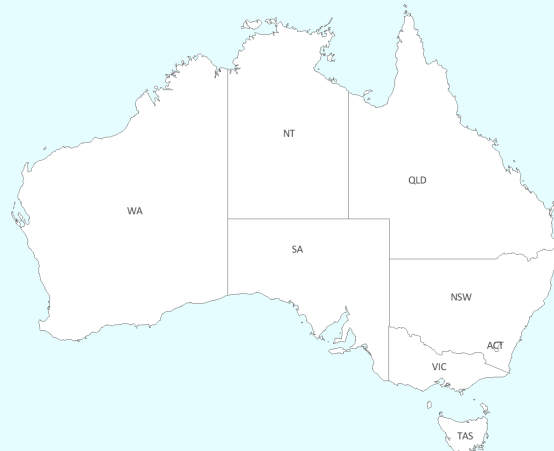
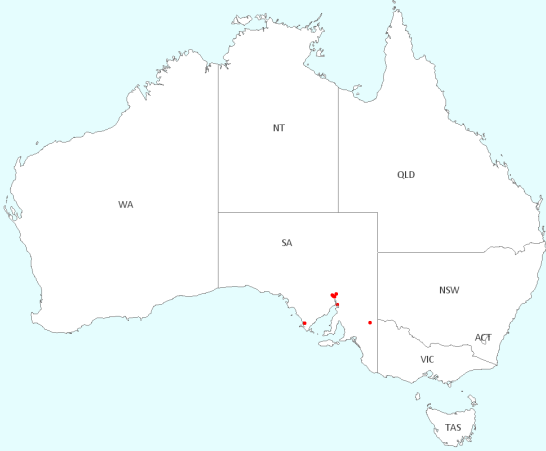
Mute Swan



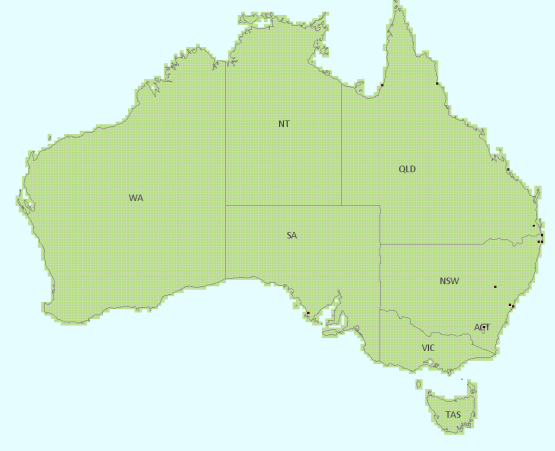
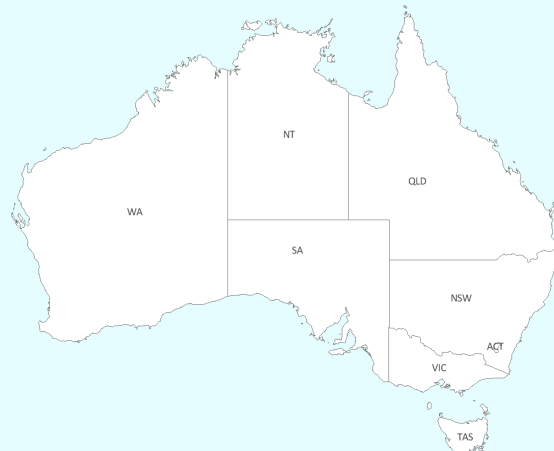
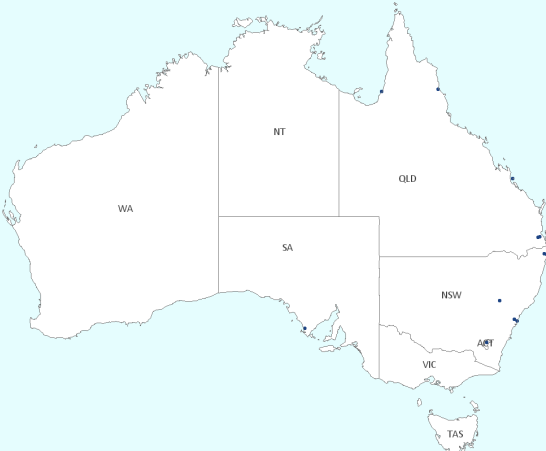
Cattle egret



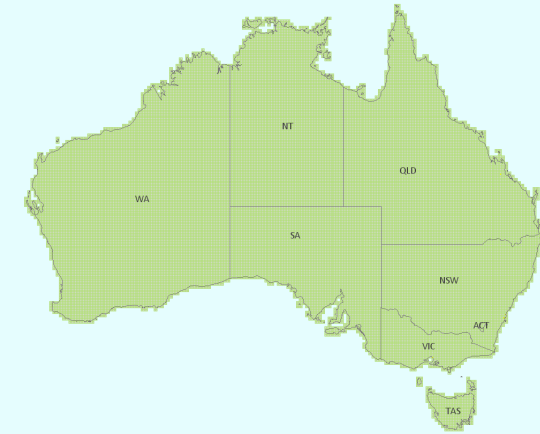
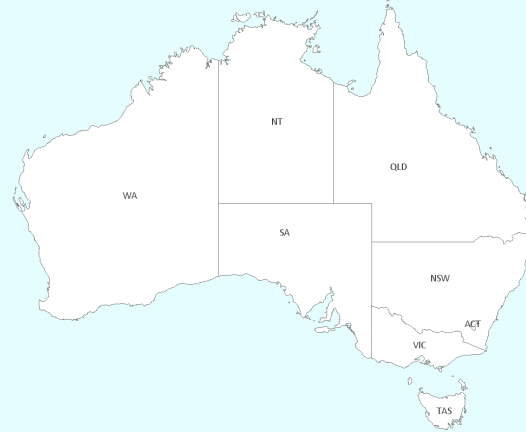
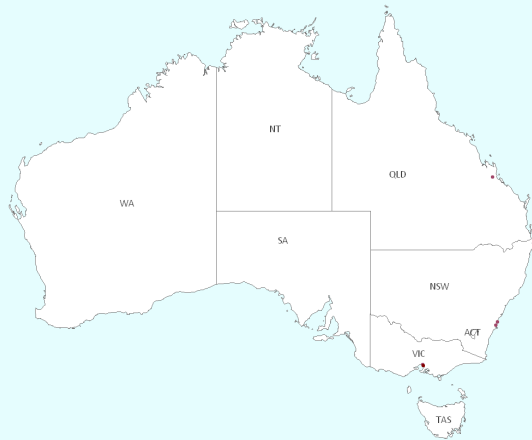
Ostrich



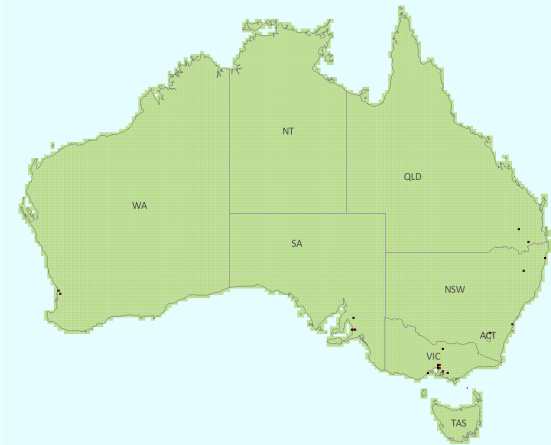
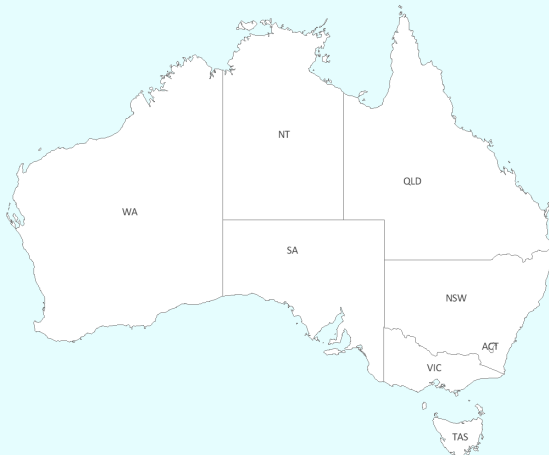
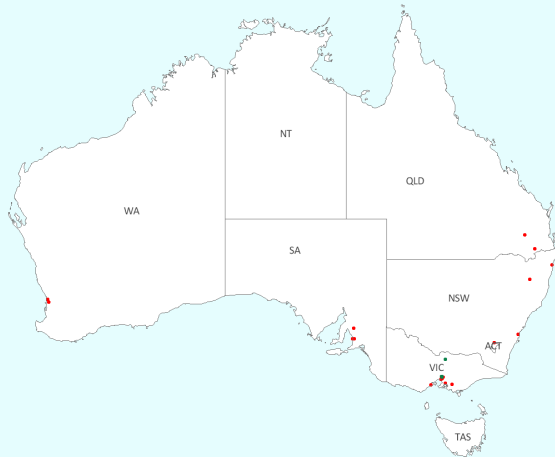
Red jungle fowl



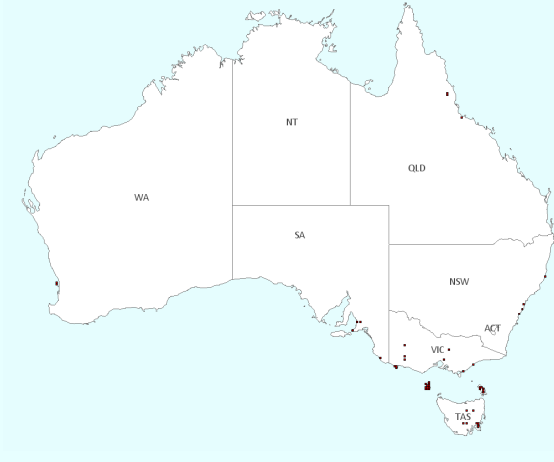
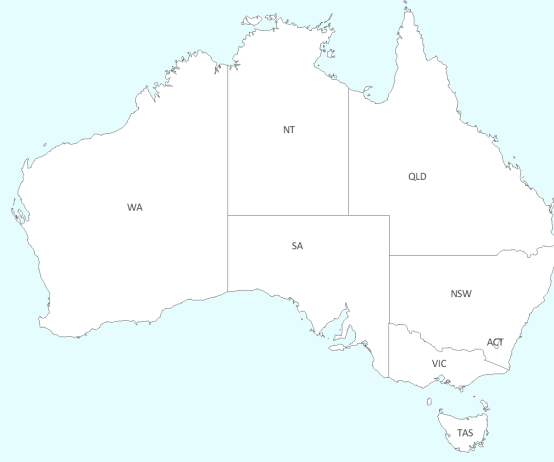
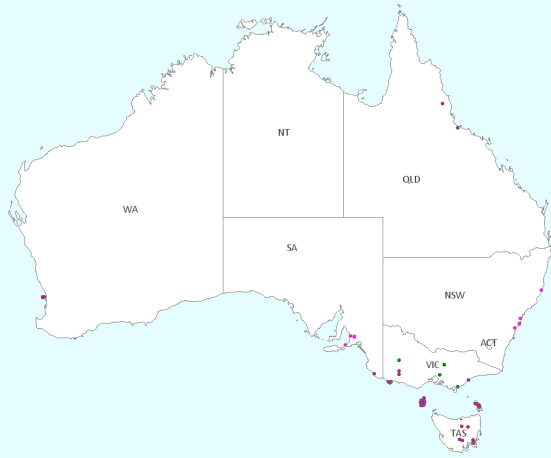
Canada goose



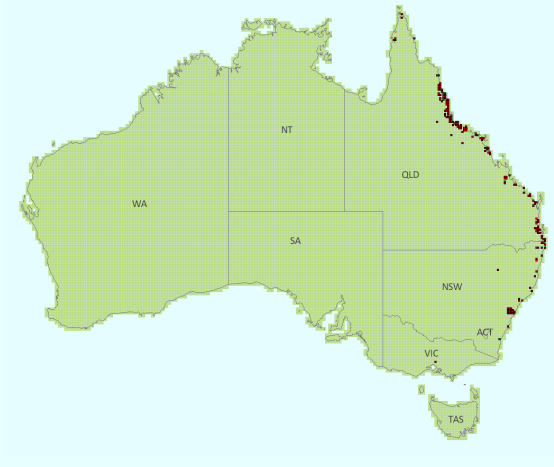
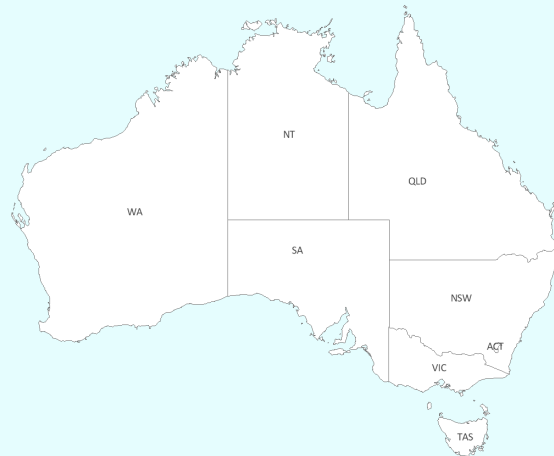
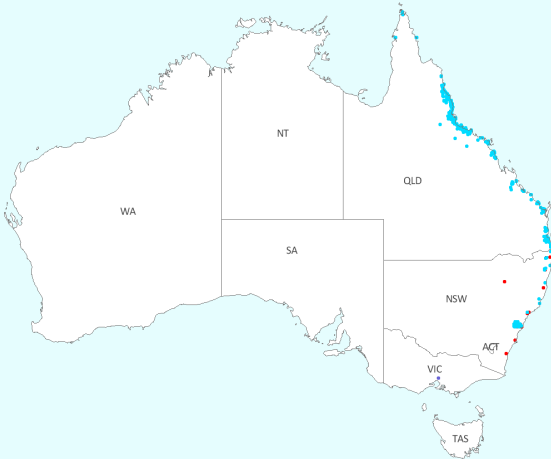
Indian ringneck parakeet



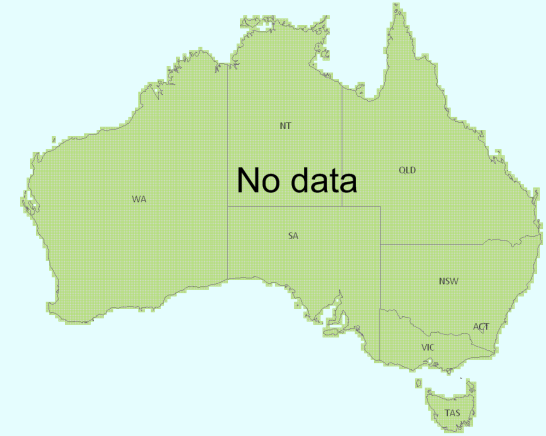
Common pheasant



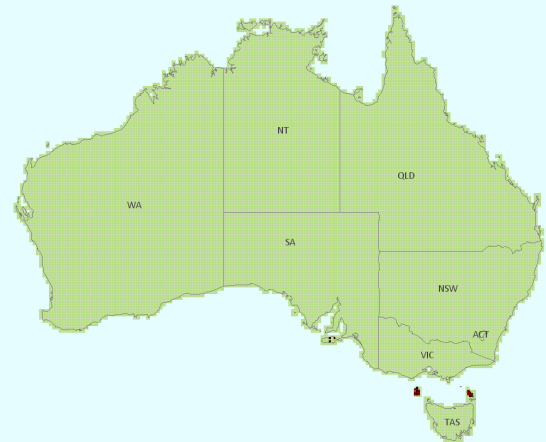
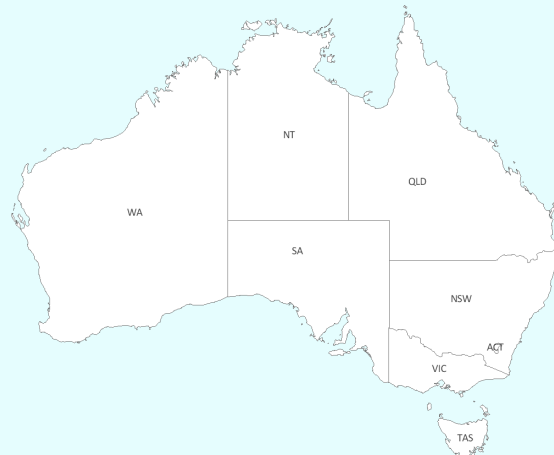
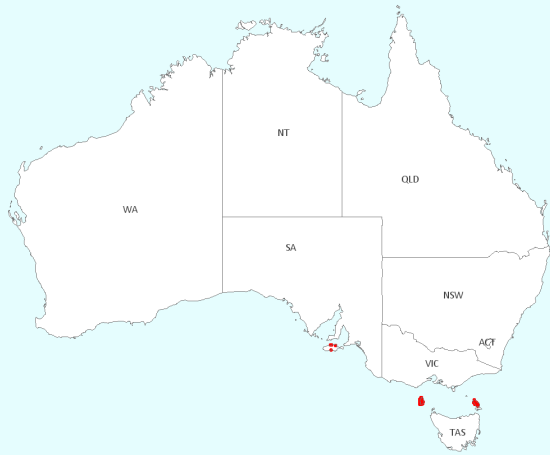
Nutmeg mannikin



Eurasian collared dove



Wild turkey



Weka

