Australian Government
Department of the Environment,
Water, Heritage and the Arts






Survey guidelines for Australia's threatened birds

Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*

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CONTENTS

HOW TO USE THESE GUIDELINES

The purpose of this document is to provide proponents and assessors with a guide to surveying Australia's threatened birds listed under national environment law—the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

These survey guidelines will help to determine the likelihood of a species' presence or absence at a site. They have been prepared using a variety of expert sources and should be read in conjunction with the Australian Government environment department's *Significant impact guidelines 1.1—Matters of national environmental significance*.

These guidelines are not mandatory. Proposals that fail to meet these survey guidelines because of efficiency, cost or validity will not necessarily mean that referral is required (that is, that a significant impact is likely), especially where the proponent provides an evidence-based rationale for an alternative survey approach. Alternatives to a dedicated survey may also be appropriate. For example, a desktop analysis of historic data may indicate that a significant impact is not likely. Similarly, a regional habitat analysis may be used to determine the importance of a site to the listed birds. Proponents should also consider the proposal's impact in the context of the species' national, regional, district and site importance to establish the most effective survey technique(s).

Failing to survey appropriately for threatened species that may be present at a site could result in the department applying the 'precautionary principle' when determining whether a significant impact is likely. That is, if no supporting evidence (such as survey results) is presented to support the claim of species absence then the department may assume that the species is in fact present. The department will not accept claimed species absence without effective validation such as through these survey guidelines, other survey techniques (for example, a state guideline or an accepted industry guideline), or relevant expertise. Where a claim of absence is made, proposals should provide a robust evaluation of species absence.

Biological surveys are usually an essential component of significant impact assessment and should be conducted on the site of the proposed action before referral. Surveys help evaluate impact on matters of national environmental significance by establishing whether a species is present or likely to be present. Before starting a survey, proponents may wish to contact the department's relevant assessment section to discuss their project and seek advice on appropriate survey effort and design.

Doing a survey to this model and confirming that nationally protected species are at the site does not in itself predict a significant impact—it is one of many factors that increase the likelihood of significant impact and should be considered when establishing whether a significant impact is likely or certain. As part of the assessment process, sufficient information is usually required to determine whether a species' presence at a site constitutes a 'population' or 'important population' as defined in the *Significant impact guidelines 1.1*. Surveys done using these guidelines will not necessarily be enough to determine whether the occurrence constitutes a 'population' or 'important population'.

These guidelines help to determine presence or the probability of presence. They **do not** establish or assess species abundance, as the effort in terms of cost and time required for an abundance survey is much greater than that determining presence/absence. Effective abundance surveys would need to compare survey effort and techniques with further exploration of a proposal's context, including important population location(s), habitat importance, ecological function and species behaviour.

INTRODUCTION

This document provides a guide to planning and undertaking surveys on threatened birds listed under the EPBC Act, relevant to a referral to the federal environment minister.

The individual taxa (species or subspecies) accounts provide a guide to appropriate survey methods and effort when assessing whether listed taxa occur at or near a specified site ('study area'). These guidelines focus on assessing the presence or likelihood of presence of taxa in a study area and not on assessing the abundance of individuals.

These guidelines are limited to recommending the effort with selected techniques to establish whether a target species is present, absent or in low abundance in a project area. A survey is interpreted as the first step in assessing the impact of a proposed project on any threatened bird species. The approaches in each species profile should be regarded as a minimum and should be included in any general fauna survey that seeks to determine the presence of threatened species. If threatened species are found during the survey, then different techniques may be required to establish whether the project area contains important habitat (nest sites, foraging sites, water sources and movement corridors) for those threatened species.

The taxa accounts relate to the 108 bird taxa that are classified as threatened under the EPBC Act (see Table A.1) as at June 2009. However, the EPBC Act threatened species list is dynamic and survey guidelines are likely to be applied to some taxa not currently listed. Hopefully, with ongoing conservation programs the populations of some taxa will recover and be removed from this list. Appendix 2 provides a general outline of the considerations and standard methods used for groups of related birds (for example, shorebirds).

DETERMINING PRESENCE

Evidence of presence

A wide variety of survey methods have been developed to detect the presence of birds (for example, see Ralph & Scott 1981; Bibby et al. 1992; Watson 2004). The presence of a bird taxa is usually established by direct observation or the identification of species-specific vocalisations. The nature of the habitat, the survey method and the particular bird taxa will dictate which of these detection methods are most useful. For example, in dense forest more than 90 per cent of species recorded may be detected by call alone (Loyn 1986). Conversely, species that occur in open habitats, such as some ducks and shorebirds, are mostly detected by direct observation (Howes & Bakewell 1989). Several indirect evidence 'signs' can also indicate whether a particular species is present. These include distinctive droppings, regurgitated pellets, feathers, tracks, current or old nests and eggshell. For example, dung and footprints have been used to determine the distribution and habitat use of the threatened southern cassowary *Casuarius casuarius* in north Queensland (Westcott 1999). Similarly, surveys of the threatened mallee fowl *Leipoa ocellata* in areas where it occurs in low abundance have focused on detecting active nesting mounds rather than the birds themselves (TBN 2002).

Detection and search effort

Generally, the more time spent searching for a species that at least occasionally occurs in an area, the greater the likelihood of detecting it (Bibby et al. 1992; Slater 1994). The amount of time spent searching is referred to as the 'search effort', and is usually quantified in terms of 'person hours' or, if working in teams, 'survey team hours'. Many bird species, however, occur at very low densities, are cryptic in nature, and/or vary greatly in abundance and distribution over time. Consequently, it is rarely possible to confidently prove the absence or local extinction of a species without exhaustive survey effort that is replicated in space (different locations at the same time) and time (same location at different times). So the failure to detect a species in a particular area at a particular time should be reported as 'not detected' rather than 'absent' (Resources Inventory Committee 1998a; NSW DEC 2004).

Predicting presence

In some cases it may be impractical or inappropriate to conduct surveys for the presence of a particular taxon. This may be the case when a taxon rarely uses the area or its abundance is so low in a particular area that the survey effort required to determine absence would not be feasible or cost effective (see Planning and design of surveys). For example, many threatened albatross species at some time will visit most areas off southern Australia, but mounting a survey to detect the presence of one species at a particular location would generally be futile. In these situations it will be necessary to rely on previous records of presence in the region and/or predictive modelling to determine the likelihood of occurrence.

In cases where occurrence must be predicted, an accurate evaluation of the habitat characteristics of the study area and the relative importance of habitat sites will be critical in assessing the likely presence of threatened taxa. Detailed habitat descriptions will also be helpful if further efforts are required to implement targeted surveys (NSW DEC 2004). For some rare birds, the presence of another more common species may reliably indicate habitat suitability. For example, coastal heath occupied by the blue-winged parrot *Neophema chrysostoma* in south-east Australia will usually be suitable for the critically endangered orange-bellied parrot *N. chrysogaster* (Starks & Holdsworth 2004), although some sites are clearly preferred by one or other species (Loyn et al. 1986; Starks et al. 1992). Similarly, concentrations of foraging nectiviorous lorikeets and honeyeaters may provide clues to suitable habitat conditions for the endangered swift parrot *Lathamus discolor* (Swift Parrot Recovery Team 2001). If habitat suitable for a threatened species occurs in an area and an appropriate survey is not done to determine presence/absence, the department may follow the 'precautionary principle' and assume that the species is in fact present.

PLANNING AND DESIGN OF SURVEYS

For any proposal, the timing of fieldwork is critical to the surveying and reporting process. Careful consideration of the necessary lead time is required, as it may be necessary to survey at specific times of the year depending on the ecology of the species in the subject area. Surveys over multiple years may be required where a single year's data is not adequate to detect the species or to address the environmental factors. There may also be a time lag due to the availability of appropriate faunistic expertise. Proponents should allow for this lag when planning projects. Commissioning biodiversity surveys as early as practicable in the planning/site selection phase of a project will help to avoid potential delays in project approvals.

Effective surveys should always begin with thorough examination of the literature to identify the best times, locations and techniques for surveys. The profiles in this document provide a basis for effective surveys of bird species listed as nationally threatened.

Conducting surveys in six steps

Step 1: Identify taxa that may occur in the study area

The first stage in the design and optimisation of surveys is to make a list of threatened birds that could potentially occur in the study area. A four-stage process is suggested below.

(i) Characterise the study area

The boundaries of the study area must be clearly established. A detailed map of the study area should then be made showing the type, locations and condition of native vegetation and important habitat features for birds, such as wetlands, rock outcrops and flowering trees. This process is not only critical to establishing which threatened species may occur in the area but also in the selection of appropriate survey methods and effort. An appropriate map will benefit almost every survey regardless of survey technique.

(ii) Establish the regional context

This stage requires an assessment of the habitat frequency and function. The regional context will help to judge how significant the loss or disturbance of habitat is likely to be. A useful test will involve the following questions:

- Are the habitats rare or common?
- Are the habitats likely to be critical to species persistence?
- Are the habitats permanent or ephemeral?
- How is the species likely to use the site (breeding, foraging, etc)? Survey design may need to be adjusted to determine these aspects.

(iii) Identify those threatened birds that are known to, likely to, or may occur in the region

This stage involves consulting a variety of sources to determine which threatened birds could occur in the surrounding region including the study area. A variety of sources should be consulted to create a list of taxa, including:

- federal environment department databases, including the protected matters search tool and species profiles and threats (SPRAT) database, which allow you to enter the site of interest and generate predictive maps and information relating to threatened species distributions
- state, territory and local government databases and predictive models
- national and state recovery plans and teams for threatened species
- reference books such as the latest (Barrett et al. 2003) or original (Blakers et al. 1984) *Atlas of Australian Birds*
- museum and other specimen collections
- unpublished environmental impact reports
- published literature
- local community groups, researchers and expert birdwatchers.

(iv) Prepare a list of threatened taxa that could occur in the study area

This can be determined by comparing the habitat requirements of each threatened taxa known or likely to occur in the locality (*stage iii*) with the habitat types and features present within the study area (*stages i and ii*).

The taxa identified in this process are referred to as 'target' taxa.

Step 2: Determine optimal timing for surveys of 'target' taxa

The timing of surveys is often critical to the likelihood of detecting the target taxa (Bibby et al. 1992). At any particular location, the abundance of many species fluctuates over the day, year and even between years (see Magrath et al. 2004). The detectability of many birds that are present also varies with the time of day and within and between years. Consequently, surveys should be timed so as to maximise the chance of detecting the target taxon.

If it is not possible to survey for target taxa that have been previously recorded in the general location of the study area during the appropriate time of day or season, it should be assumed that these taxa do occur in the study area if suitable habitat exists (NSW DEC 2004).

Time of day

To maximise the chance of detection, survey activities should be done at the time of day or night when the target species is most vocally or behaviourally active. Intensity of vocalisation and responsiveness to playback calls relates to the time of day and this may also differ with season.

Most diurnal birds are generally more vocal and active earlier in the day (Keast 1984; Bibby et al. 1992; Slater 1994; Drapeau et al. 1999), with calling often starting before sunrise. Some birds, however, prefer to call in the evening and may continue after sunset. For example, peak call detection of the endangered western ground parrot (*Pezoporus wallicus flaviventris*), occurs 30–45 minutes after sunset (Olsen et al. 2003). The larger soaring birds are typically easier to detect later in the day when thermals form.

Similarly, the likelihood of detecting nocturnal birds usually differs over the course of the night and is typically greater just after dusk and before dawn (Kavanagh & Peake 1993; Debus 1995).

Not all birds occupy the same habitat types throughout the day. For example, the areas of coastal habitat occupied by many shorebird species will vary over the course of the day in relation to tidal cycles (Howes & Bakewell 1989; Bibby et al. 1992; Resources Inventory Committee 1997). Other species use different habitats during the day compared with night. The critically endangered orange-bellied parrot flies from feeding areas to roost in trees for the night. The roosting sites can be some distance from the feeding grounds (Starks & Holdsworth 2004). Consequently, planning the timing of surveys must take into account potential daily changes in habitat use.

Seasonal changes in abundance and detectability

Several of Australia's threatened birds are migratory and use only part of their range at any particular time of the year (Marchant & Higgins 1993; Baker-Gabb & Steele 1999; Griffioen & Clarke 2002; Barrett et al. 2003). For example, most of the critically endangered orange-bellied parrot population spends the winter months in coastal salt marsh in south-east Australia but migrates to south-west Tasmania to breed between October–February (Starks & Holdsworth 2004). Other species make shorter movements—for example, leaving from higher altitudes in the colder months, particularly during the colder winters. Still other species are nomadic and may occur in an area over some periods of the year, though not as predictably as migratory species (Barrett et al. 2003). In such cases surveys focusing on particular species should be organised when individuals are likely to be present.

Weather conditions

Weather conditions such as wind velocity, precipitation, temperature, cloud cover and light intensity can all affect bird behaviour and observer performance. In general, the detectability of birds will be significantly compromised when:

- wind velocity exceeds about 10 kilometres per hour (grass, leaves, or twigs constantly moving), especially for species that are usually detected by soft or high frequency calls. Wind velocity of less than 10 kilometres per hour is also recommended for small boat surveys (Resources Inventory Committee 1999)
- rainfall intensity is above a drizzle
- conditions are misty or foggy, especially for species that are usually detected by sight
- temperatures are either well below or above the seasonal average.

It is recommended that surveyors avoid any one or combination of these weather conditions unless it is known that the detectability of the target species will be affected only minimally.

Generally, territorial species are more easily detected early in the breeding season because vocalisations are more intense and frequent when birds are in the process of establishing or re-defining territories (Bibby et al. 1992). Similarly, colonial species may be most detectable as breeding colony size peaks.

Many species will also vary in detectability between seasons because of behavioural differences or variation in habitat conditions (Bibby et al. 1992; Debus 1995). In wetlands, for example, the growth of emergent vegetation over the spring and summer can dramatically reduce the visibility of waterbirds (Resources Inventory Committee 1998b). The timing of migrations and breeding seasons may vary geographically and between years, depending on conditions.

Changes in abundance between years

In many parts of Australia, environmental conditions can vary dramatically between years. Drought, flooding and fire can radically change the availability and distribution of suitable foraging and breeding habitat (Recher 1988). These annual variations in conditions can result in substantial fluctuations in the abundance of birds between years, creating problems with assessment of the potential value of a site for threatened taxa. For example, recent fire often renders an area temporarily unsuitable for many of its usual inhabitants, sometimes for many years (Garnett & Crowley 2000; Abbott et al. 2003).

In addition to *in situ* changes in abundance, many Australian birds make irregular movements in relation to highly variable environmental conditions. For example, many nomadic species move between coastal areas and areas further inland in response to fire, drought and flooding. Some ephemeral wetlands may only become suitable for waterbirds once in five to 10 years, following inundation (Lane 1987). In some cases, existing records can provide information on the use of such sites by particular species. However, in many areas, especially inland, previous surveys will be few or absent (MacNally et al. 2004). In these cases, assessment of the habitat will be vital and could provide the only practical indication of whether the site is likely to support threatened species in some years.

Step 3: Determine optimal location of surveys

Habitat stratification

In some circumstances, the study area will be small enough to allow a comprehensive search of the entire area within a reasonable period of time. The size of the searchable area will depend on the nature of the target taxa, and the habitat and topography of the study area. For example, searching for highly cryptic species in dense scrub will take far longer than searching for large, conspicuous species in open grassland. If a comprehensive search is feasible, then sampling will not be required, and the data collected will be representative of the entire area. In many cases, however, the study area will be too large to allow a complete search within a reasonable timeframe and selective searches or sampling procedures will be required (Bibby et al. 1992; Royle & Nichols 2003).

Many study sites will contain a variety of distinct habitat types, especially if the area is large. Some of these habitats may be unsuitable for the target taxa. For example, most wetland birds will rarely be observed in dry, open grassland. An effective strategy to maximise the likelihood of detecting a particular taxon is to concentrate the search effort within habitat that is favoured by the targeted taxon (Bibby et al. 1992; Resources Inventory Committee 1998a). This means that the study area will need to be divided up, or stratified, into regions of similar habitat types.

When stratifying a study area, the study area is usually partitioned first on biophysical attributes (for example, landform, geology, elevation, slope, soil type, aspect, water depth), followed by vegetation structure (for example, forest, woodland, shrubland, sedgelands). Strata can be pre-determined based on landscape features indicative of habitat that can be derived from topographic maps, aerial photographs that show habitat types, or existing vegetation maps. Preliminary assessment of the study area before starting the surveys will be useful to check stratification units and further stratify the area if necessary (Bibby et al. 1992; NSW DEC 2004). In other situations, such as the inundation of vast floodplains, there may be little alternative but to use a form of stratified sampling based on the habitat's accessibility throughout the survey.

Focusing search effort on favoured habitat can be a valuable strategy to maximise the likelihood of detecting target taxa. However, this approach requires that the habitat preferences of target taxa are adequately known, which for many threatened species may not be the case. The fewer habitat association records reported for a taxon, the more likely that any apparent habitat preference will be an artifact of the small sample. Subsequent surveys then tend to focus on these apparently preferred habitats, which can further distort the perception of habitat preference. Consequently, investigators should not exclude particular habitat strata from survey designs, unless it is well established that these habitat types are consistently less favoured by the target taxa than other types within the study area.

Targeted searches

An extension of focusing search effort on preferred habitat strata is the *targeted search*. Search effort is confined to particular resources or habitat features that the target taxa/taxon are known to seek out, at least for some part of the day or season. These may include flowering or fruiting trees, waterholes or cliffs, all of which can attract birds that are otherwise highly dispersed (Recher 1988). Once located, these sites can be watched at appropriate times to determine if they are visited by the target taxa/taxon. For example, several studies have sought out waterholes to locate estrildid finches in northern Australia with considerable success (Davies 1972; Evans & Bougher 1987). This will be most useful for taxa that occur at very low abundance and/or have a strongly aggregated distribution (Bibby et al. 1992).

Step 4: Establish sampling design and survey effort

The previous sections on survey timing and location highlight ways to optimise the chance of detection. Nevertheless, replicated sampling will often be required to either reveal the target taxa/taxon or prove that the taxon is absent or occurs at very low abundance within the study area. Bear in mind that information on species that occur at very low abundance may be important when considering potential significant impact from the proposed actions. Sampling can be replicated in space (different locations at the same time) and time (same location at different times) or a combination of both (different locations at different times).

Spatial sampling

Replication in space will often be necessary to detect populations that are at low densities or clumped in distribution. Even after stratification, sampling may still be required if the area of favoured habitat is large or if the habitat preferences of the target taxa/taxon are variable or poorly known. There are two basic spatial sampling designs:

- **Random sampling**—when all locations within the study area (or selected strata) have an equal chance of being sampled
- **Systematic sampling**—when units are spaced evenly throughout the study area (or selected strata).

Systematic sampling will generally be superior because it produces good coverage, is easier to implement and is less subject to site selection errors. Sampling units should be placed to avoid boundaries of environmental stratification (for example, shorelines) and local disturbances such as roads, mines, quarries and eroded areas (Bibby et al. 1992; Resources Inventory Committee 1998a; NSW DEC 2004).

In general, sampling units should be positioned far enough apart that individuals are unlikely to be detected from more than one sampling location, ensuring that the samples are independent. The distance between sampling positions will usually depend on the territory or home range size of individuals in the target population and their detection distance. The vocalisations of some birds, such as the powerful owl *Ninox strenua*, may be heard for more than a kilometre (Debus 1995), depending on landform. The inter-sample distance will also depend on the survey technique used. Ideally, the number of sampling units within the study area (or strata) should be proportional to its size, a principle referred to as 'area-proportionate sampling' (MacNally & Horrocks 2002). However, a linear increase in sample number with area will become impractical at very large study areas.

A formal sampling design, such as is outlined above, is less critical in detection studies than abundance studies. However, a formal sampling design is still preferable for use in detection studies, especially if stratification is required (Resources Inventory Committee 1998a).

Temporal sampling

Temporal replication may be necessary to detect populations that fluctuate in abundance, occurrence or detectability with time, especially when these fluctuations are unpredictable. For example, some taxa are highly mobile, especially outside the breeding season and may travel through or occupy regions within their range only for brief and unpredictable periods. Consequently, regular sampling when the taxa are most likely to occur at the study area is desirable. Some locations may be occupied by target taxa/taxon in some years but not others, depending on environmental conditions.

Sampling over many years however, will rarely be feasible. In some cases, previous records can provide information on the use of such sites by particular taxa. If threatened taxa have been recorded in the general location of the study area in favourable conditions, it would be expected that these species will return, unless the habitat has been irreparably changed. Where previous data is few or absent, assessment of the habitat will be vital and could provide the only indication of whether the site is likely to support these species when conditions are suitable in the future.

Temporal sampling may also be required when the study area is small. In this situation, the individuals of some taxa will have territories or home ranges that include, but are not restricted to, the study area. Consequently, at any one time, some of these individuals will be absent from the study area and go undetected (Field et al. 2002; Mac Nally & Horrocks 2002). Regular sampling over time is recommended to increase the probability of detection on at least one occasion. Off-study area sampling will also address this problem, where sampling is done in suitable habitat surrounding the study area. This procedure increases the study area, allowing greater spatial sampling and higher probability of detecting individuals with home ranges larger than the core study area. This will be a useful strategy because temporal replication is often more costly than spatial replication, as additional travel may be required to and from the study area.

Step 5: Select appropriate personnel to conduct surveys

The single most essential component of any survey is competent observers (Bibby et al. 1992; Resources Inventory Committee 1998a). It is an expectation of EPBC Act assessors that surveys should be conducted by appropriately experienced observers who have excellent identification skills, including familiarity with species' calls and a good knowledge of bird behaviour, at least in relation to the taxa/taxon being targeted. Where calls will be important for detection, good hearing is essential, as hearing ability can strongly affect results of the survey (Resources Inventory Committee 1998a). Observers should have recognised relevant skills or experience. Observers should also have access to appropriate optical equipment (that is, binoculars or telescope). The need for excellent field identification skills of observers cannot be overstated.

When multiple observers are used it is preferable to rotate observers equally between stratification units so that observer error is equally distributed (Bibby et al. 1992). Survey leaders should assess all contributors and, where necessary, provide training and guidance to maximise the effectiveness of all observers (for example, Saffer 2002). The identity of observers should always be recorded to allow for the detection or statistical correction of differences between observers if necessary (Bibby et al. 1992; Cunningham et al. 1999; Resources Inventory Committee 1998a). The observers' experience with the target taxa, and the identification challenges inherent in surveying these taxa, should also be recorded to help assess the competency of observers and reliability of observations.

Step 6: Document survey methods and results

Survey methods and level of search effort vary widely between studies. For this reason it is essential that survey reports include detailed information on the methods used and the level of search effort adopted. This includes who was involved, what work was done, where the work took place, when the survey occurred and how the survey was carried out. The survey report should follow the standard aims, methods, results and discussion format common to all scientific research.

Without this information it is difficult to interpret the survey results and impossible to replicate the study for comparative purposes (Bibby et al. 1992; Resources Inventory Committee 1998a). It is useful to record the GPS location of all sampling units and provide maps of the study area. Detailed descriptions of the habitat should also be recorded. Information on the condition of the habitat at the time of the survey should also be included, as this may be useful in later analysis (for example, determining whether species presence/absence is due to temporary factors such as drought). Documenting the habitat occupied by target taxa during the survey process, and a site description, will add value to the survey at minimal extra expense (NSW DEC 2004). Documentation of observers and their skills is also important (see above). Presentation of all bird taxa recorded is essential as it can provide a measure of survey effort and effectiveness.

It is important that reports contain suitable information to demonstrate the survey was sufficient to draw its conclusions. Documenting the survey effort will be particularly important for species that might be present at very low abundance in the project area. Tabulated GPS coordinates of sites and equipment placement will allow precise determinations of occurrence within a project area.

Maps should be included that show the location of planned infrastructure over the top of aerial photographs (ideal) or other geographical layers that represent the habitats present in the area. Indicating the location of equipment placement and GPS coordinates of the transect paths will demonstrate survey effort.

Reports should also show justification of the survey design, whether it be opportunistic, systematic or focused on certain likely habitats. This includes information on the habitat types present and the survey effort given to each. The design should also distinguish between known or potential foraging, roosting and commuting habitats. For species that might be present at very low abundance, it is important to describe the likelihood of presence based on habitat descriptions made as part of the survey. Explanations on the timing of the survey, suitability of the weather, and tabulated duration of transects and recordings should also be given.

Survey data should also be made available to state and territory environment departments to be included in fauna databases where appropriate.

Welfare and survey impact issues

The welfare of target and other taxa should always be paramount. Surveys of breeding birds in particular have the potential to be disruptive if not conducted with adequate care. As a general rule, nests should not be disturbed, especially during the egg-laying and incubation period, to avoid the possibility of abandonment or fatal exposure of eggs or nestlings to the elements or predators.

Methods that have significant potential to cause disruption or harm to birds include trapping surveys (which can require a permit under the EPBC Act and local or state government regulations) and broadcast surveys, which should be conducted in a manner that avoids exposing individuals to prolonged playback calls. Methods should also be used in a way that minimises damage to habitat (for example, trampling of vegetation).

DETECTION METHODS FOR BIRDS

Numerous methods have been developed for the detection of birds (Ralph & Scott 1981; Pyke & Recher 1984, 1985; Recher 1988; Bibby et al. 1992). This section outlines the most commonly used methods and assesses their advantages and disadvantages. The following section provides a guide for techniques and survey effort suitable for surveying the 108 currently listed threatened birds. In Appendix 2, the methods have been classified in relation to their general suitability for groups of taxonomically and/or ecologically similar bird species. Some of these groups have been further sub-divided because members of the group vary in their conspicuousness or lifestyle, or they occupy different habitat when breeding and non-breeding.

In many cases, more than one of the following methods may be needed to detect one or more target taxa.

Area searches

The area search is an effective method for detecting many bird species, regardless of whether the study area is small enough to permit a complete search or whether sampling of a larger site is required. Area searches usually involve searching a plot of predetermined size for a predetermined period of time. Each selected area is searched systematically, while stopping or moving to investigate sightings, calls or signs of presence (Loyn 1986; Recher 1988; Hewish & Loyn 1989; Bibby et al. 1992).

When sampling is required, area searches are typically conducted over plots of about 1–3 ha, for 10–20 min, though larger plots may be surveyed over hours, days and even months (for example, Blakers et al. 1984). The ideal amount of time to search plots of a given size depends on the aim of the search and the habitat type (Hewish & Loyn 1989). For example, if the aim is to locate a highly conspicuous species in open woodland, far less search time is required than if the aim is to detect a cryptic species in dense forest.

Area searches will generally be the best of the random or systematic sampling methods to use to detect target species because of its easy application and flexibility of observer movement. Free movement allows the investigator to more thoroughly explore any noises, indicative signs or favoured habitat features, than other more structured searches such as transects and point counts. Also, the shape of the sample area can usually be tailored more easily to target preferred habitat compared with transect methods. Area searches are argued to be less sensitive to biases resulting from environmental influences such as weather and time of day, because of the more active approach to surveying and a reduced reliance on calls for detection (Loyn 1986; Hewish & Loyn 1989).

Transect surveys

Transect surveys usually involve recording birds that are seen or heard while travelling a pre-determined path between two fixed points of known distance apart. Alternatively, transects may be travelled for a fixed period of time without regard for distance, though this approach is less common. Transects typically follow a

straight path but can follow roads, rivers, coastlines or contours. They are usually done on foot, though travel by motor vehicle may be appropriate where target species are conspicuous (Recher 1988; Bibby et al. 1992). Transects may also be done by ship or aircraft and these forms of survey are detailed in separate sections.

The optimal length of transects will depend on the aim of the survey (Recher 1988; Bibby et al. 1992). For surveys that aim only to detect particular taxa, transect lengths may vary and be dictated by the dimensions of patches of habitat favoured by the target taxa/taxon. For example, transects may be placed across a wetland at regular intervals but the length of each transect will vary with the width of the wetland at that location.

Transects should be travelled at a speed that is appropriate for the habitat and purpose of the study. Generally, the number of detected taxa will increase with slower speed (Harden et al. 1986; Er et al. 1995, 2003) because there will be more time to detect less-conspicuous taxa. Consequently, the optimal travel speed will be a trade-off between covering as much terrain as possible and detecting individuals of the target taxa. Conspicuous taxa can be detected in open habitat at speeds well above walking pace so may reliably be detected by transect surveys using vehicles or boats. These modes of travel may be particularly useful for revealing uncommon species in extensive study areas, provided that access is suitable. Even when conducted on foot, transects may sometimes be better than area searches for detecting conspicuous or highly audible species in extensive areas because of the greater area that can be surveyed per unit time.

Transect surveys by boat are well suited to (and in some cases the only method of) detecting birds that occur on rocky shores and cliffs of offshore islands or inaccessible mainland shorelines (Resources Inventory Committee 1997). Good views of these coastal habitats are obtained by boat, provided the sea conditions are calm. Similarly, boat transects along streams and rivers or around the edge of large water bodies are an effective way to survey riparian and wetland habitats.

Point surveys

Point surveys involve recording the presence, and usually number of individuals, of each taxon detected at a series of specified locations. The sampling points are usually pre-determined and selected either randomly or systematically within the study area.

Before starting a point sampling survey, a range of variables are usually specified, including the amount of time spent at each point and the distance between points. The amount of time allocated to each point is usually 5–20 min, although intervals ranging from 2–60 min have been used (Recher 1988; Bibby et al. 1992). Longer times increase the number of taxa detected at each point location and increase the probability of detecting more cryptic taxa (Dettmers et al. 1999). However, fewer points can be visited in the same period, which will to some extent negate the benefit of longer sampling intervals. Generally, points should be spaced far enough apart so that individuals of the target taxa would not be detected from multiple points (Recher 1988; Bibby et al. 1992).

Point surveys are typically easier to do than transects and, to a lesser extent, area searches, especially in difficult terrain or dense vegetation and when sample locations are positioned randomly or systematically. Also, the observer has the advantage of being able to concentrate on detecting birds without the noise and distraction of avoiding obstacles while walking (Recher 1988; Bibby et al. 1992). Positioning the sampling points at specific locations may also be more appropriate in fine-grained habitat, if the aim is to target species that favour habitat usually occurring in small patches (Rosenstock et al. 2002). However, compared to transect and area search surveys, point sampling has a high proportion of ‘dead’ travel time between sampling points when birds are not recorded (Bibby et al. 1992; Rosenstock et al. 2002).

Point surveys are often considered better at revealing cryptic species than transects because more time is available for their detection and the observer creates less disturbance once the sample period starts (Recher 1988). Opposite findings have been demonstrated by some workers however (Arnold 1984; Hewish & Loyn 1989). The reduced area surveyed by point counts may also limit the number of less mobile species recorded (Hewish & Loyn 1989).

Compared to transect sampling and especially area searches, point surveys usually have a greater reliance on detecting birds by call (Cunningham et al. 1999). Consequently, several studies suggest that point counts may be more efficient at detecting more vocally active birds than transects or searches (Arnold 1984; Cunningham et al. 1999).

In general, point surveys are used to determine species richness or abundance and will normally be unsuitable for detecting threatened species because the method is insufficiently targeted and much time is lost while travelling between sampling points. However, it will be more useful when combined with other methods such as transect procedures. Point surveys also form the basis of the broadcast survey, which is a highly effective method for detecting some species.

Transect-point surveys

Transect and point surveys may be combined to produce a method that is well-suited to some detection studies. This involves conducting a series of point samples at regular or habitat determined positions along a transect line. This approach combines the strengths of both procedures (Recher 1988; Resources Inventory Committee 1999) and may be especially useful where a range of taxa with varying detectabilities are being targeted.

Broadcast surveys

Broadcast surveys provide a highly effective method for detecting a wide variety of birds, especially when they are nocturnal or visually cryptic and/or reside in dense vegetation. Broadcast detection involves playing a recording of the vocalisations of the target taxon over a loudspeaker (often referred to as 'playback') and detecting individuals of that species that respond to the call vocally, or are attracted by the call and observed as a result. Broadcast surveys are most commonly used for nocturnal taxa, such as owls, but are also useful for detecting secretive diurnal and crepuscular (active at dawn or dusk) taxa, such as wrens, crakes and bristlebirds. Some simple calls, such as that of the little bittern *Ixobrychus minutus,* may also be imitated by an experienced observer but this approach will introduce inconsistencies and bias results. Some workers also produce a 'pishing' sound at survey stations, which is a well-known method for attracting birds generally (Zimmerling & Ankney 2000).

Recorded vocalisations are generally broadcast from a series of positions, which are selected systematically within suitable habitat. Broadcast stations should be spaced far enough apart that the same individual(s) would not be heard from adjacent stations. For wetland birds, about 250 m is recommended (Gibbs & Melvin 1993), while for some raptors about 1 km is usually advised (Debus 1995; Loyn et al. 2001; Resources Inventory Committee 2001). Spacing of broadcast stations will, however, vary in relation to the loudness of the call and the environmental conditions.

At each broadcast station the basic procedure is usually as follows (adapted from Debus 1995; Resources Inventory Committee 1999, 2001):

- After arriving at the broadcast station, wait for a predetermined period while scanning the surrounding area (using a spotlight if at night) and listening for unsolicited calls. Do not broadcast calls if the target taxon is detected in this period.
- Broadcast the call of the target taxon for a predetermined period of time, usually between 10–20 seconds depending on the species.
- Listen for the response or appearance of the target taxon for a predetermined period of time, usually between 30–60 seconds.
- The broadcast and listening sequence may be repeated up to about five times at each station. Do not continue to broadcast calls if the target taxa/taxon is detected or if the calls result in mobbing or threatening behavior between any individuals or towards the observer.
- If surveying for multiple taxa, it is recommended that the call sequence of each taxa is broadcast separately rather than intermixed.
- The area surrounding the station should be searched for a predetermined period after the broadcasts have finished to check for birds that were attracted but did not vocalise.

Detections from broadcast surveys will most often be the result of the observer hearing the response call of the particular species, so it is critical that the observer is familiar with response calls of the target taxa and also the potential for mimicry of the response call by other species in the area. More than most other survey methods, broadcast surveys are sensitive to seasonal biases resulting from between-season changes in the responsiveness of birds to playback (Herzog et al. 2002). Responses will generally be most evident in the breeding season, although several studies indicate that playback may disrupt the breeding activities of some species (Debus 1995). Consequently, it is important that playback techniques be used sparingly at these times (NSW DEC 2004), and are never broadcast after the species has been detected.

Appropriate broadcasting equipment is essential. The power output required will depend on the broadcast range that is required. For surveys on foot, a portable battery-operated speaker or megaphone connected to a cassette, CD or MP3 player is recommended because it is lighter and easier to pack than a portable stereo (Resources Inventory Committee 2001). From a vehicle, a portable stereo or detachable speaker connected to the vehicle's stereo may be equally convenient.

Trapping

Trapping birds can be a useful method to determine the presence of some taxa. Trapping has the advantage of not relying on the visual and auditory abilities of observers, although it does require good 'in-the-hand' identification skills. Trapping can be done in a variety of ways (McClure 1984) but mist-netting is the most commonly used method. Mist-netting is most useful in densely vegetated habitat where visibility of nets will be low, and for the detection of highly secretive species (Karr 1981; Robertson & Liley 1998; Pagen et al. 2002).

Typically, early morning is the most appropriate time to use mist-nests, though some groups of birds are more likely to be trapped at other times of the day (Robertson & Liley 1998). Open nets should be checked at least every half hour or more frequently if temperatures are unusually hot or cold, drizzle occurs or a likely predator is spotted nearby. Nets should be closed immediately at the onset of rain. Typically, more birds tend to be caught if the nets are set along lines especially cut through moderately dense vegetation than if existing tracks or open areas with little understorey are used (Robertson & Liley 1998). However, the effectiveness of

mist-netting varies widely between species and is strongly biased towards the detection of understorey species because nets are usually set at ground level. This method is time and labour intensive so coverage will be limited. Consequently, netting will be most useful in conjunction with other survey methods.

Mist-netting and most other forms of trapping require specialised equipment, expertise and permits. Any technique that involves the capture of birds requires authorisation from the relevant state and federal government agencies.

Shipboard surveys

Shipboard surveys involve the observation and recording of birds at sea, typically from a moving vessel. All birds observed are counted and their identity recorded to the lowest taxonomic group possible, usually species. For detection-only studies, the entire area around the ship should be scanned out to the maximum distance that still permits accurate identification. As well as species present, other variables usually recorded include location, vessel speed and direction and weather conditions (see BIOMASS 1982 for details on other variables that may be recorded).

The effect of ships on the behaviour of birds can influence seabird detections (Tasker et al. 1984; Hyrenbach 2001). Many species are attracted to ships, while others are repelled. Before conducting ship surveys, observers should determine the target taxa's likely responses to the vessel.

Both shipboard and aerial surveys may be used to detect and count birds offshore. Shipboard surveys have the advantage of providing more time to identify the taxa and record other details such as age, sex and behaviour. This improves the chances of recording rare, inconspicuous and diving taxa. Shipboard surveys are also less vulnerable to weather conditions (Komdeur et al. 1992), although these can still have a strong influence on the detectability of birds (Reid et al. 2002). Shipboard surveys are usually restricted to depths of more than about 5 m. Additionally, if specifically engaged for the purpose of surveying, ships are slower and more expensive to use than aircraft to survey the same area (Komdeur et al. 1992). Most shipboard surveys are conducted opportunistically and observers do not get the opportunity to specify the ship's course, so sampling is rarely random. Stratified sampling may be possible but requires previous knowledge of the area (Anganuzzi & Buckland 1993).

In some cases, shipboard studies will be the only feasible method of detecting the presence of pelagic species in an area. However, for a number of rare taxa the probability of an encounter will be so remote that adequate search effort will be prohibitively expensive.

Aerial surveys

Aerial surveys are typically performed for counts of waterbirds, shorebirds, seabirds and the nests of some large raptors, and are usually conducted from helicopters, fixed-wing or ultra-light aircraft. Aerial surveys usually involve flying along systematically or randomly-placed, straight-line routes (similar to ground-based transect surveys), or along shorelines, rivers, cliffs or other natural features where birds may occur. In large study areas, a sampling procedure must be used, while in smaller areas and open lakes, systematic coverage of the entire area may be possible (Braithwaithe et al. 1986; Howes & Bakewell 1989; Komdeur et al. 1992).

Aerial surveys can provide information on taxon presence and their quantity, and also reveal the location of particular habitat types or nest sites for follow-up ground surveys. Photographs are sometimes taken to help identify and count species. The best coverage and accuracy is achieved with two observers recording from

each side of the aircraft (Komdeur et al. 1992). The altitude at which the survey is done should be chosen to maximise ease of bird detection and identification (typically well below 100 m), and minimise the risk of collision with ground structures or airborne birds (Howes & Bakewell 1989). For aerial surveys of waterbirds, transects are typically 50–100 m wide (for example, Kingsford et al. 1994; Reid & Jaensch 2004). About 600–1000 km of transects can be flown in a six-hour period (Resources Inventory Committee 1999). Detailed procedures for conducting aerial surveys can be found in Braithwaite et al. (1986) and Resources Inventory Committee (1999).

Aerial surveys have the advantage of allowing rapid coverage of large areas of land and/or water and can cover areas that are difficult to access on the ground. They are also inexpensive to conduct relative to the area that can be covered. However, the high speed at which the aircraft travels permits the observer only a short time for each observation, which is usually insufficient to determine the sex and age of individuals or, in some cases their correct identification to species level. Furthermore, short observation time reduces the chance of sighting rare or scarce birds, especially when they are mixed with common or abundant taxa. Even relatively common taxa may be overlooked in aggregations that comprise thousands of waterbirds (R. Jaensch pers. comm.). Some waterbirds such as the blue-billed duck *Oxyura australis* and musk duck *Biziura lobata* may also be difficult to detect because of their propensity to dive and remain submerged ahead of approaching aircraft (R. Jaensch pers. comm.). Aerial surveys are highly sensitive to weather conditions (Briggs et al. 1985; Braithwaithe et al. 1986; Komdeur et al. 1992). Comparisons between aerial and ground surveys reveal that aerial surveys sometime fail to detect species, particularly on wetlands with dense cover, and counts are often underestimated by a factor of at least two (Kingsford et al. 1994; Reid & Jaensch 2004). However, ground counters may miss taxa in the middle of large wetlands (Halse & Pearson 2003).

Aerial surveys are well suited to detecting the presence of target taxa/taxon when the study area is very large, the density of individuals or aggregations of individuals is low, and the species are large and easily detected from the air. Aerial surveys may also be of value for identifying the location of particular habitat types or landscape features, favoured by the target taxon, which can be subsequently searched on the ground.

Resource or habitat targeted searches

Many birds seek out particular resources or habitat features, at least for some part of the day or season. Tree hollows are used by many species (such as parrots and owls) for nesting, while flowering or fruiting trees will often attract specialist nectarivores or frugivores. Water holes or roosting sites can attract birds that are otherwise highly dispersed (Recher 1988). In these cases, searches directed at finding a taxon's resources will often be more effective than methods based on random or systematic spatial sampling. Once located, the sites can be watched at appropriate times to detect their use by target species. For example, several studies have sought out waterholes to locate estrildid finches in northern Australia, with considerable success (Davies 1972; Evans & Bougher 1987).

Targeted searches will be particularly useful for detecting some threatened species because the method focuses not only on the species of interest but also on the specific habitat features where the species will most likely be found. This will be most useful for highly mobile species that occur at low abundance and/or have a strongly clumped distribution. When surveying identified resources or habitats, care must be taken to account for daily, seasonal and yearly variations in the use of those habitats or resources (see Planning and design of surveys). For example, finches may only drink from waterholes at particular times of day.

Flushing

Some grassland and wetland birds can be very difficult to detect, especially outside the breeding season when call and display behaviours are infrequent. In such circumstances, a useful method is for a group of observers to walk parallel at a short spacing between each other, across an area of suitable habitat in an attempt to flush any birds that may be present (Robertson & Liley 1998). A fast pace may be required to avoid birds fleeing without breaking cover. Similarly, a rope can be dragged across the top of the vegetation in some grasslands to flush birds. The rope should be thick enough to disturb the vegetation without being too heavy to drag. This method is recommended for the detection of cryptic species, especially when broadcast methods have failed or are unsuitable. Care should be taken to minimise damage to the vegetation and breeding birds should not be flushed using this method as it has the potential to cause abandonment of nests. Breeding birds should not be flushed using any method unless absolutely necessary.

Remote detection

A number of remote methods have been developed recently that have considerable potential for detecting uncommon species. One method involves the continuous recording of ambient noise by a remote logging device. Subsequent sound analysis, using specialised software or expertise, identifies the calls of particular species. This could be an efficient method of detecting species that only occasionally frequent an area or are highly secretive and difficult to detect.

Sniffer dog surveys

The use of properly trained sniffer or 'pointing' dogs could be useful when attempting to locate ground-dwelling birds living in thick or dense habitats such as grasslands. This technique has been used overseas on threatened species such as the kakapo *Strigops habrotilus*, where well-trained, muzzled dogs, closely accompanied by a trained handler, can locate birds (Henry 1903; Cresswell 1996). Hunters of quail species often use dogs to locate birds in dense habitat. The use of dogs requires substantial expertise and care, will sometimes require ethics committee approval, and may require special access arrangements. Thus, dog surveys should only be used in exceptional circumstances by experienced personnel.

SURVEY GUIDELINES FOR AUSTRALIA'S THREATENED BIRDS

A guide to conducting presence/absence surveys for birds currently listed as threatened under the EPBC Act is given below. Surveys should be designed to maximise the chance of detecting the species and should also be used to determine the context of the site within the broader landscape. Consideration should be given to the timing, effort, methods and area to be covered in the context of the proposed action. If surveys are conducted outside recommended periods or conditions, survey methods and effort should be adjusted to compensate for the decreased likelihood of detecting the species.

Using taxon accounts

Taxon accounts provide a concise summary of the features that are likely to influence the success of surveys and formulation of survey protocols. These summaries are not intended to provide a comprehensive account of taxon, but instead highlight aspects that are relevant to survey design. They complement the SPRAT (Species Profiles and Threats) profiles, which provide detailed information on the biology, ecology and threats of listed threatened taxa. Relevant literature should also be consulted before surveying.

Taxon accounts include:

- **Maps:** maps show the general distribution of the taxa as given in Garnett & Crowley (2000). They should be treated as indicative only.
- **Distinctiveness:** This section describes the ways in which the taxon can be distinguished from other similar taxa. In some cases, differentiation from other taxa requires expert identification skills. Reference material includes field guides to Australian birds and some international guides specific to groups of birds such as shorebirds and seabirds. Some electronic guides contain digitised calls.
- **Movements:** This section outlines the known movement patterns of the taxon so that the period of most likely occurrence and the best survey times can be determined for different parts of Australia.
- **Breeding season:** This section describes the period when the taxon is present in its breeding range and likely to be undertaking breeding activities. This information helps to determine when seasonal abundance at breeding areas might occur and is also useful where a species' behaviour, and hence survey type, change during the year. For example, broadcast surveys are often effective only before and during the breeding season.
- **Habitat:** This section describes the habitat typically used by a taxon, so that survey effort can be focused. For some threatened taxa, however, preferred habitat is not well known and in these cases searches should not be restricted to apparently favoured habitat types.
- **Dispersion:** This section describes the spatial pattern of the taxon—for example, whether it is clumped or widely scattered. Such information can be factored into survey design and effort.
- **Detectability:** Not all taxa are equally detectable even when they are present. This section provides a guide to how readily a taxon is detected, and the way in which it is usually detected (that is, by sighting, call or sign).

- **Recommended methods:** The methods that are most likely to detect a taxon are provided here. Less effective methods have been flagged as such or omitted. Note: where multiple methods are listed, it is not necessary to perform each of the methods; they are listed to provide alternatives where logistical difficulties may arise. However, in many cases it may be appropriate to use a combination of methods.
- **Survey effort guide:** This section is presented as a table that provides a guide to the minimum search effort recommended for detecting each listed bird. These estimates of search effort have been derived largely from expert consultation, as there is very little published data for most taxa that relate detection rate to survey effort. In many cases, additional survey effort is highly desirable. The recommended minimum search effort is shown in column two, expressed as the total number of person hours spent on a given search area (usually 50 ha) for each of the recommended survey techniques. The minimum search effort indicated for a taxon is that considered sufficient to indicate presence/absence in a given area over a specified period. Survey sites or project areas may range in size from one to thousands of hectares, and be either relatively uniform or contain a variety of landforms and vegetation types. The survey effort guide should be used as a reference for modifying survey effort to accommodate different sites.

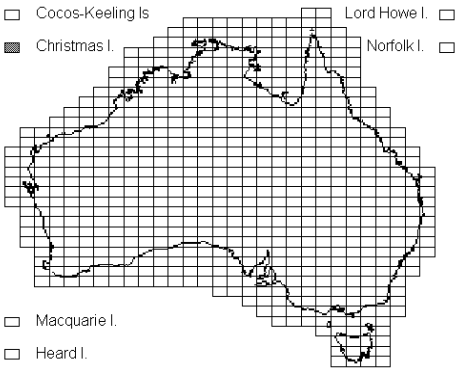
When surveying a project site significantly larger than 50 ha you should consider contacting commonwealth and state/territory environment departments to discuss the appropriate level of effort.

Some justification of the sampling effort used, in reference to the survey guidelines, would be expected in the report.

The third column presents the number of days over which the survey hours should be spread, as detection likelihood is usually greater when surveys are done over different days within the optimal season.

Abbott's booby

Common name	Abbott's booby
Scientific name	*Papasula abbotti*
Family	Sulidae
EPBC Act status	Endangered; marine; migratory



Distinctiveness

Unlikely to be confused with any other species.

Movements

Abbott's booby may travel up to 400 km to feeding grounds when they are breeding (Becking 1976). When not breeding, they may travel greater distances. Some adults leave Christmas Island for at least four to five months, returning in April but it is uncertain where they go (Nelson & Powell 1986; Marchant & Higgins 1990).

Breeding season

Breeding starts in March when established pairs begin returning to nest sites and start collecting nest material (Nelson & Powell 1986). Laying may occur at any time between April and October but mostly between mid-May and mid-July (Nelson & Powell 1986). The mean period from hatching to fledging is 151 days (range 140–175, n=11). Free-flying juveniles remain dependent on their parents for a further 230 days (162–260). Therefore, for an individual, the average time from hatching to independence is about 363 days (314–418, n=22) (Nelson & Powell 1986). Hence, pairs are thought to breed every second year at most (Olsen 2002).

Habitat

Tropical, marine and aerial. Abbott's booby spends much of its time at sea. Foraging is concentrated north and west of Christmas Island, especially in up-welling sea currents off Java (Becking 1976). Breeds on Christmas Island where it nests in tall rainforest trees on the western and central plateau, and northern coastal portions of the island. Location of nest sites is determined by the topography and nature of the canopy, resulting in a patchy distribution of nests. Most nest trees are located in uneven canopy containing emergent trees and sites are densest along crests of gullies and west-facing slopes (Nelson & Powell 1986). The nest tree species most often used are *Syzygium nervosum* and *Planchonella nitida*. *Tristiropsis acutangula* is not as common but is used when it becomes an emergent (Nelson & Powell 1986; Yorkston & Green 1997).

Dispersion

Gregarious on land and probably also at sea.

Detectability

Conspicuous on land and at sea.

Recommended methods

Observation of birds leaving the island in the morning and returning in the evening from onshore vantage points, preferably about mid-July. Searches or transect surveys to detect birds, nests and excreta beneath roost sites. Nesting sites are well documented and held by the federal environment department (Christmas Island). Aerial surveys for birds and nests have potential but helicopters are rarely available on the island (Olsen 2002). At sea, birds are only occasionally detected from ships.

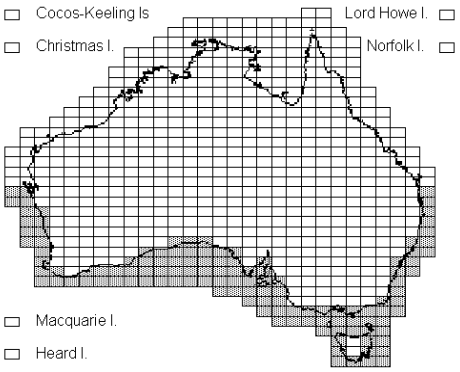
Survey effort guide

Methods	Hours	Days
Land-based area searches or line transects*	20	4
Land-based sea observations**	8	4
Shipboard surveys	15	3

* In potential breeding areas during breeding season, for sites up to 10 ha.
** Most effective method to conduct during rough weather.

Amsterdam albatross

Common name	Amsterdam albatross
Scientific name	*Diomedea amsterdamensis*
Family	Diomedeidae
EPBC Act status	Endangered; marine



Distinctiveness

Can be confused with closely related wandering albatross *D. exulans*.

Movements

No confirmed records in Australian waters but visitation likely to occur (Garnett & Crowley 2000; RPAGP 2001).

Breeding season

No breeding has been recorded in Australian territories. This species nests only on Amsterdam Island in the Indian Ocean (RPAGP 2001).

Habitat

Breeding on Amsterdam Island and foraging mainly in the surrounding Indian Ocean (Garnett & Crowley 2000). Possibly occurring in Tasmanian and New Zealand waters (Gales 1998).

Dispersion

The low population size (90 birds; RPAGP 2001) means that the species will probably be highly dispersed in Australian waters.

Detectability

Conspicuous at sea and on land (Amsterdam Island, Indian Ocean).

Recommended methods

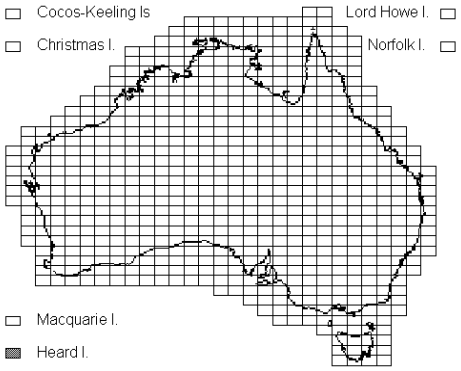
At sea, shipboard surveys. Unlikely to occur on Australian land. Detection would involve observation of flying birds. One bird off Tasmania was caught on a longline fishing boat (RPAGP 2001). Surveys of beach cast birds may provide an opportunity to detect rare seabird species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

The unconfirmed occurrence in Australian waters, very small population size, and resultant low chance of detection means that specific surveys for this taxon are inappropriate.

Antarctic tern (Indian Ocean)

Common name	Antarctic tern (Indian Ocean)
Scientific name	*Sterna vittata vittata*
Family	Laridae
EPBC Act status	Vulnerable; marine



Distinctiveness

This species may be confused with the Arctic tern *Sterna paradisaea* (especially in non-breeding plumages or at sea away from breeding colonies) and also the roseate, white-fronted and common terns, *S. dougallii*, *S. striata* and *S. hirundo* respectively. Also very similar to other subspecies of Antarctic tern (Higgins & Davies 1996) of which one (*S. v. bethunei*) is also listed under the EPBC Act.

Movements

Recent evidence suggests this subspecies is migratory (E. Woehler, pers. comm.). Most or all birds on some islands leave their breeding islands during the non-breeding season. Generally, young fledge and leave the breeding grounds with adults during January and May. They depart Iles Kerguelen from about the end of April, from Heard Island by June and from Iles Crozet by July. They return to breeding grounds generally from September to October. On Heard Island they return during December.

Breeding season

Laying occurs from late December to February, with young being present until April or, rarely, until July (Downes et al. 1959; Higgins & Davies 1996).

Habitat

These birds occur in embayments with rocky shores or cliffs and feed in inshore waters, which often support large beds of kelp. Outside the breeding season they may move into pelagic zones far from land. They prefer to breed in rocky areas or glacial moraine, either very near the coast or a short distance inland (Higgins & Davies 1996).

Dispersion

Often gregarious, forming flocks often with other species, after breeding and in the non-breeding season. Breeding is either solitary or colonial.

Detectability

Conspicuous at sea and on land, particularly when in flocks.

Recommended methods

At sea, shipboard surveys. For inshore waters, boat transects and observation from onshore vantage points using telescopes. On land, area searches or transect surveys. Detection of flying birds and nests. Scanning through mixed flocks of roosting or foraging terns when they are present is a potentially useful method of detection. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds. Colony sites are well documented, with the only Australian breeding occurring at Heard Island (Higgins & Davies 1996).

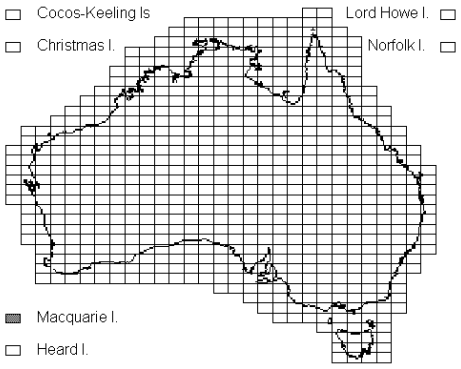
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Inshore boat surveys	5	5
Roost site scans	8	10
Land-based sea observations*	8	4
Land-based area searches or transects**	12	4

* Most effective method to conduct during rough weather.
** In potential breeding areas, for sites up to 10 ha.

Antarctic tern (New Zealand)

Common name	Antarctic tern (New Zealand)
Scientific name	*Sterna vittata bethunei*
Family	Laridae
EPBC Act status	Endangered; marine



Distinctiveness

May be confused with the Arctic tern *Sterna paradisaea*, (especially in non-breeding plumages or at sea away from breeding colonies), roseate *S. dougallii*, white-fronted *S. striata* and common terns *S. hirundo*. Also very similar to other subspecies of Antarctic tern (Higgins & Davies 1996) of which one (*S. v. vittata*) is also listed under the EPBC Act.

Movements

Poorly understood. Not considered migratory. Many birds remain on the breeding islands throughout the year. Some birds—for example on Campbell Island (Sadleir et al. 1986)—are thought to be sedentary, moving only to nearest open water in winter. On some islands, some birds leave the breeding areas during the non-breeding period. Non-breeding ranges of the populations are poorly known, with birds possibly moving out to sea. Some individuals from Macquarie Island are said to disperse as far north as Australia and New Zealand, though there are no confirmed records (Higgins & Davies 1996; Garnett & Crowley 2000; Miskelly et al. 2001).

Breeding season

The laying period occurs from September to December, rarely extending into February and March, and with young until late March to early April. On the Antipodes Is, laying appears to occur later during February (Higgins & Davies 1996; Miskelly et al. 2001).

Habitat

Occurs on islands of subantarctic seas preferring embayments with rocky shores or cliffs and feeding in inshore waters, often supporting large beds of kelp. Prefer to breed in rocky areas, either very near the coast or a short distance inland, including steep slopes or cliffs adjacent to the sea. Breeding on Macquarie Island is confined to offshore stacks. Nests are usually on live vegetation, though they occasionally occur in unvegetated crevices. On the Snares Islands, nearly all nests were near groups of nesting silver gulls *Larus novaehollandiae* (Sagar 1978; Higgins & Davies 1996; Garnett & Crowley 2000; Miskelly et al. 2001).

Dispersion

Often gregarious, forming flocks after breeding and in the non-breeding season. Breeding may be solitary or colonial.

Detectability

Conspicuous at sea and on land, particularly when in flocks.

Recommended methods

At sea, shipboard surveys. For inshore waters, boat transects and observation from onshore vantage points using telescopes. On land, area searches or transect surveys. Detection of flying birds, and nests. Scanning through mixed flocks of roosting or foraging terns is a potentially useful method of detection. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds. Colony sites are well documented, with the only Australian breeding occurring at Macquarie Island (Higgins & Davies 1996).

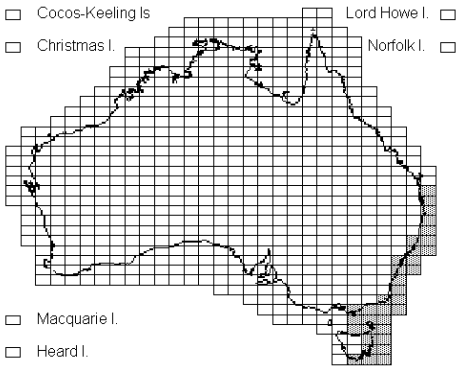
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Inshore boat surveys	5	5
Roost site scans	8	10
Land-based sea observations*	8	4
Land-based area searches or transects**	12	4

* Most effective method to conduct during rough weather.
** In potential breeding areas, for sites up to 10 ha.

Antipodean albatross

Common name	Antipodean albatross
Scientific name	*Diomedea antipodensis*
Family	Diomedeidae
EPBC Act status	Vulnerable; marine



Distinctiveness

Similar to wandering albatross *D. exulans*.

Movements

Disperse from breeding colonies in Antipodes and Campbell Islands (few) off New Zealand. Highly mobile and far ranging—one tracked bird moved 8000 km in 17 days (see RPAGP 2001). During the non-breeding season apparently restricted to the Tasman Sea and south-west Pacific Ocean (Marchant & Higgins 1990). Could potentially occur in any seas and near any coasts of southern Australia.

Breeding season

No breeding in Australian territory. Biennial breeder when successful. Young fledge between January and March (RPAGP 2001).

Habitat

Pelagic feeding in the southwest Pacific and Tasman Sea, notably off the coast of New South Wales (Marchant & Higgins 1990; EABG 1999).

Dispersion

Highly dispersed in Australian waters.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys during the non-breeding season. On land, observation from onshore vantage points using telescope. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

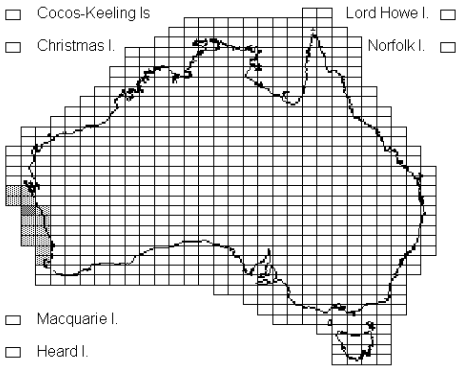
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Land-based sea observations*	8	2

* Most efficient method to conduct during rough weather.

Australian lesser noddy

Common name	Australian lesser noddy
Scientific name	*Anous tenuirostris melanops*
Family	Laridae
EPBC Act status	Vulnerable; marine



Distinctiveness

Easily confused with common noddy *A. stolidus* and black noddy *A. minutus*.

Movements

Poorly known. Thought to be sedentary, mainly sedentary or resident since they tend to stay around breeding islands in the non-breeding season, however, some movements do occur. They possibly leave nesting islands for short periods during the non-breeding season and probably forage widely (Higgins & Davies 1996).

Breeding season

The breeding season is rather protracted, extending from about mid-August through to early April, but this can vary from year to year (Higgins & Davies 1996). On Pelsaert Island in 1991–92, the laying period of the population extended from late August to early December, with a peak in September. The first eggs hatched on 30 September (Surman & Wooller 1995). Fledged young first go to sea from late January to early April (Storr et al. 1986).

Habitat

Usually occupy mangroves on coral-limestone islands that are densely fringed with white mangrove *Avicennia marina*. Occasionally seen on shingle or sandy beaches (Higgins & Davies 1996). On Houtman Abrolhos, they breed in dense clumps of mangroves up to 4 metres tall (Johnstone & Coate 1992). On Ashmore Reef, they are thought to nest in low bushes of sesbania pea *Sesbania cannibina* (Stokes & Hinchey 1990). Foraging habitat is virtually unknown. They feed from or just below surface of water (Serventy et al. 1971) and may forage well out to sea (Storr et al. 1986; Johnstone & Storr 1998) or in seas close to breeding islands (Whittell 1942; Storr et al. 1986). Roost mainly in mangroves, especially at night (Serventy 1943; Storr et al. 1986; Fuller & Burbidge 1992); sometimes rest on beach (Storr et al. 1986). Immatures have been observed roosting in large flocks on beaches near nesting areas during the day, and moving back to mangroves later in the day (Serventy et al. 1971).

Dispersion

Gregarious. Large flocks occur in the breeding season and smaller flocks at other times.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. Inshore waters, boat transects and observation from onshore vantage points using telescope. On land, area searches or transect surveys. Detection of flying birds, nests, excreta beneath roost sites. Surveys of beach cast birds may provide an opportunity to detect the species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

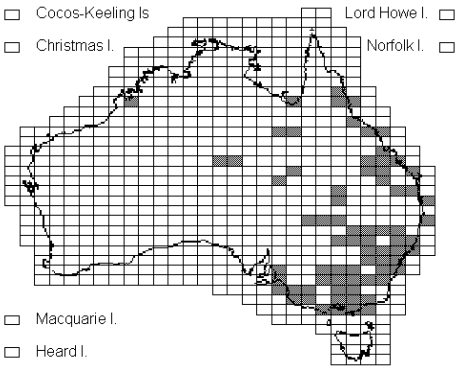
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Inshore boat surveys	10	4
Roost site scans	8	10
Land-based sea observations*	8	2
Land-based area searches or line transects**	12	4

* Most effective method to conduct during rough weather.
** In potential breeding areas during breeding season, for sites up to 10 ha.

Australian painted snipe

Common name	Australian painted snipe
Scientific name	*Rostratula australis*
Family	Rostratulidae
EPBC Act status	Vulnerable



Distinctiveness

Distinctive. Unlikely to be confused with other species but snipe-like in shape when settled (Marchant & Higgins 1993). Flight differentiated from true snipe (Subfamily *Gallinagoninae*—for example Latham's snipe *Gallinago hardwickii*)—by rounded wing shape (C. Tzaros pers. comm.).

Movements

Unknown but possibly dispersive or migratory.

Breeding season

Very poorly known. In southern Australia, generally August to February but earlier in the north (Marchant & Higgins 1993; C. Tzaros pers. comm.).

Habitat

Mainly in shallow, often temporary freshwater wetlands or saltmarshes, generally with good cover of grasses, low scrub, lignum, open timber or samphire (Marchant & Higgins 1993).

Dispersion

Generally singly or in twos; less often in flocks (Marchant & Higgins 1993).

Detectability

Difficult to detect even when present. Thought to be mainly crepuscular but can be detected during the day. Secretive but conspicuous when in the open (rare) (Marchant & Higgins 1993; C. Tzaros pers. comm.). Intensive vigilance is required to detect flushed birds (C. Tzaros pers. comm.).

Recommended methods

Area searches or transects through suitable wetlands; detection by sighting and flushing. Targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands; detection by sighting. Also a brief spotlight search shortly after dusk may detect birds. To date, trials of broadcast (playback) have not been successful (C. Tzaros pers. comm.).

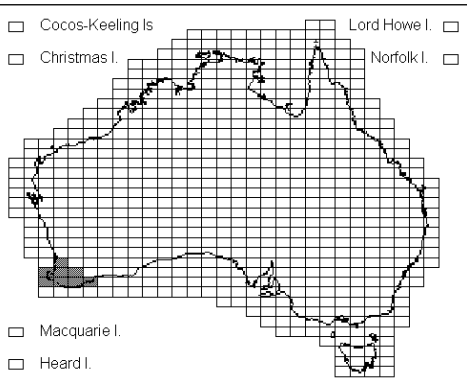
Survey effort guide

Methods	Hours	Days
Targeted stationary observations	10	5
Land-based area searches or line transects*	10	3

* For sites of less than 50 ha when wetland holds water but is not flooded.

Baudin's black cockatoo

Common name	Baudin's black cockatoo, long-billed black cockatoo
Scientific name	*Calyptorhynchus baudinii*
Family	Cacatuidae
EPBC Act status	Vulnerable



Distinctiveness

Easily confused with very similar Carnaby's (short-billed) black cockatoo *C. latirostris* (Higgins 1999).

Movements

Resident (Davies 1966; Saunders 1974b) and possibly partially dispersive. During the non-breeding season forages widely, increasing the species' range (Saunders 1974a, 1974b, 1979). At the end of the breeding season, usually during January, many birds move away from breeding areas and congregate in flocks that move in response to the availability of food (Saunders 1974a, 1974b). During June or July, begins returning to breeding areas, the flocks splitting up as they return. Adults probably return to the same breeding area each year (Saunders 1979). Some of the population remains in the breeding grounds all year (Higgins 1999).

Breeding season

Breed during late winter and spring, from July to December (Saunders 1974a, 1974b; Johnstone 1997).

Habitat

Largely restricted to moist, heavily forested areas dominated by marri *Eucalyptus calophylla*, karri *E. diversicolor* and jarrah *E. marginata*. Their overall non-breeding range is said to be determined by the distribution of marri, although they also occur in apple and pear orchards as far north as Mundaring and on the outskirts of Perth and, occasionally, in Wandoo *E. wandoo* woodland (Higgins 1999). Breeds in large hollows of old karri, marri and wandoo within heavily forested areas (Saunders 1974b, 1979). Occasionally forages on the ground: among *Erodium* weeds growing in pastures or along cleared roadsides and railway verges, on forest floors (Higgins 1999).

Dispersion

Gregarious, usually seen in threes or small parties. Occasionally gathers in flocks during the non-breeding season.

Detectability

Conspicuous, though the nests are cryptic and birds may be seldom sighted when breeding. Active nests best located about dusk when male birds bring food to the incubating/brooding female. Foraging signs may also be a useful indicator of presence (Cooper 2000).

Recommended methods

Ground area searches and road transects. Also targeted watches of food and nest trees in suitable habitat. Detection by sighting, vocalisation and foraging signs. Aerial surveys over suitable habitat may be effective in extensive areas.

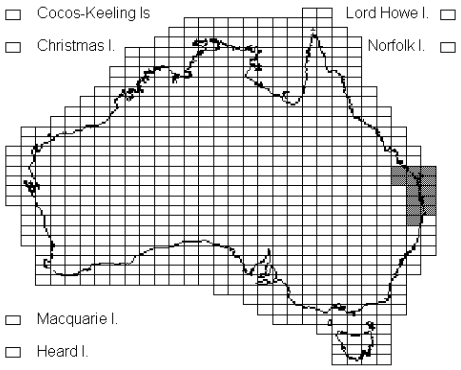
Survey effort guide

Methods	Hours	Days
Targeted searches of food and nest trees.	8	4
Land-based area searches or line transects*	12	6
Aerial searches**	4	2

* In areas of less than 50 ha.
** As long as is required to conduct sufficiently close transects over the area of interest.

Black-breasted button quail

Common name	Black-breasted button quail
Scientific name	*Turnix melanogaster*
Family	Turnicidae
EPBC Act status	Vulnerable



Distinctiveness

Adult females are distinctive. Males and juveniles could be confused with painted button quail *T. varia* (Marchant & Higgins 1993).

Movements

There is no evidence of seasonal or long-distance movements (Marchant & Higgins 1993).

Breeding season

The breeding season generally occurs from September to February or March; at one site in south-east Queensland, juveniles were observed in all except one month, suggesting breeding can occur throughout the year at certain localities (Hughes & Hughes 1991; Smyth & Young 1996).

Habitat

The species is restricted to rainforests and forests, mostly in areas with rainfall of 770–1200 mm per annum (Bennett 1985; Hughes & Hughes 1991; Marchant & Higgins 1993). Prefers drier, low, closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest (Bennett 1985; Hughes & Hughes 1991; Marchant & Higgins 1993; Smyth et al. 2001). Many reports are from dry forest described as bottle tree scrub, comprising brigalow *Acacia harpophylla*, belah *Casuarina cristata* and bottle tree *Brachychiton rupestris*, with a shrub understorey and thick litter layer (Barnard 1925; Bennett 1985). In some coastal areas, particularly north or Brisbane, associated with vegetation behind dunes, including dry vine thickets, acacia thickets and areas densely covered in shrubs, particularly midgen berry *Austromyrtus dulcis* (M. Mathieson, G. Smith pers. comm.).

Dispersion

Singly or small parties of up to five. Females are territorial in the breeding season (Marchant & Higgins 1993). Home ranges at Googa State Forest, south-east Queensland were estimated to range from 2.2–6.1 ha and overlapped considerably, both within and between sexes (Smith et al. 1998).

Detectability

Shy and inconspicuous. Highly cryptic. Usually detected by observation of birds that flush or walk away after being disturbed. May also be detected by their scratching when foraging in the leaf litter. Platelets may indicate presence of this taxon but is not conclusive as these are also made by other button quail (M. Mathieson & G. Smith, pers. comm.). Call playback has been used to survey for black-breasted button quail, but the effectiveness of this method is uncertain.

Recommended methods

Area searches of suitable habitat with detection of flushing birds or hearing of foraging scratching. Also search for platelets, although not conclusive unless birds also sighted.

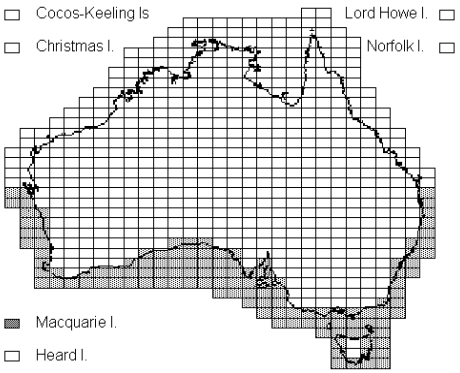
Survey effort guide

Methods	Hours	Days
Land-based area searches*	15	3

* In areas of less than 50 ha.

Black-browed albatross

Common name	Black-browed albatross
Scientific name	*Thalassarche melanophris*
Family	Diomedeidae
EPBC Act status	Vulnerable; marine; migratory



Distinctiveness

Easily confused with Campbell albatross *T. impavida* with which it was previously considered conspecific. Iris of Campbell albatross pale yellow, and brow darker and heavier in appearance.

Movements

Migratory from breeding colonies to continental shelf waters of Australia (and other parts of the world) (Marchant & Higgins 1990). Tasmania, New South Wales, and south-east Queensland. Peak numbers occur between April and October (Marchant & Higgins 1990).

Breeding season

In Australian territory breeds on Heard Island and Macquarie Island, arriving September. On Macquarie Island arrives in late August or early September; egg laying occurs late September through October, chicks hatch in December and fledge from April to May (Terauds et al. 2005). Fledgling chicks and birds that have bred depart Heard Island and Macquarie Island from the second half of April (Marchant & Higgins 1990).

Habitat

Marine. Rarely fly over land except when breeding. Fly low to moderately high, rising with updraft produced by wave fronts. Accompanies fishing boats.

Dispersion

Solitary or gregarious at sea. Concentrations occur over rises along shelf-break and over outer shelf, and on continental shelves and slopes (Marchant and Higgins 1990). Congregate starting September, forming breeding colonies on coastal areas of subantartic and north Antarctic islands (Marchant and Higgins 1990).

Detectability

Conspicuous at sea and on land. Habitually follows ships and also attends trawlers in large numbers. Noisy at colonies, giving variety of calls (Marchant and Higgins 1990)

Recommended methods

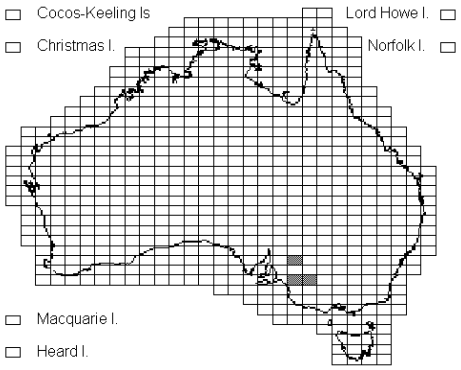
Shipboard surveys. Continuous 300 m wide survey transects while the vessel is in motion (Woehler 1997).

Survey effort guide

Methods	Hours	Days
Shipboard surveys	21	3

Black-eared miner

Common name	Black-eared miner
Scientific name	*Manorina melanotis*
Family	Meliphagidae
EPBC Act status	Endangered



Distinctiveness

Can be confused with yellow-throated miner, *M. flavigula,* and in particular with hybrids between these two species.

Movements

Sedentary. When breeding, adults typically forage short distances from the nest (up to 0.8 km). When not breeding, birds move as groups (either as an entire colony or in smaller aggregations) over greater distances to forage. Non-breeding birds remain within a home range of several hundred hectares and sightings of marked individuals have been made up to 2 km from the core territory during these non-breeding periods (Clarke & Clarke 1999).

Breeding season

Opportunistic; breeding when conditions are suitable. Nests have been found in all months of the year, however breeding typically extends from September to December and appears to be linked to rainfall events during mild to warm seasons, which promote elevated insect activity (Higgins et al. 2001).

Habitat

Black-eared miners are restricted to mature mallee eucalypt woodland, favouring areas that have not been burnt for at least 50 years and have not been cleared (Starks 1987; McLaughlin 1990; Muir et al. 1999). Nests are built in upright forks of mallee eucalypts or dense epicormic shoots (McLaughlin 1990; Higgins et al. 2001).

Dispersion

Territorial and gregarious; live in communal groups but typically seen singly or in small groups.

Detectability

Shyer, quieter and less aggressive than other miners.

Recommended methods

Broadcast (playback) surveys effective during the breeding season to induce vocalisations but rarely useful if birds are not breeding. However, playbacks should be used sparingly so as not to overly disrupt breeding activities. Also conduct area searches of suitable habitat. Further research is needed to determine the most effective time of day to conduct call playback.

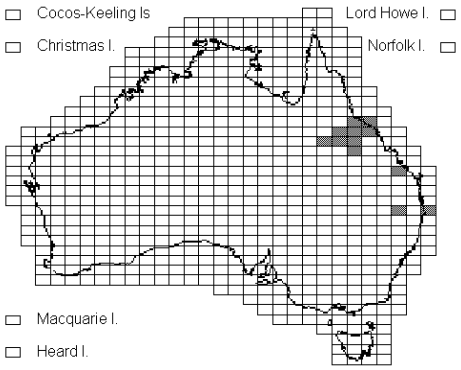
Survey effort guide

Methods	Hours	Days
Area searches*	24	8
Broadcast surveys*	16	8

* For sites of less than 50 ha.

Black-throated finch (southern)

Common name	Black-throated finch (southern)
Scientific name	*Poephila cincta cincta*
Family	Passeridae
EPBC Act status	Endangered



Distinctiveness

This taxon may be confused with the other subspecies of black-throated finch (*P. c. atropygialis*), which occurs in north-east Queensland. This is especially likely in the zone of integration between the two subspecies, around the Burdekin-Lynd divide.

Movements

Probably sedentary, but erratic appearances at certain localities suggests there may be some local movement (McCutcheon 1976; Blakers et al. 1984). Possibly move in response to drought (Ley & Cook 2000).

Breeding season

In northern Australia nests built from September to April (Lavery 1986) but breeding occurs February to May after the wet season (Immelmann 1982). In the southern part of the range breeds from August to January (Storr 1984a; 1984b). Conditions are most favourable for breeding when there is an abundance of seeding grasses with half-ripe seeds (Immelmann 1982).

Habitat

Occupies grassy woodland dominated by eucalypts, paperbarks or acacias, where there is access to seeding grasses and water (Zann 1976; Immelmann 1982; Britton & Britton 2000; Crowley & Garnett 2000). Several recent sightings in the southern part of the range were in riparian vegetation (Baldwin 1976; Ley & Cook 2000).

Dispersion

Usually seen in small flocks of up to 20 birds but sometimes occur in larger flocks of 50 to 60 birds (for example, Longmore 1978; Britton & Britton 2000).

Detectability

Readily seen near waterholes. Less commonly encountered when feeding. Usually heard or seen in small flocks flying up into low trees.

Recommended methods

In the tropics, locate and watch suitable waterholes late in the dry season and conduct area searches of savanna woodland. Also check around breeding black-faced woodswallow *Artamus cinereus* flocks in the early wet season (S. Garnett pers. comm.). Elsewhere use area searches of suitable habitat for sightings and checking flocks of other finch species.

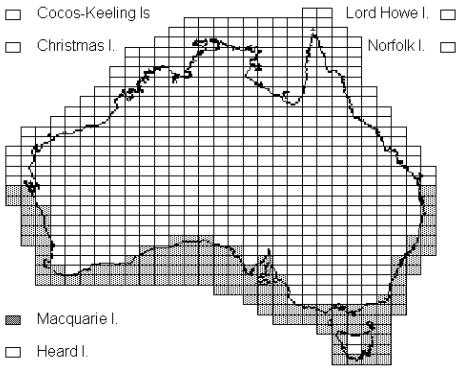
Survey effort guide

Methods	Hours	Days
Land-based area searches*	10	5
Targeted searches**	6	2

*For areas of less than 50 ha.
** Targeting waterholes and woodswallow nests.

Blue petrel

Common name	Blue petrel
Scientific name	*Halobaena caerulea*
Family	Procellariidae
EPBC Act status	Vulnerable; marine



Distinctiveness

Can be confused with Gould's petrel *Pterodroma leucoptera* and especially Stejneger's petrel *P. longirostris* (which does not occur in Australian waters).

Movements

Timing of movements away from the breeding grounds is poorly documented and adults may be largely sedentary (Marchant & Higgins 1990). Apparently, departs breeding colonies following fledging from late January to early March. Adults may disperse only to adjacent waters, especially initially; adults have been recorded at some breeding colonies until June, and at Macquarie Island occasionally return to nesting chambers throughout winter. Non-breeders move north from the pack-ice in winter to about 30 °S. Most records in Australian waters are from August to October but they are present in the Tasman Sea from May (Marchant & Higgins 1990). Recorded in south-eastern Australian waters from July to January, mostly from September to November (Reid et al. 2003). Begins to return to breeding colonies from late August to early September and probably usually remains north of Antarctic Polar Front in summer.

Breeding season

Return to burrows from late August to September and generally lays eggs mid to late October, though sometimes as early as September. Fledging and departure from the breeding areas occurs from late January to early February (Marchant & Higgins 1990).

Habitat

Marine; occurring in subantarctic and Antarctic seas. In summer, mainly over waters of -2 to +2 °C surface temperatures but ranging south to the edge of the pack-ice and north to approximately 30 °S, or farther north over cool currents. Prefers open water. Feeds around the periphery of icebergs; sometimes gathering at surface swarms of krill. Generally oceanic. May be driven inshore during the non-breeding season by strong onshore winds (Marchant & Higgins 1990). Breed on subantarctic islands including Macquarie Island, on coastal lowlands below 500 m above sea level, offshore rock stacks and islets.

Dispersion

Gregarious, usually in small, loose flocks of up to 100 but sometimes in thousands close to breeding islands. Breed colonially in dense but discrete colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea. Nocturnally active at colonies; calls loudly from burrows both during day and night.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys in potential breeding habitat to locate burrows with follow-up spotlighting at night when birds active at colony. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens, as bodies are usually displaced by currents and winds. Colony sites are well documented.

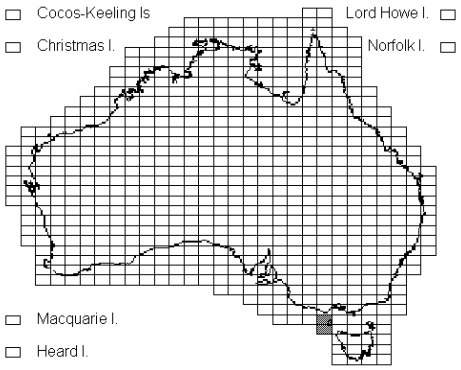
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Land-based area searches or line transects*	20	4

* At sites less than 10 ha, including follow-up spotlighting at night.

Brown thornbill (King Island)

Common name	Brown thornbill (King Island)
Scientific name	*Acanthiza pusilla archibaldi*
Family	Pardalotidae
EPBC Act status	Endangered



Distinctiveness

King Island populations of brown thornbills are distinguished principally by their longer bill compared with populations of brown thornbills on mainland Australia and mainland Tasmania (Green & McGarvie 1971; Schodde & Mason 1999; Higgins & Peter 2002).

Movements

Probably sedentary but no information. Brown thornbills from mainland Australia are sedentary and defend permanent territories (Higgins & Peter 2002).

Breeding season

No information. Brown thornbills from mainland Tasmania breed from August to January (Higgins & Peter 2002).

Habitat

Almost no information. Most recently, two seen in Pegarah State Forest in 2002 (E. Woolmore pers. comm.).

Dispersion

Probably dispersed on all-purpose territories year round, like mainland brown thornbills, with some dispersal of young birds in winter (Higgins & Peter 2002).

Detectability

Other thornbills are vocal and confiding but are small and rarely stop moving to afford good views.

Recommended methods

Initially area searches and transect surveys in suitable habitat to locate thornbill species. Mist-netting would then be required as birds need to be in the hand for positive identification.

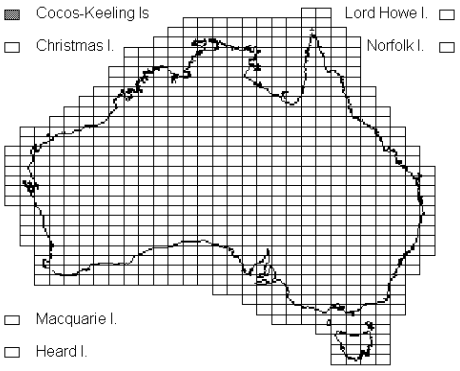
Survey effort guide

Methods	Hours	Days
Land-based area searches or line transects*	10	5
Mist-netting+	6	3

* At sites of less than 50 ha.
+ In areas where thornbills have been located by area and transect searches.

Buff-banded rail (Cocos (Keeling) Islands)

Common name	Buff-banded rail (Cocos (Keeling) Islands)
Scientific name	*Gallirallus philippensis andrewsi*
Family	Rallidae
EPBC Act status	Endangered



Distinctiveness

No similar species on the islands.

Movements

Resident.

Breeding season

Probably from May to December but may breed any time of year depending on resources (Marchant & Higgins 1993; Reid 2000).

Habitat

On North Keeling Island, occurs in all habitats, using them in approximate proportion to their occrrence: pisonia *Pisonia grandis* forest (53 per cent of North Keeling Island), *Cordia* woodland (eight per cent), coconut plantation (five per cent), mixed *Pisonia* forest and coconut plantation (29 per cent) and along the lagoon shore (5 per cent) (Stokes 1984; Garnett & Crowley 2000; Reid 2000). On West Island, this subspecies formerly used an airstrip for feeding and sheltered in thickets of *Scaevola taccada* (Stokes 1984; Garnett & Crowley 2000).

Dispersion

Observed singly, in pairs, or occasionally in loose groups.

Detectability

Secretive and wary; most often seen in early morning or late afternoon. More often heard than seen. Distinctive voice, especially in the breeding season.

Recommended methods

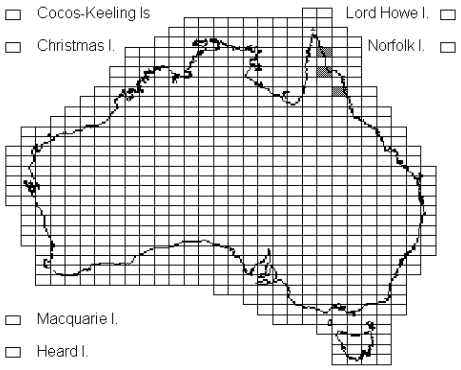
Line transects (n=13) have been established on North Keeling Island (Reid 2000). Detection by sight, call and footprints in mud. Area searches would also be suitable.

Survey effort guide

Methods	Hours	Days
Land-based area searches or line transects	8	3

Buff-breasted button quail

Common name	Buff-breasted button quail
Scientific name	*Turnex olivei*
Family	Turnicidae
EPBC Act status	Endangered



Distinctiveness

Slight risk of confusion with little *T. velox*, red-chested *T. pyrrhothorax* and painted *T. varia* button quails where their ranges overlap.

Movements

No information on movements. May make nomadic or irruptive movements as do some other button quail (Squire 1990). It has been suggested that birds may move farther south from Cape York Peninsula following especially wet summers and a flush of green growth.

Breeding season

Very little known. Appears to breed in the wet season. Nests with eggs have been recorded from early January to late March (White 1922; Squire 1990; Marchant & Higgins 1993; L. Nielsen pers. comm.).

Habitat

Mostly occurs in tropical eucalypt woodland with a very sparse understorey of shrubs and grasses (Rogers 1995; WCTP 2007). Usually seen on lower, thinly grassed slopes of hills with small *Melaleuca viridiflora*, sometimes venturing a short distance into the adjacent flat (L. Nielsen pers. comm.). Also recorded on middle and upper slopes of gentle hillsides, at an altitude of 400 m above sea level (Squire 1990). On Cape York Peninsula, recorded from woodland with a ground cover of spear-grass *Heteropogon* to 1 m high (White 1922). Recorded breeding in small grassy areas near rocky ridges within open eucalypt woodland in the Mt Molloy region and in glades of *Melaleuca*, *Acacia*, *Alphitonia* or *Tristania* within rainforest on Cape York Peninsula (Squire 1990).

Dispersion

Usually seen singly or in twos, occasionally larger groups of up to eight.

Detectability

Inconspicuous. When breeding, females give a booming call. May be responsive to playback calls during the breeding season (L. Nielsen pers. comm).

Recommended methods

Area searches of favoured habitat during the wet season. Detection primarily by direct observation of flushing birds and listening for booming call. Flushing in areas with relatively open understorey may be effective. With several people, walk in lines perpendicular to direction of travel to flush birds along the base of slope (WCTQ 2007). When flushed, can be difficult to identify and distinguish from other button-quail so having several observers to see a bird from different angles during flushing will help to increase chance of a correct identification (WCTQ 2007). Broadcast surveys may also be useful if female can be recorded.

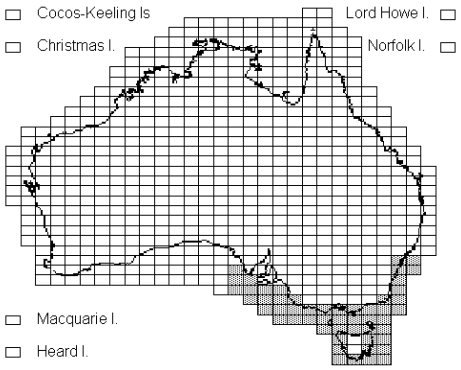
Survey effort guide

Methods	Hours	Days
Land-based area searches*	25	5

* In areas of less than 50 ha.

Buller's albatross

Common name	Buller's albatross
Scientific name	*Thalassarche bulleri*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Superficially similar to grey-headed albatross *Diomedea chrysostoma* (Marchant & Higgins 1990).

Movements

Regular visitor to south-east Australian waters from Coffs Harbour, New South Wales, around Tasmania to the Eyre Peninsula (Marchant & Higgins 1990; Stahl et al. 1998; RPAGP 2001). Non-breeding birds perhaps disperse to oceanic subtropical waters of the western South Pacific Ocean or the western South American coast (Stahl et al. 1998; RPAGP 2001). In south-eastern Australia, most common off south-east Tasmania between January and April (Stahl et al. 1998; Reid et al. 2003). For other results of satellite tracking studies see Stahl & Sagar (2000).

Breeding season

No breeding occurs in Australian territories. Adults return to their colonies in mid-December, eggs are laid in January and February, hatching in March and April and the young fledge from late August to late October (see RPAGP 2001).

Habitat

Marine, pelagic; in subtropical and subantarctic waters of the southern Pacific Ocean. Concentrations over rises and along shelf breaks; regularly ranges into outer continental shelf-waters except around breeding places, usually seen inshore or from land only during rough weather. Breeds on islands south of New Zealand (Marchant & Higgins 1990).

Dispersion

At sea usually solitary until mid-April but more gregarious in autumn. Nests in colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys during the late breeding season or non-breeding season. On land, observation from onshore vantage points using telescope. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

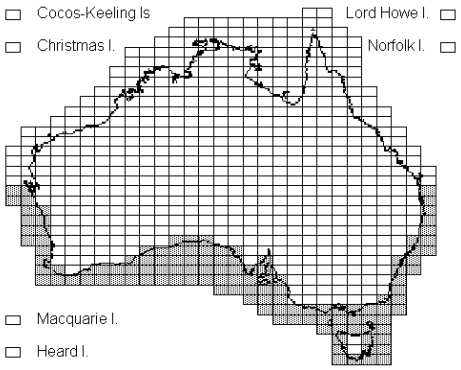
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Land-based sea observations*	8	4

* Most effective method to conduct during rough weather.

Campbell albatross

Common name	Campbell albatross
Scientific name	*Thalassarche impavida*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Easily confused with black-browed albatross *T. melanophris* with which it was once considered conspecific.

Movements

Disperse from Campbell Island to Antarctic and subantarctic waters and to the subtropical South Pacific Ocean (RPAGP 2001). In Australian waters, birds occur over the continental shelf, off Victoria, New South Wales and Tasmania (RPAGP 2001).

Breeding season

No breeding occurs in Australian territories; breeds only at Campbell Island (see RPAGP 2001). Breeds annually, adults returning early to mid August. The young fledge in April and May (RPAGP 2001).

Habitat

Non-breeding birds forage over temperate shelf waters off New Zealand, Australia and the central and western Pacific (Marchant & Higgins 1990; Garnett & Crowley 2000).

Dispersion

Breed in dense colonies with nests as close as 1 m (see RPAGP 2001).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys during non-breeding season. On land, observation from onshore vantage points using telescope. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

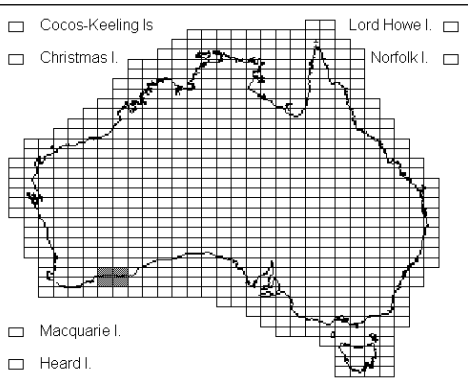
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Land-based sea observations*	8	4

* Most effective method to conduct during rough weather.

Cape Barren goose (south-western)

Common name	Cape Barren goose (sw), Recherche Cape Barren goose
Scientific name	*Cereopsis novaehollandiae grisea*
Family	Anatidae
EPBC Act status	Vulnerable; marine; migratory



Distinctiveness

Unmistakable on the ground and in the air (Marchant & Higgins 1990).

Movements

Mostly resident on the islands of the Recherche Archipelago with some dispersal. The birds congregate on the islands for breeding from April to November, although some non-breeding birds occur on the mainland during this time. During the non-breeding season, some geese disperse to the mainland and some presumably move between islands (Marchant & Higgins 1990; Shaughnessy & Haberley 1994).

Breeding season

Breeding occurs in winter from May to November, with young seen up to December (Lane 1982; Johnstone et al. 1990a,b,c; Shaughnessy & Haberley 1994; Johnstone & Storr 1998).

Habitat

Primarily on rocky islands with open grassland, glades in scrub and succulent mats (pigface *Carpobrotus*). The islands with the highest counts were found to have a high proportion of grassy or herbaceous vegetation. Nests on the ground at the base of bushes and among grass tussocks (Shaughnessy & Haberley 1994; Halse et al. 1995; Johnstone & Storr 1998).

Dispersion

Territorial, maintains all-purpose territories. No information is available on territory size on the Recherche Archipelago, however, the mean size of a territory (different subspecies) on Big Green Island, Tasmania, was 0.33 ha; and on poorer pasture on Maria Island, 0.52 ha (Marchant & Higgins 1990).

Detectability

Highly visible and vocal in flight. Easily seen in the open habitats where it occurs.

Recommended methods

Circumnavigating of islands by boat is effective as birds favour low vegetation and tend to walk or fly up as the vessel or people approach. Landings can be made on islands by dinghy or by swimming. On land, area searches for nests. Surveys may also be conducted aerially using a helicopter or small aircraft, flying around the outside first, then over the top. Survey of islands best conducted during April when birds are least often recorded on the mainland, weather is more likely to be calm, and it is before the breeding season, so that breeding is not interrupted (Marchant & Higgins 1990; Shaughnessy & Haberley 1994; Halse et al. 1995).

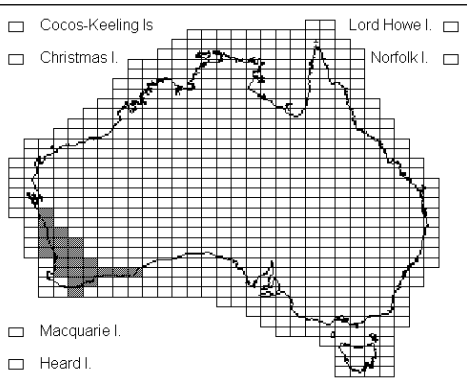
Survey effort guide

Methods	Hours	Days
Inshore boat surveys*	10	5
Land-based area searches*	20	4
Aerial surveys**	4	2

* In areas up to 50 ha.
** As long as is required to conduct sufficiently close transects over the area of interest

Carnaby's black cockatoo

Common name	Carnaby's black cockatoo, short-billed black cockatoo
Scientific name	*Calyptorhynchus latirostris*
Family	Cacatuidae
EPBC Act status	Endangered



Distinctiveness

Easily confused with Baudin's black cockatoo *C. baudinii* of which it was previously considered a subspecies. The only other black cockatoo in Western Australia is the red-tailed black cockatoo *C. banksii* (Saunders 1974b; Higgins 1999).

Movements

Partly migratory and partly resident (Davies 1966; Saunders & Ingram 1995). May be resident in higher rainfall parts of the breeding range but in higher rainfall districts (that is, south-western forests where they overlap with Baudin's black cockatoo) they are visitors during the non-breeding season. In drier parts of their range and at sites where most of the native vegetation has been cleared (for example, Manmanning, 170 km north-east of Perth), they are a breeding migrant. Populations that breed in the drier parts of their range appear in late winter and spring, breed, then adults and young move to higher rainfall districts during summer. During the non-breeding season they may forage within the range of Baudin's black cockatoo (Saunders 1979, 1980; Saunders & Ingram 1995).

Breeding season

Laying occurs late July to late October, usually during August and September, though further inland, laying may start up to three weeks later than at the coast (Saunders 1977, 1979a; 1979b).

Habitat

Occurs in native woodlands dominated by eucalyptus, particularly wandoo *E. wandoo* and salmon gum *E. salmonophloia*. Also on surrounding sandplains in shrubland or kwongan heathland, dominated by *Hakea*, *Dryandra*, *Banksia* and *Grevillea*; and in remnant patches of the above vegetation on cleared farmland. Seasonally occurs in higher rainfall regions in *Pinus* plantations, and less often in forests of marri *Corymbia calophylla*, karri *Eucalyptus diversicolor* or jarrah *E. marginata*. Occasionally in *Allocasuarina* woodlands or 'mallee country' (Higgins 1999). Breeds in eucalyptus woodlands, in large hollows in tall eucalypts, especially salmon gums, which may be either dead or alive (Mawson 1997; Higgins 1999).

Dispersion

Gregarious, usually seen in threes or small parties; ocasionally in flocks of several hundred.

Detectability

Active, noisy and conspicuous, though adults quiet when feeding. Don't usually allow close approach. Often heard long before seen. Feeding sign can also be a useful indication of presence (Cooper 2000).

Recommended methods

Area searches or transects on foot through suitable habitat, detecting birds by sight, call and feeding signs. Also road transects by vehicle or aerial transects by plane useful in extensive areas. Targeted searches for potential food and nest trees in areas of suitable habitat may also be effective.

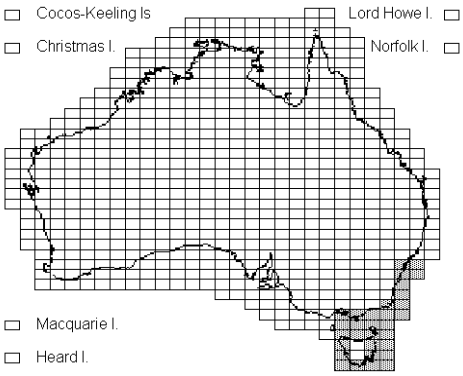
Survey effort guide

Methods	Hours	Days
Targeted searches*	8	4
Land-based area searches or line transects*	12	6
Aerial searches**	4	2

* In areas of up to 50 ha.
** As long as is required to conduct sufficiently close transects over the area of interest

Chatham albatross

Common name	Chatham albatross
Scientific name	*Thalassarche eremita*
Family	Diomedeidae
EPBC Act status	Endangered



Distinctiveness

A distinctive albatross, unlikely to be confused with any other (Barry Baker pers. comm.).

Movements

Poorly known but presumably disperse from Chatham Islands eastward to waters off the coast of South America, off Chile and Peru (see RPAGP 2001; Barry Baker pers. comm.).

Breeding season

No breeding occurs within Australian territory, with the only breeding site being the Chatham Islands off New Zealand. Presumed to breed annually and arrives at the breeding grounds in late August, laying eggs in September and October; young fledge about April (see RPAGP 2001).

Habitat

Principle foraging range in coastal waters off eastern and southern New Zealand and Tasmania, as well as the central south Pacific Ocean and off South America. Breeding restricted to Pyramid Rock, Chatham Islands (Garnett & Crowley 2000 and refs within).

Dispersion

Poorly known. Nests in dense colonies (RPAGP 2001).

Detectability

Conspicuous at sea and on land.

Recommended methods

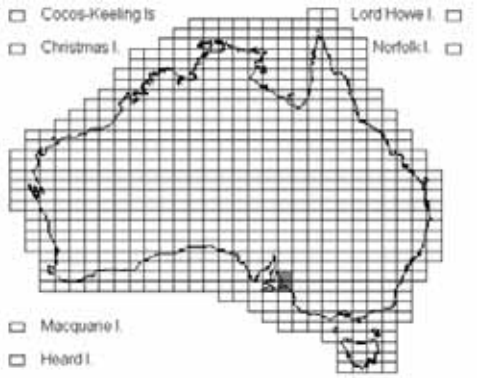
This species is unlikely to be regularly detected in Australia.

Survey effort guide

The small population size and resultant low chance of detection means that specific surveys for this taxon are inappropriate.

Chestnut-rumped heathwren (Mount Lofty Ranges)

Common name	Chestnut-rumped heathwren (Mount Lofty Ranges)
Scientific name	*Hylacola pyrrhopygia parkeri*
Family	Pardalotidae
EPBC Act status	Endangered



Distinctiveness

May be confused with shy heathwren *Hylacola cauta*. Most distinguishable feature to note is the supercilium (marking above eye), which is whiter and more prominent on shy heathwren, and duller and off-white on chestnut-rumped heathwren. Underbody colour on shy heathwren is cleaner and whiter, being duller off-white on male, and buff in female chestnut heathwren (Higgins and Peter 2002).

Movements

Little known, however has been described as resident or sedentary. No long distance seasonal movements known (Higgins and Peter 2002).

Breeding season

Breeding occurs from June to December.

Habitat

Pure dry heath, also stringybark (*baxteri* or *obliqua*) woodland with dense understorey. In the area between Sellicks Beach and Gawler known as Hills Face Zone, inhabits rocky areas. In southern Mt Lofty Ranges, known to inhabit sandy flat areas (H. Possingham pers. comm.).

Dispersion

Unknown.

Detectability

Shy, secretive and usually silent apart from during breeding season when males may sing persistently. Forages briskly through shrubs and over ground. When flushed, flight is swift and undulating before dropping into cover (Marchant and Higgins 2002). Detected by sighting and call, however observers need to be experienced (H. Possingham pers. comm.).

Recommended methods

Transect surveys on foot through potential habitat, stopping periodically to listen to calls (either songs or contact calls), during spring, early morning on days with little or no wind (G. Carpenter pers. comm.).

Broadcast surveys, especially at dawn, dusk and during breeding season when calling is more likely to occur.

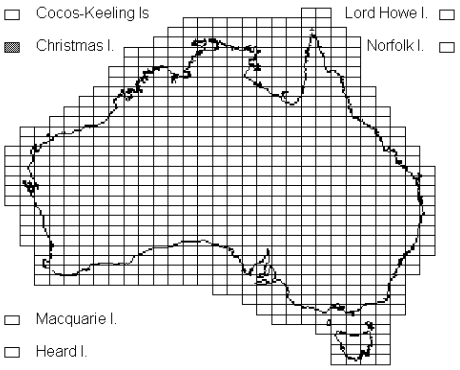
Survey effort guide

Methods	Hours	Days
Targeted searches*	9	3
Transect surveys with call playback*	9	3

* In areas of up to 50 ha.

Christmas Island frigatebird

Common name	Christmas Island frigatebird, Andrew's frigatebird
Scientific name	*Fregata andrewsi*
Family	Fregatidae
EPBC Act status	Vulnerable; Migratory



Distinctiveness

May be confused with lesser frigatebird *F. ariel* and great frigatebird *F. minor* (Marchant & Higgins 1990).

Movements

Not well known. Isolated records away from Christmas Island show no pattern and some birds are present at Christmas Island throughout the year (Gibson-Hill 1947; Marchant & Higgins 1990). When not breeding, ranges widely around south-east Asia and the Indian Ocean. Occasional visitors to Darwin and the Cocos (Keeling) Islands (Gore 1968; Marchant & Higgins 1990).

Breeding season

Most eggs are laid between early March and mid May (Marchant & Higgins 1990). Young frigatebirds first take to the air when they are about six months old (Nelson 1975; Marchant & Higgins 1990) but remain dependent on the parents for at least a further nine months (Nelson 1975). This extended period of dependency effectively means that the breeding cycle is biannual since the time from laying to independence is approximately 15 months.

Habitat

A pelagic, marine species that frequents tropical waters of the Indian Ocean (Marchant & Higgins 1990). Nests in only three colonies, all of which occur on Christmas Island. Prefers to nest in Indian almond *Terminalia catappa* (Nelson 1975) but little it known of the specific habitat requirements for breeding.

Dispersion

Gregarious when nesting and roosting. Often solitary when foraging at sea but may congregate at food sources.

Detectability

Mostly silent at sea but utters a variety of calls at nest sites and when approached.

Recommended methods

At sea, shipboard surveys. Also observation of flying birds leaving and arriving from vantage points on the island. Location of breeding colonies well known and available from the federal environment department (Christmas Island), though access to some sites difficult due to rugged terrain.

Survey effort guide

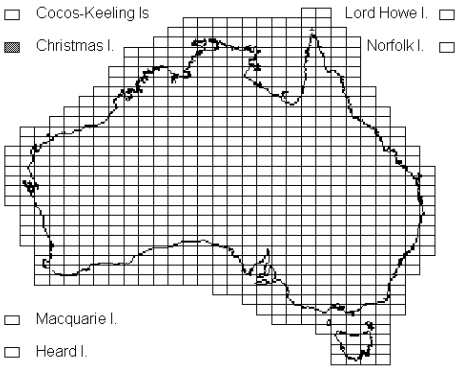
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land-based area searches or line transects **	20	4

* Most effective method to conduct during rough weather.

** In potential breeding areas during breeding season, for sites up to 10 ha.

Christmas Island goshawk

Common name	Christmas Island goshawk
Scientific name	*Accipiter fasciatus natalis*
Family	Accipitridae
EPBC Act status	Endangered



Distinctiveness

No other similar species on Christmas Island.

Movements

Sedentary.

Breeding season

Unknown.

Habitat

Restricted to Christmas Island where it occurs in all forest types but is uncommonly seen in secondary forest, settlements or rehabilitated habitat (Garnett & Crowley 2000).

Dispersion

Territorial. Usually seen singly outside the breeding season and in pairs or family groups immediately post-breeding.

Detectability

Secretive but confiding and approachable (Marchant & Higgins 1993; Hill 1997).

Recommended methods

Area searches for sightings or calls. Also watches for courting pairs soaring above the canopy from suitable vantage points. Daytime broadcast (playback) surveys may be effective before and during the breeding season, although the timing of breeding is currently unknown.

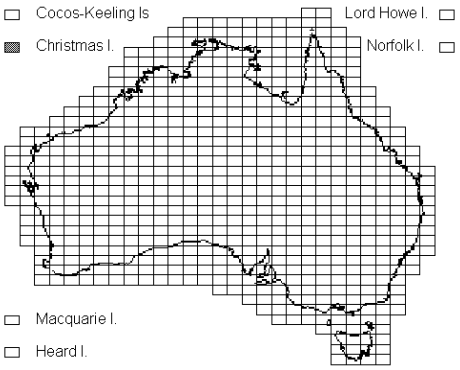
Survey effort guide

Methods	Hours	Days
Area searches*	20	4
Broadcast surveys	2	2

* In areas of less than 50 ha.

Christmas Island hawk owl

Common name	Christmas Island hawk owl
Scientific name	*Ninox natalis*
Family	Strigidae
EPBC Act status	Vulnerable



Distinctiveness

No other similar species on Christmas Island.

Movements

Sedentary.

Breeding season

Protracted; reported at all times of the year.

Habitat

Restricted to Christmas Island where it occurs in all forest types but mainly in dense rainforest on both plateau and coastal terraces.

Dispersion

Defend year-round territories that are about 18 ha on average. Generally seen in pairs or family groups.

Detectability

Nocturnally active. Secretive but tame and approachable day and night. Males often give a territorial call.

Recommended methods

Broadcast (playback) surveys are effective, especially in lead-up to breeding. Also, listening for unsolicited calls about dusk, beginning just before nightfall, especially early in the breeding season (that is, before egg laying).

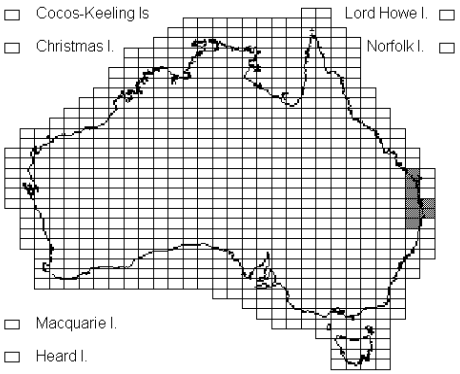
Survey effort guide

Methods	Hours	Days
Broadcast surveys*	2	2

* Conducted during the night, preferably about dusk.

Coxen's fig parrot

Common name	Coxen's fig parrot
Scientific name	*Cyclopsitta diophthalma coxeni*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

Perched birds normally unmistakable if seen clearly, though some risk of confusion with little *Glossopsitta pusilla*, musk *G. concinna* and scaly-breasted *Trichoglossus chlorolepidotus* lorikeets. Confusion with lorikeets most likely in flight (Higgins 1999).

Movements

Probably seasonal, altitudinal migrants (Holmes 1990; NSW NPWS 2002). However, movements may be a result of habitat decline and may vary with local food availability. Where food resources are capable of supporting a part or whole population throughout the year, altitudinal migrations may be reduced or absent (NSW NPWS 2002). In some highland areas, from August to February, birds may move to progressively higher altitudes following the wave of ripening fruit through the rainforests (Holmes 1995). Ripening fig and other fruit in the lowlands from March to about October may encourage the fig parrots to follow this food resource. Lowland figs have a winter fruiting peak and at this time, fig parrots may travel in search of food in small flocks (Holmes 1990).

Breeding season

Nest construction is thought to begin in August and breeding from October to December or January.

Habitat

Lowland subtropical rainforest, dry rainforest, littoral and developing littoral rainforest. Sub-littoral mixed scrub, riparian corridors in woodland, open woodland and otherwise cleared land, and urban and agricultural areas with fig trees (Holmes 1990; Garnett & Crowley 2000; NSW NPWS 2002).

Dispersion

Usually seen in pairs, especially in summer, or in small parties of up to seven, more common in winter (Holmes 1990).

Detectability

Quiet and unobtrusive when feeding. Sometimes noticed by quiet chattering calls and falling debris. May be noisy and conspicuous in flight.

Recommended methods

Search area for potential nesting trees or fruiting fig trees. Conduct watches of food trees, especially during early morning and late afternoon at dawn and dusk. These often involve observers lying on their back looking at the focal tree with binoculars. The birds are more likely to be heard than seen, and listening may also be an effective survey strategy as their calls are diagnostic. Falling fruit particles and fruit strips under trees may also indicate their presence. Surveys are organised regularly by the NSW NPWS in accordance with an established protocol (NSW NPWS 2002). These are done intermittently during the non-breeding season (January–July) to identify areas with evidence of recent nesting activity. These searches focus on preferred habitats within localities of recent, credible incidental sightings, or at localities judged to be potentially important based on knowledge of the bird's past distribution. Surveys during the breeding season are more intensive and involve searches of most probable nesting localities (NSW NPWS 2002). The NSW NPWS should be contacted to obtain information on methods and location of any traditional food trees or recent sightings near the study area.

Survey effort guide

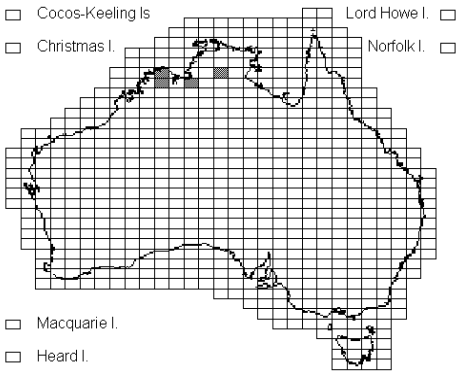
Methods	Hours	Days
Area searches*	20	5
Targeted search **	15	4

* For potential nesting and feeding trees.

** At dawn and dusk in areas where potential nesting and feeding trees have been located.

Crested shrike tit (northern)

Common name	Crested shrike tit (northern), northern shrike tit
Scientific name	*Falcunculus frontatus whitei*
Family	Pachycephalidae
EPBC Act status	Vulnerable



Distinctiveness

Unlikely to be mistaken for any other species within its range (Higgins & Peter 2002).

Movements

Not well known. Resident or present throughout the year in the Kimberley Division, Western Australia (Slater 1959) and the Top End of the Northern Territory (Higgins & Peter 2002), including the lower reaches of McArthur River (Schodde 1976).

Breeding season

In the Kimberley Division, Western Australia, eggs have been recorded in March (Storr 1980); and near Borroloola, Northern Territory, one clutch was recorded in late January (White 1914). No other information is available.

Habitat

Mainly inhabit open eucalypt woodlands, such as those dominated by *Eucalyptus opaca*, Darwin box *E. tectifica* and Roughleaf cabbage gum *E. confertiflora*, and less often in woodland dominated by Darwin woollybutt *E. miniata*, Darwin stringybark *E. tetrodonta* or smooth-stemmed bloodwood *E. bleeseri* (Sedgwick 1988; Robinson & Woinarski 1992; Franklin et al. 1997; Garnett & Crowley 2000; Higgins & Peter 2002). Recorded in areas with grassy understorey—for example, *Sorghum* spp.—but may also inhabit areas with shrubby understorey (Robinson & Woinarski 1992).

Dispersion

Usually seen singly, in twos or groups of three to five. Groups apparently widely spaced, possibly up to 20km apart (Hill 1911; Robinson & Woinarski 1992).

Detectability

Generally inconspicuous. Often noisy during the breeding season but quieter in the non-breeding season.

Recommended methods

Survey design

Broadcast surveys at a series of sites 500 m or more apart, before 11 am or after 4.30 pm. At each site the call should be broadcast for five minutes, then the player moved 5-10 m and set up to broadcast in another direction for five minutes. Responses listened for during the broadcast and at least two minutes after. Use binoculars to identify any birds active in the trees around the broadcast site. Broadcast surveys for the species should be conducted in September to March.

Area searches or transect surveys in suitable habitat. Detection mainly by call. Check for their presence in mobile foraging parties that may include varied Sittellas *Daphoenositta chrysoptera* and black-faced woodswallows *Artamus cinereus*. In dense habitat, mist-netting may also be useful in conjunction with other methods.

Survey effort guide

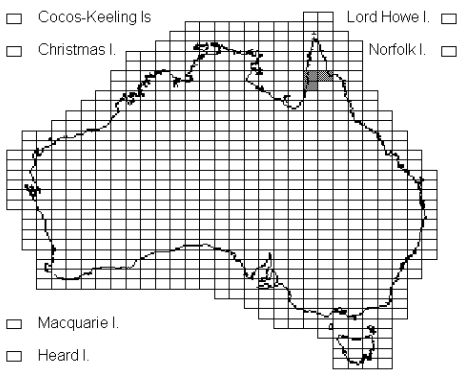
Methods	Hours	Days
Broadcast surveys*	4	3
Area searches or line transects**	8	4

* Effort indicated for September to March only.

** In areas less than 50 ha.

Crimson finch (white-bellied)

Common name	Crimson finch (white-bellied)
Scientific name	*Neochmia phaeton evangelinae*
Family	Passeridae
EPBC Act status	Vulnerable



Distinctiveness

Unlikely to be confused with other finches. Easily differentiated from the other subspecies by experienced observers.

Movements

Movements are poorly known. Regarded as sedentary with only local movements (both subspecies): analysis of count and Atlas data suggest that no long-distance movements occur (Griffioen 2001); banding studies of *N. p. evangelinae* suggest that individuals are largely sedentary (Garnett & Crowley 2000). Occurs in pairs in the breeding season and in small family parties and flocks of up to 20 birds in the non-breeding season (Blakers et al. 1984). Flocking occurs in the non-breeding season implying local movement.

Breeding season

The breeding season varies depending upon location, year and rainfall patterns (see Todd 2002). In Queensland, breeding reported from September to May but in the Northern Territory and Western Australia, towards the end of the wet season from January to April (see Campbell 1900; Gill 1970; Boekel 1980; Immelmann 1982; Strahan 1996). During a study in the eastern Kimberley, Western Australia and on Cape York, 1998-2000, breeding records of *N. p. phaeton* were obtained throughout the year, though 85 per cent were recorded during the wet season (January–May) (Todd 2002). All breeding records (n=13) for *N. p. evangelinae* were made from January to May (Todd 2002).

Habitat

Both subspecies of the crimson finch occupy vegetation associated with watercourses, including the rank grasses, *Typha* swamps, *Pandanus* and scattered shrubs of eucalypt or paperbark (*Melaleuca*) woodlands (Campbell 1900; Macgillivray 1918; Barnard 1914, 1926; Keast 1958; Boekel 1980; Immelmann 1982; Blakers et al. 1984; Garnett & Bredl 1985; Schodde & Mason 1999; Garnett & Crowley 2000; Todd 2002). Where surface water is freely available, they also occur in orchards, pineapple plantations, human settlements, the gardens of homesteads and on the margins of cane fields (Barnard 1926; Boekel 1980; Immelmann 1982; Strahan 1996; Todd 2002). At the Edward River Settlement, Cape York Peninsula, Garnett & Bredl (1985) recorded *N. p. evangelinae* in long damp grass on the edges of pandanus and paperbark swamps, and around the settlement. The habitat of *N. p. evangelinae* may be regularly burnt but the finches survive in shrubs and

nearby, unburnt remnants (Garnett & Crowley 2000). At Pormpuraaw, *N. p. evangelinae* occurs in dune swales and uses unburnt vine forest on the dunes, and a crocodile breeding lagoon, as fire refuges (Garnett & Crowley 2000).

Dispersion

Usually in pairs, sometimes solitary, often with small family parties. Often in flocks with other finches (Higgins & Peter in press).

Detectability

Not usually shy. When disturbed flies to tree or cover giving distinct call. Calls can be heard up to 100 m away (Higgins & Peter in press).

Recommended methods

Area searches or transect-point surveys in suitable habitat, such as rank grasses in riparian areas with pandanus or corypha palm, checking carefully within flocks of other finches. Detection by calls and sighting. Broadcast (playback) surveys may be useful, especially in the morning and evening. Targeted searches and watches of waterholes may also be useful in the dry season. In larger sites, vehicle transects may be an appropriate way to locate water sources and flocks of finches.

Survey effort guide

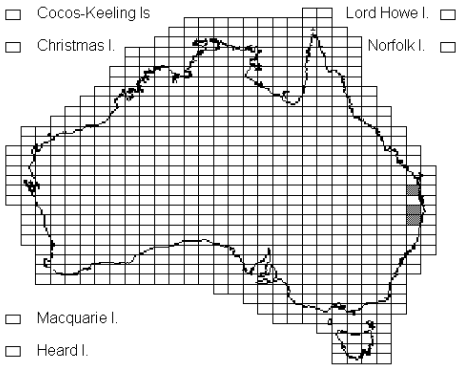
Methods	Hours	Days
Area searches and line transects*	10	5
Targeted searches**	12	2

* In areas of less than 50 ha.

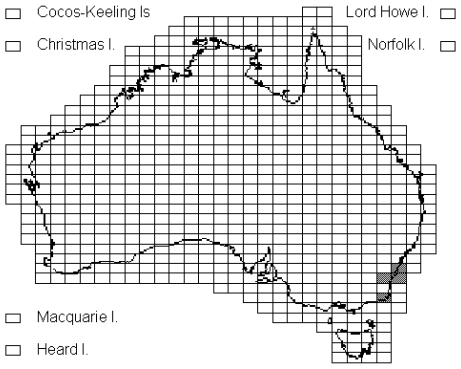
** Targeting waterholes and areas of ripening grass seed.

Eastern bristlebird

Common name	Eastern bristlebird
Scientific name	*Dasyornis brachypterus*
Family	Pardalotidae
EPBC Act status	Endangered



Eastern bristlebird (northern), *Dasyornis brachypterus monoides*



Eastern bristlebird (southern), *Dasyornis brachypterus brachypterus*

Distinctiveness

Usually distinctive given reasonable views but superficially similar to rufous scrub-bird (Higgins & Peter 2002).

Movements

Sedentary with weak flight; local movements do occur and they are able to recolonise areas after fire if there is adequate cover (Higgins & Peter 2002). Radio-tracking of 22 birds on Bherwerre Peninsula, New South Wales, for 1–41 days, indicated that birds had overlapping home ranges; the longest daily movement was 525 m (Baker 1998; Baker & Clarke 1999). Territorial in the breeding season (for example, Hartley & Kikkawa 1994; Baker 2001).

Breeding season

Breeds from August to February.

Habitat

Inhabits low, dense vegetation in a wide variety of habitats on ranges, tablelands and near coast, including sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland and rainforest (Higgins & Peter 2002). Suitable habitats are floristically diverse but all have a similar structure, providing dense, low cover, sometimes occurring as understorey below trees or shrubs (Lamb et al. 1993; Clarke & Bramwell 1998; Baker 2000). Occasionally recorded in areas infested with dense weedy undergrowth, such as among blackberries or lantana (Gibson 1977; Lamb et al. 1993; Baker 2000). Nests are placed in low, dense vegetation, usually 15–45 cm above ground, in the centre or near the base of tufted plants, especially sedges but also grasses, ferns or shrubs (Higgins & Peter 2002).

Dispersion

Usually seen singly and less often in pairs. Appear to occupy permanent home ranges or territories, that have been reported to vary up to 10 ha (Higgins & Peter 2002; J. Baker pers. comm.). Territory size is possibly larger during the breeding season than at other times (Hartley & Kikkawa 1994).

Detectability

Usually shy and furtive but sometimes inquisitive. Sings and calls throughout the year, though more frequently in the breeding season, especially at dawn and dusk (Higgins & Peter 2002).

Recommended methods

Area searches or transects of suitable habitat in the early morning or dusk, listening for unsolicited calls. Most effective in the breeding season. Broadcast (playback) surveys may also be used to solicit responses. Again, this will be most effective in the breeding season, though should be used sparingly because of the sensitivity of birds to disturbance at this time. Population locations should be kept confidential to reduce exposure of birds to call playback from birdwatching groups.

Survey effort guide

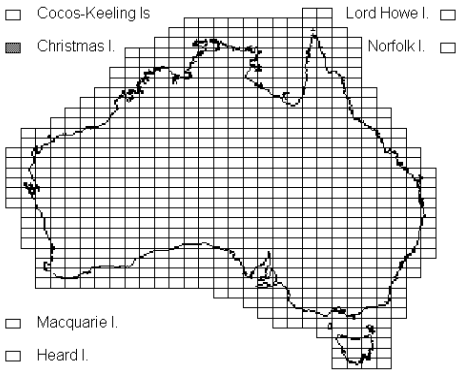
Methods	Hours	Days
Area searches and line transects*	9	3
Broadcast surveys**	5	5

* In areas of less than 50 ha.

** At dawn or dusk, only during breeding season.

Emerald dove (Christmas Island)

Common name	Emerald dove (Christmas Island)
Scientific name	*Chalcophaps indica natalis*
Family	Columbidae
EPBC Act status	Endangered



Distinctiveness

Adults easily identified. Black and chestnut barring on juveniles unmistakable (Higgins and Davies 1996). Similar to other subspecies of emerald dove (*C. i. chrysochlora* and *C. i. longirostris*), but only *C. i. natalis* occurs on Christmas Island.

Movements

Considered sedentary. Home range small. No seasonality in detectability (D. James pers. comm.).

Breeding season

Breeds between October and February.

Habitat

Prefers evergreen forest. Most common in forested areas but may be found in any habitat type. Recorded less frequently in cleared habitat (James et al. 2007).

Dispersion

Scattered throughout nearly all habitat types on Christmas Island (James et al. 2007).

Detectability

Secretive and not very confiding. In forest with dense undergrowth they can be foraging quietly on the ground nearby and go unnoticed. Easily flushed from vegetation when disturbed. Call most often in the morning. Call very low and soft, and may easily be missed if observer not concentrating or listening specifically for it, particularly amongst the loud morning call of white-eyes *Zosterops natalis* and imperial pigeons *Ducula whartoni* (D. James pers. comm.).

Recommended methods

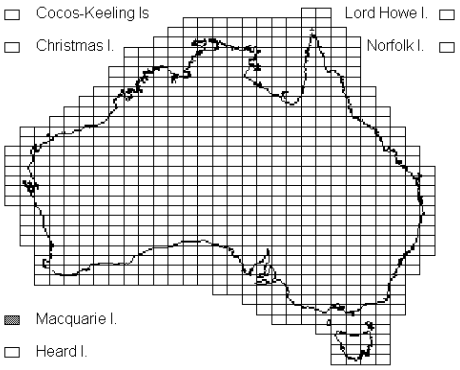
Surveys best carried out during early morning; 10-minute point surveys 500 m apart in forested habitat recommended. If not detected, wandering around plot to flush birds may be worthwhile. If present, birds should flush after only a couple of attempts.

Survey effort guide

Methods	Hours	Days
Point surveys	5	5

Fairy prion (southern)

Common name	Fairy prion (southern)
Scientific name	*Pachyptila turtur subantarctica*
Family	Procellariidae
EPBC Act status	Vulnerable; marine



Distinctiveness

The species is generally indistinguishable at sea from the fulmar prion *Pachyptila crassirostris* (Marchant & Higgins 1990), with which it probably forms a superspecies (del Hoyo et al. 1992).

Movements

Little information is available for this subspecies but some individuals may migrate north towards New Zealand and southern Australia during winter (Marchant & Higgins 1990; Garnett & Crowley 2000). In the Tasmanian region, apparently sedentary: birds can be found occupying burrows and courting at any time of year (Brothers et al. 2001). The species as a whole is migratory or dispersive but movements are poorly known.

Breeding season

Typically, breeds between September and early March (Marchant & Higgins 1990).

Habitat

Marine; found mostly in temperate and subantarctic seas. The species as a whole is abundant in south-east Australia, New Zealand and Indian Ocean waters but its oceanic distribution is poorly known. Sometimes forages over the continental shelves and continental slopes but can come close inshore during rough weather (Marchant & Higgins 1990). Breeds on islands and rock stacks; burrowing in soil or using crevices and caves in cliffs or rock falls; can also nest in scrub, herbland, tussock or pasture (Marchant & Higgins 1990).

Dispersion

Gregarious when feeding at sea and when breeding. At other times, may be solitary, in flocks or dispersed congregations (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land, except when in burrows.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Detection of flying birds and burrows with follow-up spotlighting at night when birds are active at colony. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

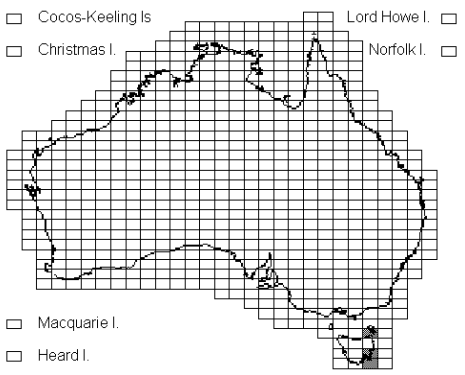
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land-based area searches and line transects**	20	4

* Most effective method to conduct during rough weather.

** In potential breeding areas during breeding season, for sites up to 10 ha with follow-up spotlighting at night.

Forty-spotted pardalote

Common name	Forty-spotted pardalote
Scientific name	*Pardalotus quadragintus*
Family	Pardalotidae
EPBC Act status	Endangered



Distinctiveness

Similar to the spotted pardalote *Pardalotus punctatus* and, to a lesser degree, the striated pardalote *P. striatus* (Higgins & Peter 2002).

Movements

Movements not well known. Adults occupy traditional breeding sites centred around white gum *E. viminalis* stands (TSU 1998). Considered more sedentary than other pardalotes, rarely moves between patches of suitable habitat. Juveniles thought to be nomadic outside breeding season, possibly dispersing from natal sites (Wall 1982; Brown 1986; Bulman et al. 1986; Bryant 1991). All banding recoveries (n=67 birds) have been within 10 km of banding sites (Higgins & Peter 2002).

Breeding season

Generally September to January. Egg laying September to December, mostly in October (Higgins & Peter 2002).

Habitat

Inhabit dry sclerophyll forest and open woodland where white gum *Eucalyptus viminalis* dominates or is at least present, and is sometimes mixed with other eucalypts such as *E. ovata, E. globulus, E. amygdalina, E. obliqua* or *E. pulchella*, usually with a moderate to low shrub layer and a dense, species-rich ground-layer of grasses and herbs, though sometimes with cultivated or open ground (Brereton et al. 1997). Prefers areas of mature trees with hollows (Woinarski & Rounsevell 1983). Typically occurs in low coastal areas in eastern Tasmania, characterised by low rainfall, rarely farther than 5 km from coast (Brereton et al. 1997).

Dispersion

Gregarious, usually seen in twos or small flocks, though occasionally singly. Territorial in breeding season. In high density population on northern Bruny Island, 1.57 breeding birds/ha; mean area of territory, 0.7 ha (S.D.=0.29; range 0.3-1.6; n=44 pairs) (Woinarski & Bulman 1985).

Detectability

Diurnally active but inconspicuous except when producing distinctive call. Presence sometimes detected by clicking sound made when feeding. Males more vocal in breeding season and both sexes respond to playback calls (Higgins & Peter 2002).

Recommended methods

Broadcast (playback) surveys in suitable habitat early in the morning, listening for solicited responses. Most effective in the breeding season. Also area searches or transect-point surveys of suitable habitat in the early morning, with detection by sight or unsolicited calls.

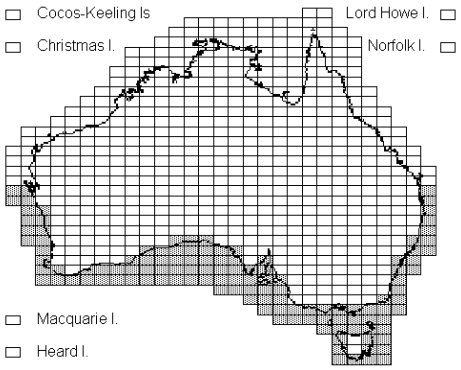
Survey effort guide

Methods	Hours	Days
Broadcast surveys	10	5
Land-based area searches or transects*	20	4

* In areas of less than 50 ha.

Gibson's albatross

Common name	Gibson's albatross
Scientific name	*Diomedea gibsoni*
Family	Diomedeidae
EPBC Act status	Vulnerable; marine



Distinctiveness

May be confused with the similar wandering albatross *D. exulans* with which it was once considered conspecific.

Movements

Poorly known. Forages widely in the Tasman Sea and south Pacific Ocean. Females frequent Tasman Sea in the vicinity of 40 ˚S; males disperse westwards at lower latitudes or travel towards the mid-Pacific Ocean. Often forages up to 1500 km away from nesting sites on Auckland Islands, New Zealand (RPAGP 2001).

Breeding season

No breeding on Australian territory.

Habitat

Principle feeding areas in Tasman sea or further south, and in the mid-Pacific Ocean (EABG 1999). In Australian waters, recorded foraging between Coffs Harbour and Wilsons Promontory. Breeding on Auckland Islands, New Zealand (Garnett & Crowley 2000 and refs within).

Dispersion

Poorly known. Nest in colonies (RPAGP 2001).

Detectability

Conspicuous at sea and on land.

Recommended methods

Survey in non-breeding season. At sea, shipboard surveys. On land, observation from onshore vantage points using telescope. Detection of flying birds. Colony sites well documented. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

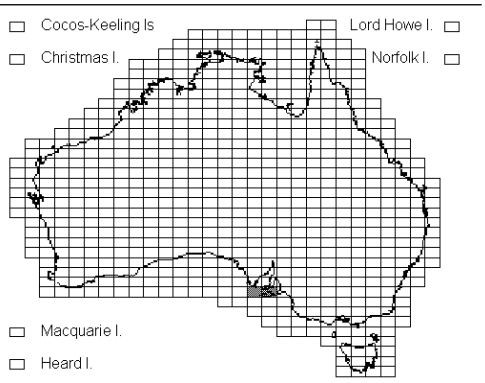
Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	3
Land-based sea observations*	8	4

* Most effective method to conduct during periods of rough weather.

Glossy black cockatoo (Kangaroo Island)

Common name	Glossy black cockatoo (Kangaroo Island)
Scientific name	*Calyptorhynchus lathami halmaturinus*
Family	Cacatuidae
EPBC Act status	Endangered



Distinctiveness

No similar species on Kangaroo Island (Higgins 1999).

Movements

Present on Kangaroo Island throughout the year but patterns of movement are not fully known. They move locally up to 12 km between breeding and feeding areas (Garnett et al. 1999), but occasionally individuals travel up to 70 km between flocks. The population is loosely segregated into six flocks (Mooney & Pedler 2004). Flock size increases in late winter, post-breeding, and conversely decreases in late summer, at the beginning of the breeding season (Joseph 1982; Pepper 1996, 1997; Mooney pers. comm.). Some birds may occasionally move to adjoining mainland (Joseph 1982, 1989; Blakers et al. 1984), however, there are no confirmed records from the mainland since 1977 (G.M. Crowley pers. comm.), although there have been several unconfirmed reports in the past 10 years (Mooney pers. comm.).

Breeding season

Eggs laid between January and July, mostly before the end of March (Garnett et al. 1999). The latest recorded fledging was 12 October (Garnett, S.T. & L.P. Pedler in Higgins 1999).

Habitat

Occurs in woodland usually dominated by drooping sheoak *Allocasuarina verticillata*, which is required for foraging, and large hollow bearing eucalypts for roosting and nesting habitat. Occurs in habitat that is intact but also isolated trees in remnant patches, surrounded by cleared agricultural land (Joseph 1982). Nests in hollow stumps or limbs, living or dead, or in a hole in the trunk of a tall tree, usually in a 20–40 m, living sugar gum *Eucalyptus cladocalyx* or a South Australian blue gum *E. leucoxylon*. Many nest trees are used repeatedly over consecutive years. Forages arboreally, almost exclusively in drooping sheoak and spends most of the day feeding in the trees, often feeding in the same tree for hours (Forshaw 1981; Joseph 1982, 1983, 1989; Pepper 1993, 1997; Garnett et al. 2000; Pepper et al. 2000; Crowley et al. 2001). Roosts communally and in traditional sites, particularly in spring (Pepper 1996). Most roost sites are in sugar gum stands (Garnett et al. 2000).

Dispersion

Usually seen in pairs, threes or small parties in the summer, gathering and roosting in flocks of up to 40 in the winter and spring (Higgins 1999). Appears to be territorial only around the active nest site, although there can be up to three active nests in a single tree (Garnett et al. 1999).

Detectability

Detection of birds by sight, foraging sign, calls and feeding sounds. Quiet and unobtrusive, though usually fly off at close approach. Feeding birds can often be located by listening for breaking of cones and falling debris. Feeding occurs all day during breeding season but non-breeding birds usually rest quietly during the middle of the day. Contact call often uttered before and during flight, and occasionally while feeding (Higgins 1999; S. Garnett pers.comm.).

Recommended methods

Presence most reliably detected through area searches or transects on foot through areas of drooping sheoak in search of sign of recent feeding, which consists of chewed cones that are either white (generated within previous 24 hours), cream (within a week) or orange (within about six weeks). Brown or grey chewed cones may be up to a year old. Birds found most readily during the first or last two hours of daylight when they are most active, usually by call. Feeding birds often detected by continual clicking of mandibles and sound of falling debris. Nesting and feeding areas are well known to staff of the federal environment department at Kingscote.

Survey effort guide

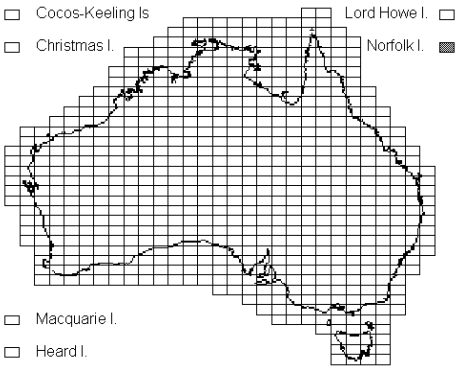
Methods	Hours	Days
Land-based area searches *	5	1
Targeted Searches**	20	4

* For each area of 50 ha or less (one day's search and morning/evening watch for breeding birds sufficient to check for feeding sign or breeding in a 50 ha patch, see above).

** Search for signs of feeding or nests.

Golden whistler (Norfolk Island)

Common name	Golden whistler (Norfolk Island)
Scientific name	*Pachycephala pectoralis xanthoprocta*
Family	Pachycephalidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species on Norfolk Island.

Movements

Resident and apparently permanently territorial (Schodde et al. 1983) at least as breeding adults. Dispersal of young unstudied and poorly known.

Breeding season

Recorded from September to February but little data (Higgins & Peter 2002).

Habitat

Usually inhabits shrubby understorey in rainforest, palm forest and Norfolk Island pine *Araucaria heterophylla* forest; also occurs in regenerating forest and gardens; sometimes in remnant patches of vegetation in farmland (Smithers & Disney 1969; Hermes 1985). In 1960s and 1970s, recorded in or at the edges of pockets of habitat, including riparian clumps of rainforest trees and thickets throughout island (Smithers & Disney 1969; Schodde et al. 1983), however, much habitat has been cleared or fragmented and range has contracted recently. Mainly confined to largest tract of remnant forest in Norfolk Island National Park (De Ravin 1975; Garnett & Crowley 2000).

Dispersion

Usually seen singly or in pairs. Apparently permanently in territories that are probably quite large (>two ha) (D. Robinson pers. comm.).

Detectability

Highly conspicuous when perched in the open. Usually located by loud calls, which carry up to 300 m. Calling apparently more frequent early in the breeding season (Higgins & Peter 2002).

Recommended methods

Broadcast (playback) surveys in suitable habitat early in the morning, listening for solicited calls and sightings. Should be most effective in the breeding season. Also area searches or transect-point surveys of suitable habitat in the early morning, for detection by sightings and calls.

Survey effort guide

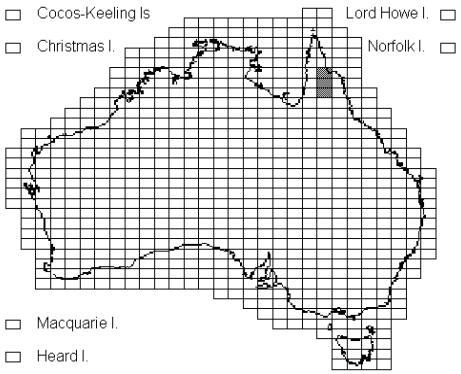
Methods	Hours	Days
Area searches or transect surveys*	10	5
Broadcast surveys**	5	5

* In areas of less than 50 ha, preferably during early morning.

** Preferably during early breeding season.

Golden-shouldered parrot

Common name	Golden-shouldered parrot
Scientific name	*Psephotus chrysopterygius*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

Occasionally mistaken for pale-headed rosella *Platycercus adscitus*, which is larger and has a pale head and breast. Nests in termite mounds, in holes similar to those of red-backed kingfisher *Todiramphus pyrrhopygia*. The nests have a round hole about 4.5 cm across and a horizontal tunnel that enters the side of a conical mound or the end of a magnetic mound. Kingfisher holes are wider than they are high, slope gently upwards, often have two small grooves in the base made by the kingfisher's feet and are commonly in the side of magnetic termite mounds (only noted in northern population) but can be the same place as the parrot's nest holes when made in conical mounds (southern population).

Movements

Sedentary. No large-scale seasonal movements and no evidence of long-distance post-breeding movement away from nesting areas. All banding recoveries (n=144) within 12 km of banding site (S.T. Garnett & G.M. Crowley in Higgins 1999) but some individuals appear to move further during wet season (S. Garnett pers. comm.). After fledging (May to August), most juveniles stay within 2–3 km of nest for about two months; then disperse, some up to at least 12 km, and form dry-season flocks, with any unmated immature males. Dry-season flocks remain sedentary, within 1 km of water, till end of dry season (October to November). Adults appear to stay near nesting sites. With first rains of early wet season, juveniles and immature and second-year males from dry-season flocks move to gravelly sites where black-faced woodswallows *Artamus cinereus* traditionally breed (and thus confined to small home-ranges) and where remaining dry-season food is still available. Parrots stay and feed in area until woodswallows finish breeding and disperse in mid-wet season (January to February).

Breeding season

Breed from March to August (dry season); eggs laid from early March to early June, with peak in early April, and last fledging mid-August (S.T. Garnett & G.M. Crowley in Higgins 1999).

Habitat

Inhabit open, wet or dry tropical savanna woodlands with canopy dominated by *Melaleuca* or *Eucalyptus* and ground layer dominated by *Schizachyrium*, *Thaumastachloa*, *Sorghum plumosum* and *Eriachne burkitti*. During dry season inhabits woodland dominated by Darwin stringybark *E. tetrodonta*, Cullen's ironbark *E. cullenii*,

E. clarksoniana, E. hylandii, ghost gum *E. papuana*, ironwood *Erythrophleum chlorostachys* and *Grevillea glauca*, with understorey of annual grasses *Schizachyrium fragile* and *S. pachyarthron*. After first rains of wet season, moves to low open woodlands dominated by broad-leafed tea-tree *Melaleuca viridiflora* and *Petalostigma banksii*, with grevillea, and understorey of fire grass *Schizachyrium*, *Planichloa nervilemma* and *Hyptis suaveolens* (S.T. Garnett & G.M. Crowley in Higgins 1999). Nests in termite mounds, mostly in mounds of *Amitermes scopulus* in ecotone between grassy flats of impeded drainage lines and interfluvial sand ridges, or on metamorphic boundary between sandstone and granite in low hills. Sometimes also in mounds of *Amitermes laurensis* on grassy flats or *Nasutitermes triodiae* on sandy ridges. Mainly forages on ground, in dry season preferring recently-burnt grassland. Also forages in trees, on leaves and flowers, and on ground beside roads. During middle of day, loafs below canopy in shady trees along watercourses or in patches of dry rainforest, with as many as 30 in one tree; usually congregates at same place each day (S.T. Garnett & G.M. Crowley in Higgins 1999).

Dispersion

Gregarious, usually in pairs or family parties. Nests as close as 100 m but never in sight of each other and mostly more dispersed (S.T. Garnett & G.M. Crowley in Higgins 1999).

Detectability

Quiet, inconspicuous and generally allow close approach. Presence in an area usually detected from discovery of nest holes. Nests of the year have a fresh pile of dirt below hole. Old nests, and particularly shorter exploratory tunnels, can still be present more than a decade after excavation, although become increasingly weathered and most built over within a season of use. Old nests can also be detected by presence of 5–10 cm diameter honeycombed patch of spent pupae of commensal moth *Trisyntopa scatophaga*, even if old tunnel obstructed. Live birds usually detected by call. In the mornings calls frequently when leaving roost sites to feed or drink. Gives alarm calls when flushed from feeding activities and when flushed from daytime roost, which may be from 9 am to 4 pm during the dry season. Breeding females sometimes flushed from nests before nest holes seen, and during late wet season and early dry season commonly feed at roadsides from which they are flushed by passing vehicles. In the dry season, flocks come to waterholes, including farm dams, but absence from waterholes may mean birds are drinking from dew in tree tops. In early wet season usually found near black-faced woodswallows with immature males remaining with woodswallows well into breeding season (S.T. Garnett & G.M. Crowley in Higgins 1999).

Recommended methods

Area searches through suitable habitat. Detection by call, sightings and observation of nest holes in termite mounds. Holes similar to, but distinguishable from, red-backed kingfisher *Todiramphus pyrrhopygia* (see above). Targeted searches and watches at waterholes may also be useful in the dry season. Also check for association with breeding black-faced woodswallows.

Survey effort guide

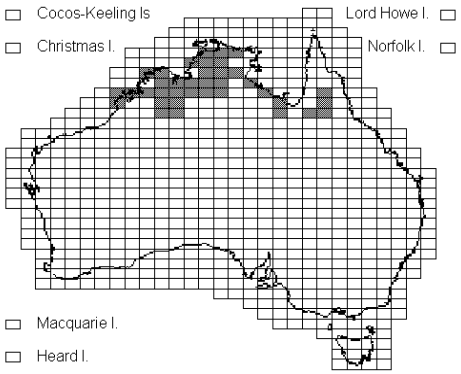
Methods	Hours	Days
Targeted searches*	12	4
Area searches**	10	2

*Targeting waterholes during late dry season (September to November) and flocks of woodswallows (November to January).

** In areas of suitable habitat less than 50 ha.

Gouldian finch

Common name	Gouldian finch
Scientific name	*Erythrura gouldiae*
Family	Passeridae
EPBC Act status	Endangered



Distinctiveness

Adults unmistakable; green flush to mantle distinguishes immature birds from immatures of other co-occurring finches.

Movements

Woinarski and Tidemann (1992) reported flocks appearing irregularly and briefly in locations where they were not normally known, and suggested that nomadism may be a response to conditions of the late dry-season where localised fires, rainstorms, water availability and phenological variation in vegetation may create a dynamic patchwork of environments. From recent studies at Yinberrie Hills, there is no indication of large-scale movement (Dostine 1998). However, there are regular and predictable local shifts in habitat use throughout the year. During and following nesting (mostly between March and July) near Katherine, Nothern Territory, birds are mostly confined to hill woodland, which support high densities of territory salmon gum *Eucalyptus tintinnans*. Soon after the simultaneous germination of *Sorghum intrans* seed in the early wet season, they move to sites where new grass seed is available from early seeding perennial grasses. Long distance movements are possible, as evidenced by sightings near Simpson Desert (M. Mathieson pers.comm.).

Breeding season

Breeds in the second half of the wet season (February to April), with a longer season (January to August) when extended rains provide ample seeds (Storr 1977, 1984; Woinarski & Tidemann 1991; Tidemann & Woinarski 1994; Tidemann et al. 1999).

Habitat

Occupies tropical eucalypt woodlands and paperbark woodlands, usually with a grassy understorey and usually in the vicinity of water (Barnard 1914; Immelmann 1965; Storr 1977, 1980, 1984; Blakers et al. 1984; Woinarski & Tidemann 1991, 1992; Dostine 1998; Schodde & Mason 1999; Garnett & Crowley 2000). In the Northern Territory, most known breeding sites are in hilly terrain in woodland dominated either by territory salmon gum *Eucalyptus salmonophloia* or snappy gum *Eucalyptus brevifolia* (Dostine 1998). For much of the dry season remains in the breeding habitat but uses a variety of woodland types in adjacent lowlands during

the wet. Nests at heights of 6–13 m above the ground in tree hollows, including territory salmon gum and snappy gum (Berney 1903; Smedley 1904; Barnard 1914; Immelmann 1965; Dostine 1998; Tidemann et al. 1999; Garnett & Crowley 2000).

Dispersion

Mostly seen in pairs within small groups inside breeding season, especially in afternoon. Outside breeding season in larger flocks, frequently tens, rarely in hundreds. Often mixes with other finches, such as masked *Poephila personata* and long-tailed *P. acuticauda* finches (Higgins & Peter in press).

Detectability

Usually shy; when disturbed flies directly to trees or cover. Usually quiet but gives high-pitched contact call, often louder in afternoons (Higgins & Peter in press).

Recommended methods

Targeted searches and watches at waterholes late in the dry season. Also check for association with breeding black-faced woodswallows *Artamus cinereus* in early wet season. Area searches in suitable habitat may also be useful.

Survey effort guide

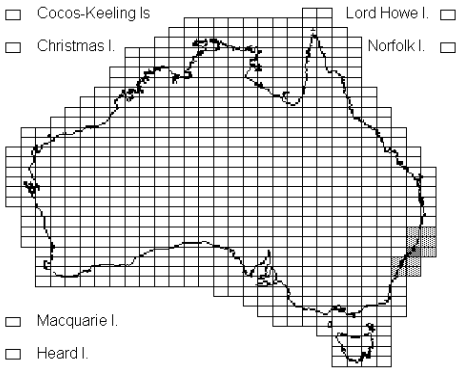
Methods	Hours	Days
Targeted searches*	12	4
Area searches**	20	5

* Targeting waterholes during dry seasons and flocks of black-faced woodswallows in early wet season.

** In areas of less than 50 ha.

Gould's petrel

Common name	Gould's petrel
Scientific name	*Pterodroma leucoptera leucoptera*
Family	Procellariidae
EPBC Act status	Endangered; marine



Distinctiveness

In Australian waters, similar to Cook's *Pterodroma cookii* and black-winged *P. nigripennis* petrels (Marchant & Higgins 1990).

Movements

Movements are poorly known away from breeding island; difficult or impossible to separate at sea from *P. l. caledonica* (Marchant & Higgins 1990). After breeding, most likely to move to northern Tasman Sea and possibly east to central Pacific (P.J. Fullagar in Marchant & Higgins 1990). Thought to feed locally during breeding season although records are few (Hindwood & Serventy 1941). Some beachcast specimens of nominate form recorded from south-east Queensland, New South Wales and Victoria (Gibson & Sefton 1957) and one from Western Australia. Leaves Cabbage Tree Island late March to early May and returns mid to late September.

Breeding season

Returns to colony mid to late September; laying mostly late November to early December; hatching about 10 January; fledging by mid-March to early May (Hindwood & Serventy 1941; Fullagar 1976).

Habitat

Marine; at-sea range in Australian waters poorly known. Probably in cooler tropical waters. Observed over warm East Australian Current but also waters of sea-surface temperatures of 9.7 to 23 °C over continental slope and open ocean. Pelagic and occasionally offshore; rarely observed less than 10 km from breeding island (Hindwood & Serventy 1941). Breeds only at Cabbage Tree and Boondelbah Islands, New South Wales. Nests in rock crevices, under fallen palm *Livistona australis* fronds or in hollows in fallen palm trunks and buttresses of figs *Ficus* spp.; in sloping gullies under palm-forest, from just above sea-level to 120 m above sea level (Fullagar 1976). Roosts at night, often in pairs in cavities beneath rocks (Marchant & Higgins 1990).

Dispersion

Usually seen singly at sea; gregarious at night over colonies. Nests are often clumped and may be less than a metre apart (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land, except when in burrows.

Recommended methods

At sea, shipboard surveys. On land, area searches of potential nesting sites after dark during the early breeding season when the colonies are most active. Visual detection of landed birds with spotlight and flying birds by vocalisation. Colony sites well documented (see above).

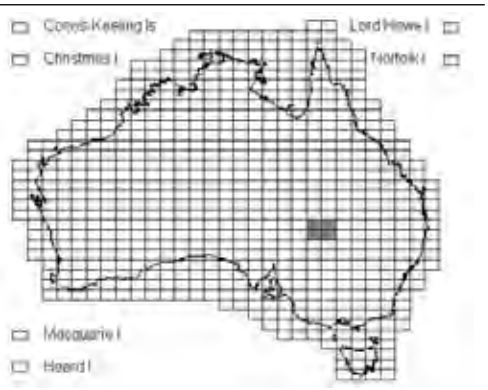
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based area searches*	20	4

* In potential breeding areas during breeding season, for sites up to 10 ha.

Grey grasswren (Bulloo)

Common name	Grey grasswren (Bulloo)
Scientific name	*Amytornis barbatus barbatus*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Very similar to the Diamantina River subspecies *A. b. diamantina*, but note that distributions of the two subspecies do not overlap. Grey Grasswren (Bulloo) has less distance between throat tips of black crescents and heavier streaking on breast than *A. b. diamantina*.

Movements

Described as sedentary ground and tussock birds (Schodde and Christidis 1987).

Breeding season

Nests with eggs or young recorded in July and August (Favaloro and McEvey 1968; Robinson 1973; *in* Higgins et al. 2001). Recently fledged chicks observed in August (Hardy 2002).

Habitat

Occur in dense thickets of lignum *Muehlenbeckia cunninghamii* interspersed with samphire *Halosarcia pergranulata* on swampy floodplains (Hardy 2002).

Dispersion

Occur in groups (D. Ingwersen pers. comm.).

Detectability

Generally shy and secretive, though may be observed and heard calling perched atop bushes (Higgins et al. 2001). Difficult to observe in dense habitat though may be seen perched and preening at top of lignum bushes when undisturbed (Rowley and Russell 1997). Sometimes venture on to open ground to forage between clumps of vegetation (Higgins et al. 2001).

Recommended methods

Broadcast (playback) surveys in combination with area searches recommended. Ideally mist-netting would only be used where banding is required, and in this case, would be used in combination with broadcast surveys.

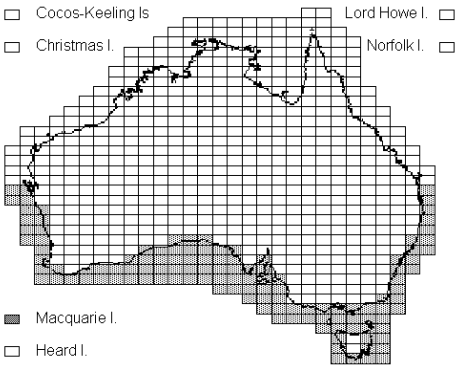
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	15	3
Broadcast surveys*	15	3
Mist-netting	15	3

* In areas of less than 50 ha.

Grey-headed albatross

Common name	Grey-headed albatross
Scientific name	*Thalassarche chrysostoma*
Family	Diomedeidae
EPBC Act status	Vulnerable; marine



Distinctiveness

Similar to black-browed *D. melanophris*, Buller's *D. bulleri* and yellow-nosed *D. chlororhynchos* albatrosses.

Movements

Breeding and non-breeding birds disperse widely across the Southern Ocean. Occur at more southerly latitudes in summer more than in winter, off southern Australia and New Zealand (Marchant & Higgins 1990).

Breeding season

Broadly, September to May (Marchant & Higgins 1990).

Habitat

Pelagic, in shelf-break and deeper offshore waters; only occurs inshore in rough weather. Breeds colonially on well-vegetated Antarctic and subantarctic islands, including Macquarie Island (Marchant & Higgins 1990).

Dispersion

Solitary or gregarious at sea. Highly gregarious in colonies at breeding grounds (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land. Vocal at colonies (Marchant & Higgins 1990).

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment and the Australian Antarctic Division, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

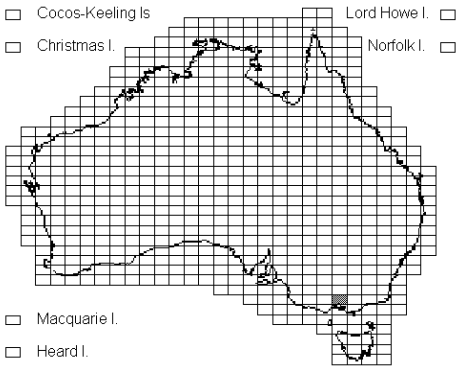
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land area searches or transect surveys**	12	4

* Most effective method to conduct during periods of southerly onshore winds and rough weather.

** In potential breeding areas during breeding season, for sites up to 10 ha.

Helmeted honeyeater

Common name	Helmeted honeyeater
Scientific name	*Lichenostomus melanops cassidix*
Family	Meliphagidae
EPBC Act status	Endangered



Distinctiveness

May be confused with subspecies *L. m. gippslandicus* although generally do not occur together. These taxa are impossible to discriminate without having the bird in the hand. *L. m. meltoni* does overlap seasonally, though experienced observers can distinguish these in the field.

Movements

The helmeted honeyeater is sedentary, and usually occurs in discrete colonies located in dense streamside habitat (Franklin et al. 1999; Menkhorst et al. 1999; Higgins et al. 2001). During the non-breeding season, territorial behaviour is less intense and there is local movement along streamside habitat and on to the adjacent slopes associated with feeding on flowers of swamp gum *E. ovata*, mountain swamp gum *E. camphora*, messmate *E. obliqua* and green scent-bark *E. fulgens*. Such winter movements usually involve immatures and adults without breeding territories and a few breeding females. These adult females disperse up to several kilometres in winter, usually returning to the same territory and partner in the following breeding season. Immature females disperse further from their natal territory than immature males and rarely settle in their natal colony.

Breeding season

The breeding season is highly regular and protracted (see Franklin et al. 1995, 1999; Menkhorst et al. 1999; Higgins et al. 2001). The first eggs are usually laid in mid-August and the last in mid-January to late-February

Habitat

Confined to narrow patches of mountain swamp gum, *E. camphora*, forest with thickets of scented paperbark, *Melaleuca squarrosa* and woolly tea-tree *Leptospermum lanigerum* in understorey, or with reeds and sedges (McMahon & Franklin 1993; Menkhorst et al. 1999; Higgins et al. 2001).

Dispersion

Usually seen in pairs or small groups. Defends all-purpose territories year-round, though less vigorously in non-breeding season. At Yellingbo, territories clustered in loose colonies with individual pairs occupying 0.2–1ha (Franklin et al. 1999; Higgins et al. 2001).

Detectability

Active, noisy and conspicuous.

Recommended methods

Area searches or transect-point surveys of suitable habitat for detection of birds by call and sightings. Only known populations, one at Yellingbo Nature Conservation Reserve and an incipient colony established at Bunyip State Park by release of captive-bred birds, are closely monitored by the Department of Sustainability and Environment, Victoria, and reportings outside known colonies are investigated.

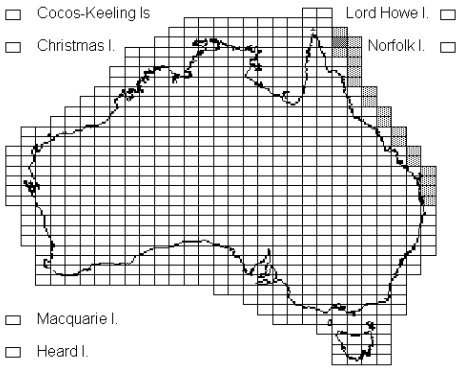
Survey effort guide

Methods	Hours	Days
Area searches*	8	2
Line transects*	8	2

* In areas less than 50 ha.

Herald petrel

Common name	Herald petrel
Scientific name	*Pterodroma heraldica*
Family	Procellariidae
EPBC Act status	Critically endangered; marine



Distinctiveness

The herald petrel has recently been separated from *P. arminjoniana*, of the Indian Ocean (Brooke & Rowe 1996; Warham 1996; Garnett & Crowley 2000), which has been named the Round Island petrel (Garnett & Crowley 2000). Almost all records in the Australasian region have been of *Pterodroma heraldica* (Izzard & Watson 1980; Marchant & Higgins 1990).

Movements

The herald petrel is described as a dispersive or migratory species but the pattern of movement is poorly known (Marchant & Higgins 1990; del Hoyo et al. 1992). The Australian population is absent from the breeding colonies on Raine Island at least from November to January (King 1984; Marchant & Higgins 1990; del Hoyo et al. 1992). In other parts of the Pacific, a continuous presence at breeding colonies is reported (Marchant & Higgins 1990). In the central Pacific, it is recorded as far north as 39 °N, with most observation from October to January (Gould 1983). During the same period, it has been recorded off Nowra and Sydney, New South Wales, Burleigh Heads, Queensland, and in the Tasman Sea, which suggests that some birds follow the East Australian Current south from the Coral Sea during summer (King 1984; Marchant & Higgins 1990). It has also been seen off Ballina, New South Wales (Izzard & Watson 1980) and in the Coral Sea away from Raine Island in May (Stokes & Corben 1985; Marchant & Higgins 1990). The latter record suggests that there are unrecorded breeding islands in the Coral Sea (King 1984), though post-juvenile dispersal is wide. On Raine Island, adult petrels are absent by day but return mid- to late afternoon to roost on the ground under vegetation (Marchant & Higgins 1990).

Breeding season

Resident and breeding on Raine Island from February to at least September, followed by post-breeding dispersal and feeding at sea by both adults and juveniles (King 1984; Marchant & Higgins 1990; King & Reimer 1991; del Hoyo et al. 1992). The breeding period is from July to September (King & Reimer 1991; King 1996). On Raine Island, nests have been recorded in July and August, and chicks in July (King 1984; King & Reimer 1991).

Habitat

The herald petrel is a marine, pelagic species of tropical and subtropical waters (Marchant & Higgins 1990; del Hoyo et al. 1992). Published sightings off eastern Australia from the edge of the continental shelf, 30–36 km offshore, and over water 250–270 m deep (Izzard & Watson 1980; McBride & Hobcroft 1984; Marchant & Higgins 1990). Nests on tropical and subtropical islands, atolls, cays and rocky islets (Marchant & Higgins 1990; del Hoyo et al. 1992). In the Australasian region, breeding only known from Raine Island, Queensland, where the birds nest on the ground on a low sand ridge, under a mat of dense shrubs (*Achyranthes aspera, Abutilon indicum, Amaranthus leptostachys, Sesbania cannabina*), creepers (*Tribulus cistoides*) and grass (*Lepturus repens*) (King 1984, 1996; King & Reimer 1991; Garnett & Crowley 2000).

Dispersion

Solitary or in small parties at sea. Gregarious at breeding sites.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Detection of flying birds and nests. Colony sites well documented (Queensland National Parks and Wildlife Service and the Great Barrier Reef Marine Park Authority). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

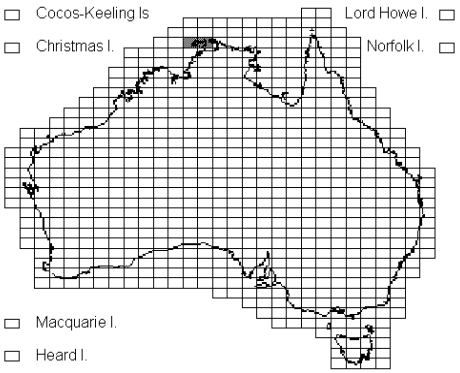
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land-based area searches or transects**	20	4

* Most effective method to use during rough weather.

** In areas up to 10 ha.

Hooded robin (Tiwi Islands)

Common name	Hooded robin (Tiwi Islands)
Scientific name	*Melanodryas cucullata melvillensis*
Family	Petroicidae
EPBC Act status	Endangered



Distinctiveness

Adult and immature of both sexes not likely to be confused with other taxa. Juvenile very similar to juvenile mangrove robin *Eopsaltria pulverulenta alligator*, the two taxa both occurring on Bathurst and Melville Is. However occupy very different habitats: mangrove robin occupies coastal mangrove communities while hooded robin is found in lightly-timbered habitat, especially woodlands and shrublands (Higgins and Peter 2002).

Movements

Sedentary (J. Woinarski pers. comm.).

Breeding season

Unknown.

Habitat

Unknown.

Dispersion

Unknown.

Detectability

Reasonably conspicuous by sight, however were not detected from 1998 to 2008 during extensive survey work (J. Woinarski pers. comm.). Last known records are of a few individuals on Bathurst and Melville Islands in the 1980s (J. Woinarski pers. comm.).

Recommended methods

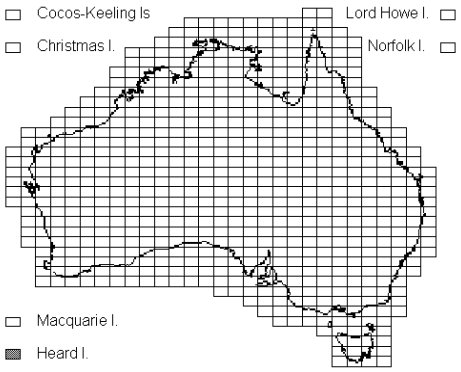
Previously used methods involved driving slowly around all tracks on island for several weeks. Used photos or stuffed specimens of hooded robins to ask Tiwi people about any knowledge of the species. Also spent several weeks walking transects within the range of available habitats (treeless plains, woodland, open forest etc.) (J. Woinarski pers. comm.).

Survey effort guide

Considerable search effort (over several weeks) using the slow-driving method is likely to be required as there have been very few recent records. Contact the Department of Natural Resources, Environment the Arts and Sport (NRETAS) for advice.

Imperial shag

Common name	Imperial shag, Herd shag
Scientific name	*Phalacrocorax nivalis*
Family	Phalacrocoracidae
EPBC Act status	Vulnerable; marine



Distinctiveness

No similar species on Heard Island (Marchant & Higgins 1990).

Movements

Local movements are confined to Heard Island (Marchant & Higgins 1990). Regular daily movement of non-breeding birds from roosting sites at Stephenson Lagoon to feed in shallow waters off Elephant Spit at east end of Heard Island (Green 1997a). In mid-February, adults and juveniles move from breeding sites on north-west coast to roosts in the south-east, especially Stephenson Lagoon (K. Green in Marchant & Higgins 1990). Date of return to breeding colonies not recorded (Marchant & Higgins 1990), however, nest construction begins May (Green 1997b).

Breeding season

Laying may start as early as second week of September and continue to third week of November. Laying usually begins in early to mid-October, lasting till early November (H.R. Burton & D.L. Williams in Marchant & Higgins 1990; Green 1997b). Chicks generally hatch in November and early December; fledge and depart colony from January to February (Green 1997b).

Habitat

Marine. Forage in coastal shallows (Marchant & Higgins 1990). Breeds on sea-facing cliff tops on nearby vegetated stack (50 m offshore), among tussock grass and *Azorella* spp. (Marchant & Higgins 1990). One colony is situated on flat ground, others on steep vegetated slopes or cliffs (Green 1997a). Roosting sites are more widely distributed than breeding sites; on cliff-tops, offshore stacks, cobbles on beaches; sandy beaches and areas of volcanic sand on headland (Marchant & Higgins 1990; Green 1997a; E. Woehler pers. comm).

Dispersion

Gregarious. Nests in colonies of 30–1000 pairs (Marchant & Higgins 1990; Woehler 2000). Density not measured but appears to vary with habitat (E.J. Woehler in Marchant & Higgins 1990) and is greatest on flat coastal terrace at Cape Pillar (E. Woehler pers. comm.).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Colony sites well known and monitored by the Australian Antarctic Division. Three of four are readily accessible but remoteness of the Cape Pillar colony prevents regular island-wide censuses (E. Woehler pers. comm). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

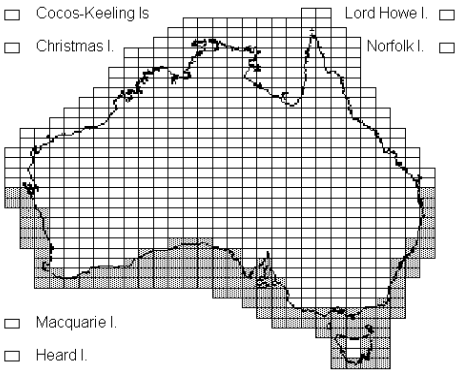
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land area searches or transect surveys**	12	4

* Most effective method to use during rough weather.

** In areas up to 10 ha.

Indian yellow-nosed albatross

Common name	Indian yellow-nosed albatross
Scientific name	*Thalassarche carteri*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

May be confused with the yellow-nosed albatross *T. chlororhynchos* from which it has been recently separated.

Movements

Poorly known. Occurs in both pelagic and inshore waters between 15 ˚S and 50 ˚S. Even during the breeding season, adults can be found foraging in distant subtropical waters (RPAGP 2001).

Breeding season

No breeding on Australian territory.

Habitat

Mostly forages in the southern Indian Ocean, where particularly abundant off Western Australia. Breeding on islands in the Indian Ocean (Marchant & Higgins 1990).

Dispersion

May be solitary or feed in groups with other albatross species at sea. May nest as dispersed pairs or as part of loose colonies (RPAGP 2001).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, observation from onshore vantage points using telescopes. Detection of flying birds and nests. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

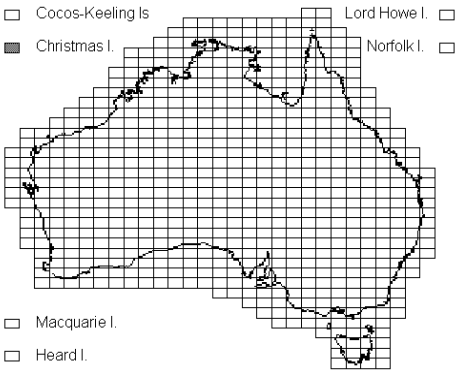
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective method to use during rough weather.

Island thrush (Christmas Island)

Common name	Island thrush (Christmas Island)
Scientific name	*Turdus poliocephalus erythropleurus*
Family	Apodidae
EPBC Act status	Endangered



Distinctiveness

No similar taxa on Christmas Island.

Movements

Unknown; probably sedentary.

Breeding season

Known to breed from October to mid-March. (Carter 2000).

Habitat

Abundant in most habitats. More frequent in evergreen forest than in disturbed habitat (James et al. 2007). Occurs in rainforest, human settlements (for example, around houses where it forages on lawns), and golf courses.

Dispersion

Widespread (James et al. 2007).

Detectability

Detected from sightings. Common and often tame, exceptionally approachable and will sometimes inquisitively approach observers (Carter 1994; Higgins et. al. 2006). Actively forages on ground in gardens, on lawns and in clearings, tossing leaves and scratching through litter.

Recommended methods

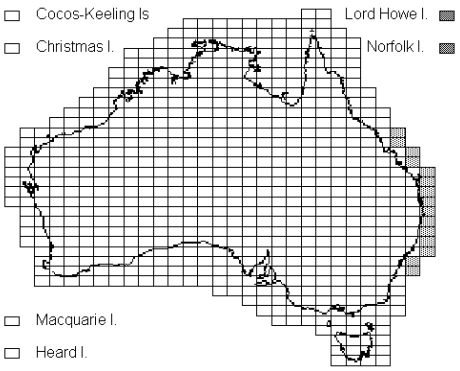
Surveys best carried out during early morning; 10-minute point surveys 500 m apart in forested habitat recommended.

Survey effort guide

Methods	Hours	Days
Point surveys	5	5

Kermadec petrel (western)

Common name	Kermadec petrel (western)
Scientific name	*Pterodroma neglecta neglecta*
Family	Procellariidae
EPBC Act status	Vulnerable; marine



Distinctiveness

In Australian territory, very similar to herald *P. heraldica* and Round Island *P. arminjoniana* Petrels, which are also polymorphic. Around breeding locations of Lord Howe and Norfolk Islands, similar species is providence petrel *P. solandri* (Marchant & Higgins 1990).

Movements

Migratory or dispersive from breeding islands, some birds moving to tropical North Pacific in non-breeding season (Marchant & Higgins 1990). In western part of range most breeding is in summer. Departs Lord Howe, Raoul and Kermadec Islands from April to June (Marchant & Higgins 1990). In non-breeding season, movements poorly known. Thinly scattered throughout North Pacific to about 40 °N, with peak in abundance from November to January (Gould 1983; Marchant & Higgins 1990; Spear et al. 1992).

Breeding season

On Raoul Island, arrives in August and lays eggs from 20 October to 6 December. First young about mid-December; all departed by early June. On Meyer Island, no consistent seasonality, with clutches recorded in most months of year, although most laying recorded from November to February or March, continuing to lesser degree to June (Veitch & Harper 1998). At Ball's Pyramid, New South Wales, regular spring–summer seasonality of occurrence (P. Fullagar pers. comm.)

Habitat

Marine, pelagic; in subantarctic and Antarctic waters. Birds breeding close to Antarctic convergence. Winter range extends into subtropics in some areas.

Dispersion

Usually solitary at sea, sometimes in small groups, more rarely large flocks. Nest in large colonies with densities up to 4000 nests/ha (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys for nest sites during the breeding season. Also as birds are nocturnal, spotlight searches at night for landed birds and vocal detection of flying birds around colony. Colony sites well documented (contact the relevant state agency). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

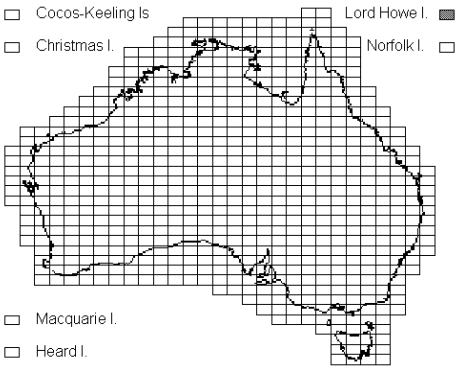
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based area searches or transects*	20	4

* In areas up to 10 ha.

Lord Howe Island currawong

Common name	Lord Howe Island currawong, pied currawong (Lord Howe Island)
Scientific name	*Strepera graculina crissalis*
Family	Artamidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species on Lord Howe Island.

Movements

Little known. Birds are said to be highly mobile (Garnett & Crowley 2000), but there is little supporting evidence, with some individuals moving up to 2 km (18 per cent of island's length) in single flights between the summit of Mt Gower and the eastern slopes of Mt Lidgbird (McFarland 1994). Territories are defended during the breeding season (Hutton 1991) but also outside the breeding season. Territories are on average 10 ha but possibly expand or contract from year to year according to family size (Knight 1987).

Breeding season

Little information. Nesting has been recorded in November and December (McFarland 1994) but Basset Hull (1909) states that the breeding season is July to September.

Habitat

Little information on specific habitat requirements. Typically occurs in tall, undisturbed forest but also visits remnant forest patches within the settlement area (Knight 1987; Hutton 1991; D. McFarland pers. comm.). Knight (1987) found that birds occupy territories always including a section of stream or gully with tall timber.

Dispersion

Most often seen in small parties, occasionally singly (Higgins & Peter in press).

Detectability

Conspicuous with loud distinctive call.

Recommended methods

Area searches or transect surveys of suitable habitat. Detection by sight and distinctive call.

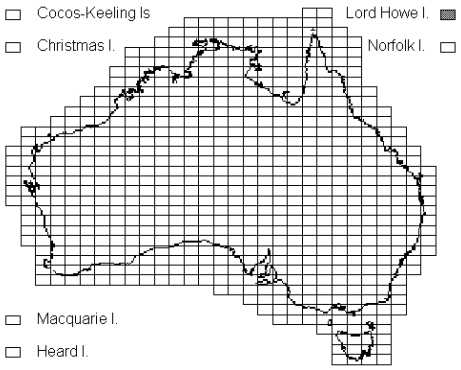
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	8	4

* In areas up to 50 ha.

Lord Howe woodhen

Common name	Lord Howe woodhen
Scientific name	*Tricholimnas sylvestris*
Family	Rallidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species on Lord Howe Island.

Movements

Sedentary and flightless; no records from the scattering of small offshore islets (see Marchant & Higgins 1993). On Mt Gower, juveniles disperse between June and July.

Breeding season

On Mt Gower, laying occurs between August and January (Marchant & Higgins 1993).

Habitat

Occurs in closed forest on boulder-covered slopes, steep scree, valleys and plateaux and near cliffs (Hindwood 1940; Hutton 1991; Marchant & Higgins 1993; Garnett & Crowley 2000). At high altitudes, occurs in gnarled mossy forest, which is unique to the mountain summits and dominated by hotbark (*Bubbia howeana*), *Dracophyllum fitzgeraldii*, pumkin tree (*Negria rhabdothamnoides*), palms and tea-tree (*Leptospermum polygalifolium*), with an understorey of tree ferns (*Cyathea* spp) (Hutton 1991; Marchant & Higgins 1993; Garnett & Crowley 2000). Rarely found in rainforest, the most widespread habitat on the island. Prefer palm-dominated lowland closed forest on igneous soils, possibly because there is more food available close to the soil surface (Hutton 1991; Marchant & Higgins 1993). Nests on the ground in thick vegetation, under tree roots and fallen logs (Hindwood 1940; Marchant & Higgins 1993). Roost sites difficult to find because they are often in dense vegetation (Marchant & Higgins 1993). These include petrel burrows, thick clumps of ferns, small caves or open tracks (where birds may huddle). When with young, adults may use brood-nests at night or during inclement weather (Marchant & Higgins 1993).

Dispersion

Strongly territorial. Observed singly, in pairs or family groups (Marchant & Higgins 1993).

Detectability

Diurnal and nocturnal. Alert and wary but not shy and will investigate noises. Vocal and will respond readily to broadcast (playback) surveys (Marchant & Higgins 1993).

Recommended methods

Area searches or transect surveys of suitable habitat. Detection by sight and call. Broadcast surveys useful for solicited response calls, though generally not necessary. The woodhen population is monitored annually by the banding of birds (Garnett & Crowley 2000).

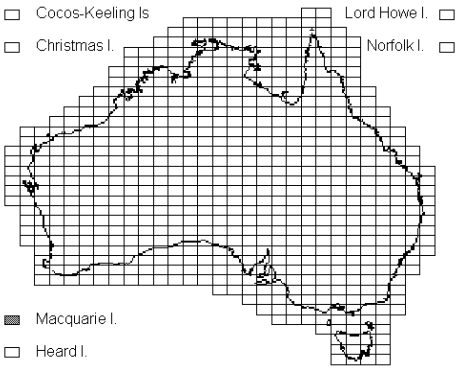
Survey effort guide

Methods	Hours	Days
Broadcast surveys	2	2
Area searches or transect surveys*	20	4

* In areas up to 50 ha.

Macquarie shag

Common name	Macquarie shag
Scientific name	*Phalacrocorax purpurascens*
Family	Phalacrocoracidae
EPBC Act status	Vulnerable; marine



Distinctiveness

No similar species on Macquarie Island (Marchant & Higgins 1990).

Movements

Confined to local movements at Macquarie Island. Inability to make headway against winds greater than 40 knots (Brothers 1985), small wings, heavy bones and water-permeable plumage, (which prevents long rests on water) restrict long-range movements (Marchant & Higgins 1990). Large foraging flocks leave roosting and nesting areas before 10 am and return at about 4 pm (W. Vestjens in Marchant & Higgins 1990).

Breeding season

Nest-building starts in July. Earliest laying 30 September, latest in mid-January but mostly in last half of October and first half of November. Most eggs hatched by late December. Fledging from late January to mid-February (Marchant & Higgins 1990).

Habitat

Marine; subantarctic inshore waters of Macquarie Island and outliers. Feeding grounds are nearshore as sea-bottom drops away steeply. Feeds mainly along less steep, western shore. Forages in shallow waters under rocks and in kelp beds (Marchant & Higgins 1990). Most breeding colonies exposed to prevailing westerly wind. Offshore stacks also used. Largest colonies are among boulders on shore of main island because small stacks accommodate fewer pairs (Brothers 1985). Roosts solitarily or in small to large (600–800 birds) flocks on bare ground.

Dispersion

Flies, feeds, rests and nests in small groups or colonies. Nests 1–2 m apart (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, area searches and observation from onshore vantage points (using telescopes) of colonies on offshore stacks during the breeding season. Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

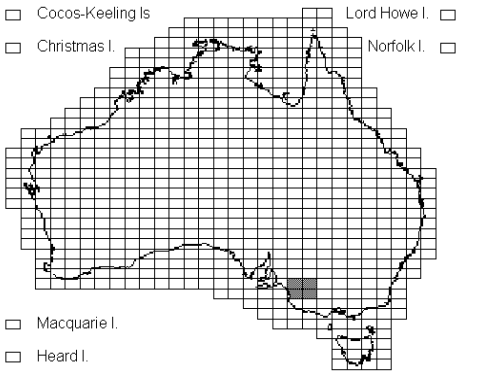
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land-based area searches**	12	4

* Most effective method to use during rough weather.

** In areas up to 10 ha.

Mallee emu wren

Common name	Mallee emu wren
Scientific name	*Stipiturus mallee*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Unmistakable within restricted range of species.

Movements

Sedentary (S Brown pers. comm.; Schodde 1982; Emison et al. 1987) but are apparently able to colonise new and sometimes distant habitats when they become available after fires (Emison et al. 1987).

Breeding season

Breeding season begins late July/early August with the setting up of territories and they breed until late December or possibly longer depending on seasonally favourable weather conditions (S Brown pers. comm.). Most nests recorded from September to November (Rowley & Russell 1997; Higgins et al. 2001).

Habitat

Associated with *Triodia* spp. (hummock grasses), which the birds depend on for foraging, nesting and protection (S Brown pers. comm.), occurring on low dunes, with or without an overstorey of low woodland dominated by mallee eucalypts such as lerp mallee *Eucalyptus incrassata*, white mallee *E. dumosa* or narrow-leaved red mallee *E. leptophylla*, cypress pine *Callitris* spp. and low shrubs (Howe 1933; Carpenter & Matthew 1986; Schodde 1982; Rowley & Russell 1997; Higgins et al. 2001). Sometimes occurs in low mallee-heath dominated by tea-trees, banksias and casuarinas, with silver broom *Baeckia behrii* and common fringe-myrtle *Calytrix tetragona* (Hatch 1977; Carpenter & Matthew 1992; Rowley & Russell 1997; Higgins et al. 2001). Possibly prefers dense stands of tall unburnt spinifex (Howe 1911, 1933; Howe & Tregellas 1914; Wilson 1912; Schodde 1982).

Dispersion

Gregarious; seen singly or, more usually, in pairs or small groups. Probably territorial in breeding season but may roam more widely outside this period. Pairs occupy breeding territories of about 5 ha (S Brown pers. comm.).

Detectability

Shy, secretive and usually detected by feeble call (Higgins et al. 2001). Described as cryptic (S Brown pers. comm.).

Recommended methods

Detection by calls and sightings. Species cryptic so repeated survey effort on large transects recommended. Fixed length transects of 500 m using frequent playback recording (for example, every 100 m) in suitable habitat. Surveys should ideally be carried out from dawn until mid-morning in windless conditions. Observers require excellent hearing in order to hear species' high-pitched call. Optimal time for surveying is early spring (August–September) when birds are vocally establishing breeding territories, however respond well to playback recording at all times of the year (S. Brown pers. comm.).

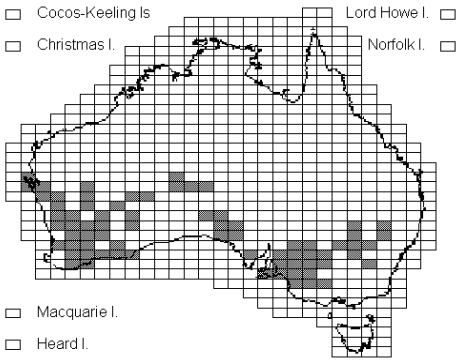
Survey effort guide

Methods	Hours	Days
Transect surveys*	20	5
Broadcast surveys*	20	5

* In areas less than 50 ha. Methods carried out simultaneously.

Malleefowl

Common name	Malleefowl
Scientific name	*Leipoa ocellata*
Family	Megapodiidae
EPBC Act status	Vulnerable



Distinctiveness

Unmistakable.

Movements

Malleefowl are sedentary and most established pairs and individuals remain in the same area throughout the year (see Frith 1962b; Marchant & Higgins 1993; Benshemesh 2000; Garnett & Crowley 2000). Over the course of a year, adult pairs may roam over an area of one to several kilometres. During the breeding season, males remain close to the nest most of the time. May display local shifts in home range between seasons or years. Young birds disperse long distances. Anecdotal reports suggest dispersion is through corridors of native vegetation, as indicated by sightings of single birds and pairs walking along roadside remnants at considerable distances from larger remnants (Benshemesh 2000).

Breeding season

Egg laying usually starts in September until mid- to late-summer or sometimes early autumn. Chicks usually begin hatching and emerging from the mound in November and most usually emerge before January but in some seasons hatching may continue until March.

Habitat

Found in semi-arid to arid shrublands and low woodlands dominated by mallee and associated habitats, such as broombush *Melaleuca uncinata* and native pine *Callitris* spp. scrub (Frith 1962a, b; Marchant & Higgins 1993; Benshemish 1999; Garnett & Crowley 2000). Favours mallee that is long unburnt and ungrazed (that is, old growth). In the Victorian mallee, the optimal fire frequency is likely to be one fire every 60 years or longer. At edge of range, also occurs in non mallee-dominated eucalypt woodlands (Benshemesh 2000). Also occurs, although less frequently, in scrubs of acacia in central Australia (Marchant & Higgins 1993; Benshemesh 1997, 2000). Nests in the portions of their home ranges that support light, sandy soil and an abundance of leaf litter for construction and heating of the incubation mound (Frith 1962b; Marchant & Higgins 1993; Benshemesh 2000; Garnett & Crowley 2000). Forages on the ground in leaf litter or among low vegetation, such as herbs and shrubs (Marchant & Higgins 1993; Benshemesh 2000; Garnett & Crowley 2000).

Dispersion

Usually solitary away from nest mound during the laying season; often in pairs at active nests and outside the laying season. Occupies home range that varies between and within locations from 0.5–5 km² (Marchant & Higgins 1993).

Detectability

Generally wary of humans. Cryptic plumage makes them difficult to detect despite their large size. Occasionally utters distinctive calls. Footprints are distinctive and provide the best means of detection in more open, sandy areas and along sandy tracks. Nest mounds are also conspicuous.

Recommended methods

In the semi-arid zone and agricultural regions, area searches in suitable habitat for active mounds, tracks and sightings are the best method of detection. Transect surveys along sandy tracks for footprints also useful. Aerial surveys for the detection of mounds may also be effective in extensive areas of relatively open habitat. In arid regions, transect searches for footprints in sandy areas are most effective provided surveys are done at least a week after wet and excessively windy weather. Work is underway to develop a survey technique that uses air-borne infra-red scanners to detect the heat emitted from open malleefowl nests early on spring mornings (Benshemesh & Emison 1996).

Survey effort guide

Methods	Hours	Days
Area searches*	10	
Transect surveys**	30	
Aerial surveys***		

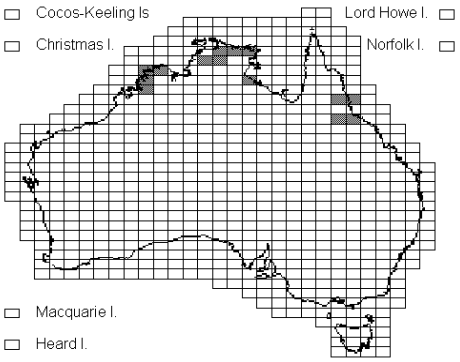
* Surveys for mounds, footprints and birds, per 50 ha.

** Transects about 1km apart for footprints in suitable arid habitat, per 5000 ha.

*** As long as is required to conduct sufficiently close transects over the area. Surveys for mounds.

Masked owl (northern)

Common name	Masked owl (northern)
Scientific name	*Tyto novaehollandiae kimberli*
Family	Tytonidae
EPBC Act status	Vulnerable



Distinctiveness

Where ranges overlap, may be confused with the barn owl *T. alba* and grass owl *T. capensis*.

Movements

Sedentary.

Breeding season

Poorly known. Probably March to October.

Habitat

Reported in riverside forest, rainforest, open forest, paperbark swamp and edge of mangroves, as well as along the margins of sugarcane fields. Usually nest in hollow trees, within patches of closed forest and feed in open woodland (Higgins 1999).

Dispersion

Territorial. Usually seen singly but occasionally in pairs or family groups. Very low density in the Northern Territory and Kimberley and apparently declining in north-east Queensland (Higgins 1999).

Detectability

Strictly nocturnal; cryptic and quiet. Usually located by call. Said to be noisy in months before breeding and quieter after incubation starts. Presence during the day sometimes indicated by alarm calls of smaller birds.

Recommended methods

Broadcast (playback) surveys effective in suitable habitat, especially in lead up to breeding season. Detection of solicited responses. Area and transect searches unlikely to be useful due to nocturnal habits and cryptic nature. May also be attracted by squeaky noises.

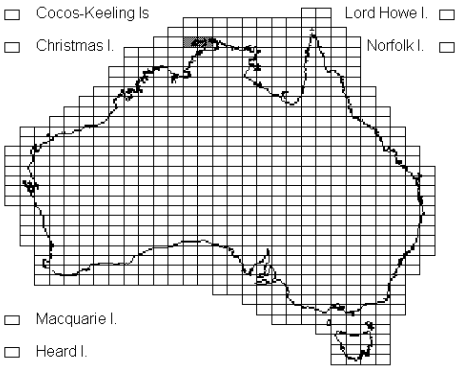
Survey effort guide

Methods	Hours	Days
Broadcast surveys*	8	4

* Most effective in lead-up to breeding season.

Masked owl (Tiwi Islands)

Common name	Masked owl (Tiwi Islands)
Scientific name	*Tyto novaehollandiae melvillensis*
Family	Tytonidae
EPBC Act status	Endangered



Distinctiveness

No other similar species on the Tiwi Islands.

Movements

Sedentary.

Breeding season

Poorly known. Probably March to October.

Habitat

Restricted to Bathurst and Melville Islands. Occurs primarily in tall, open eucalypt woodland and occasionally in plantations of introduced Caribbean pine *Pinus elliotti*. Probably nests in large eucalyptus trees with numerous hollows (Garnett & Crowley 2000 and refs therein).

Dispersion

Territorial. Usually seen singly but occasionally in pairs or family groups.

Detectability

Strictly nocturnal; quiet and cryptic. Usually located by call. Said to be noisy in months leading up to breeding, quieter after incubation starts. Presence during the day sometimes indicated by alarm calls of smaller birds.

Recommended methods

Broadcast surveys effective in suitable habitat, especially in lead-up to breeding season. Detection of solicited responses. Area and transect searches unlikely to be useful due to nocturnal habits and cryptic nature. May also be attracted to area by squeaky noises.

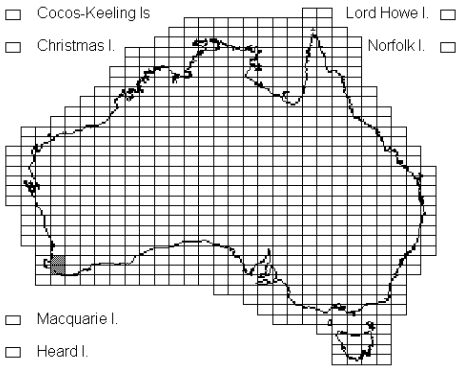
Survey effort guide

Methods	Hours	Days
Broadcast surveys*	8	4

* Most effective in lead-up to breeding season.

Muir's corella

Common name	Muir's corella, western long-billed corella (southern)
Scientific name	*Cacatua pastinator pastinator*
Family	Cacatuidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to little corella *C. sanguinea*.

Movements

Apparently movements are only local. No evidence of large-scale seasonal movements. At Lake Muir the population said to move north after breeding to spend the non-breeding season (summer) to the east of Boyup Brook. They are said to spend the summer in one or two large flocks (Saunders et al. 1985; Smith & Moore 1992). However, this movement was not obvious during population surveys between 1991 and 1997 (Massam, M. in Higgins 1999).

Breeding season

Generally September to December (Carter 1912, 1924; Forshaw 1981; Johnstone & Storr 1998).

Habitat

Woodlands on the drier, eastern side of the main forest block in south-west Australia. Specifically, in eucalyptus woodlands dominated by wandoo *E. wandoo*, marri *E. calophylla* or jarrah *E. marginata*. With clearing for agriculture, most woodland is now reduced to remnant patches, in or adjacent to farmland or along roadsides. Often occurs in farmland, especially croplands and, sometimes, pasture, where there are ample watering points and nearby large trees for roosting or breeding (Carter 1912; Forshaw 1981; Saunders et al. 1985; Smith & Moore 1991; Mawson & Long 1994; Higgins 1999; Garnett & Crowley 2000). Breeds in hollows in large, old eucalypts in woodland and remnant woodland, now often nests in lone trees in paddocks and along roadsides. The trees used are very old: in one study in the Lake Muir area the age of the trees used for nesting ranged from 167 to 1333 years (Mawson & Long 1994). Mostly nests in living trees but will nest in dead trees. Living trees must have dead limbs (Carter 1912, 1924; Mawson & Long 1994; Johnstone & Storr 1998; Higgins 1999). Pairs may use a different hollow each year or use the same hollow for up to three consecutive seasons (Carter 1912, 1924). Usually feed on the ground in open areas, such as pasture or mown firebreaks at the edge of crops, and formerly, on sandplains (Carter 1912; Smith & Moore 1991; Smith, G. in Higgins 1999).

Dispersion

Gregarious, especially when roosting and foraging (Higgins 1999).

Detectability

Active, noisy and conspicuous but normally wary.

Recommended methods

Transect surveys from vehicles through suitable habitat. Detection by observation and calls. Also aerial surveys over extensive areas. Targeted surveys of remnants with suitable nesting and roosting trees in predominantly agricultural landscapes may also be useful.

Survey effort guide

Methods	Hours	Days
Transect surveys*	8	4
Targeted surveys**	8	4
Aerial surveys***	4	2

* May be conducted from vehicles where appropriate.

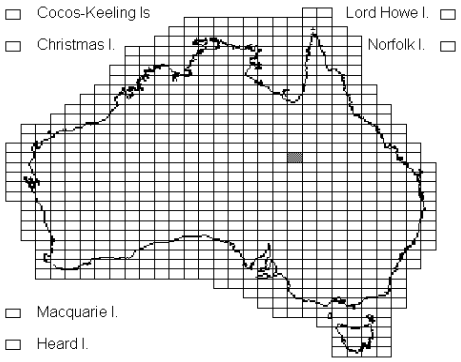
** Targeting remnants of suitable habitat in agricultural areas.

*** As long as is required to conduct sufficiently close transects over the area.

Erratum April 2017 – the survey guidelines for the night parrot in this document are out of date. Appropriate survey methods for night parrot are available at https://nightparrot.com.au/index.php/advice/, which is maintained by the night parrot recovery team.

Night parrot

Common name	Night parrot
Scientific name	*Pezoporus occidentalis*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

Superficially similar to ground parrot *Pezoporus wallicus* and budgerigar *Melopsittacus undulatus* (Higgins 1999).

Movements

Unknown and too few records or reports to assess. Almost everything written on the movements of this species is speculative (Higgins 1999). Only real evidence of movements are observations of Andrews in northern South Australia in 19th century where present in wet seasons when seed plentiful, and absent in dry seasons when no seed available (Higgins 1999). Variously said to be nomadic or to have very large home ranges or that birds might be sedentary while conditions remain suitable and move in response to availability of food and water (Higgins 1999). Fly to water up to a distance of 6.5 to 8 km (Higgins 1999).

Breeding season

Said to breed after abundant rainfall but poorly known (Higgins 1999).

Habitat

Arid and semi-arid zones in spinifex *Triodia* or *Plectrachne* grasslands in stony or sandy areas including sandplains, hills and escarpments. Also shrubby samphire and chenopod associations, including saltbush *Atriplex*, bluebush *Maireana* and *Bassia* on floodplains, claypans or at edges of saltlakes, creeks and other watercourses. Also occur at ecotone of each of these habitats (Higgins 1999). Road-killed specimen found near Boulia, western Queensland, in area of low, sparse Mitchell grass *Astrebla*, burr-daisy *Calotis* and chenopods, with some areas of bare gibber (Boles et al. 1994), although possibly accidentally transported to this site from elsewhere (Higgins 1999). Roost during day; beneath dense clumps of spinifex or in thick patches of shrubby samphire or chenopods. May sometimes roost in caves or shelter in tunnels dug into sand (Higgins 1999).

Dispersion

Most sightings (confirmed and unconfirmed) have been of singles, twos, with some small groups (Higgins 1999).

Detectability

Nocturnal and secretive. Concealed beneath vegetation during the day. Voice is little-known but calls are apparently distinctive (Higgins 1999).

Recommended methods

Targeted searches at isolated waterholes and subsequent evening watches. Area searches for feathers around waterholes and in the nests of other birds. Area searches from camels may improve habitat access and coverage whilst providing observer with a higher vantage point and greater field of view. Team of sniffer dogs may also be useful in seeking this species but highly trained dogs and handlers would be essential.

Survey effort guide

Methods	Hours	Days
Targeted searches*	Unknown	Unknown
Area searches**	Unknown	Unknown
Sniffer dog surveys	Unknown	Unknown

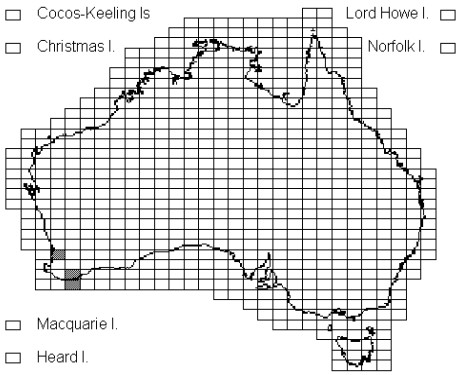
* Targeting waterholes in suitable habitat in evening and spotlighting in dense, seeding spinifex.

** Possibly with the aid of camels.

A considerable undefined amount of effort would be required.

Noisy scrub bird

Common name	Noisy scrub bird
Scientific name	*Atrichornis clamosus*
Family	Atrichornithidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to western bristlebird *Dasyornis longirostris*.

Movements

Sedentary and not known to move seasonally, though some dispersal occurs, probably by young birds. However, the movement of translocated males after release and natural dispersal shows that they are capable of moving up to 10 km. They disperse along corridors of continuous cover and will cross roads but not cleared land. New territories and subpopulations, which have been assumed to result from the dispersal of young, have been located about 3 km from original breeding population. One male (age unknown) heard calling at Mt Taylor, moved at least 8 km (Blakers et al. 1984; Smith 1985a; 1985b; Burbidge et al. 1986; Danks 1991, 1993).

Breeding season

Breeds mainly April to October, with peaks during late June and late August (Smith & Robinson 1976), with some (possibly replacement) clutches laid in early October, extending the season to November (Danks et al. 1996). Most young hatch during late July or early August and fledge during late August or early September (Danks et al. 1996).

Habitat

Inhabits dense undergrowth in the wetter parts of dense, low, coastal eucalypt forests and scrub/thicket adjoining swamps or drainage lines. Most abundant in areas that have been unburnt for more than 20 years, colonising areas between two and 10 years after a fire (Burbidge et al. 1986; Smith 1996; Danks et al. 1996). Thought to formerly have preferred habitat in wetter areas within the distribution of marri *Eucalyptus calophylla* and jarrah *E. marginata* forest, where breaks in the canopy promoted the development of a dense layer of shrubs, rushes and sedges, favouring the ecotone between forest and swamps but also occurring near other wetlands. Also occupied drier slopes away from wetlands, which supported dense middle and upper storeys and a relatively open ground layer with a thick cover of litter. Ecotones provided dense cover for nests and the drier slopes provided feeding habitat. Noisy scrub bird now occupies only a small part of its former range but such habitat could conceivably be re-occupied—for example, through translocation.

Dispersion

Territorial males defend long-term territories using song. The core area within a male's territory is constant throughout the year and between years, and is probably maintained for life. Females are also found to nest in same area each year, often within 5 m of previous nest. Mean territory size is 6 ha. The male spends about 80 per cent of his time in a core area of the territory of about 1.25 ha, from which he does most singing. During the breeding season, the male moves slowly around his territory each day, except when moving to and from roosting areas. Little is known of the daily movements of or area used by females.

Detectability

Extremely secretive. Much more often heard than seen and almost never away from dense cover. Calls of males powerful and directional (Higgins et al. 2001). Birds spend more time calling before and during the breeding season (Smith & Forrester 1981).

Recommended methods

Area searches or transect-point surveys early in the morning in suitable habitat. Detection mostly by call. Most effective before and during the breeding season. At low densities, if area searches or transects unsuccessful, broadcast surveys in suitable habitat early in the morning, listening for solicited responses.

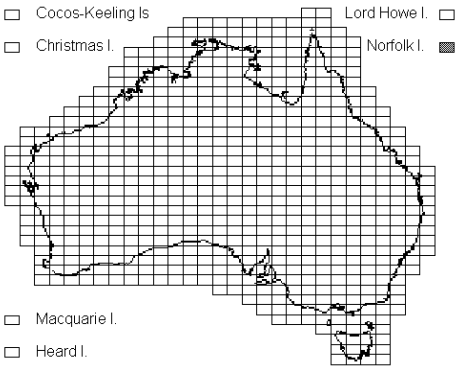
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	8	4
Broadcast surveys*	6	3

* In areas less than 50 ha. Most effective in lead-up to, and during, breeding season.

Norfolk Island boobook owl

Common name	Norfolk Island boobook owl, southern boobook
Scientific name	*Ninox novaeseelandiae undulata*
Family	Strigidae
EPBC Act status	Endangered



Distinctiveness

No other similar species on Norfolk Island although remaining population phenologically indistinct from nominate subspecies *T. n. novaeseelandiae*, which has hybridised with all remaining individuals. This subspecies is regarded as phenologically extinct by Garnett & Crowley (2000).

Movements

Sedentary.

Breeding season

Laying from September to October, fledging December to January (Olsen 1996).

Habitat

Restricted to Norfolk Island. Most recent records from native forest or exotic Eucalypt plantation; favours areas with relatively clear understorey, free of woody weeds. Currently all nesting in nest boxes (Garnett & Crowley 2000 and refs therein).

Dispersion

Territorial. Seen singly, in pairs or family groups.

Detectability

Inconspicuous by day but call frequent and distinctive, especially before laying and when feeding offspring. May be heard for up to 1 km (dependent on topography and conditions). Mainly nocturnal but sometimes crepuscular. Roost often revealed by presence of whitish excreta and pellets on foliage or ground beneath site.

Recommended methods

Area searches or transect-point surveys in suitable habitat beginning just before dusk with spotlight, especially just before breeding season. Check nest boxes for signs of active use. Detection by call. Listening for unsolicited first call made on departure from day roost, about dusk. Broadcast (playback) surveys in suitable habitat, listening for solicited responses; most effective early in the breeding season (that is, before egg laying). As most if not all individuals are banded and the whereabouts of breeding pairs known, contact the Conservator, Department of Environment and Heritage, Norfolk Island.

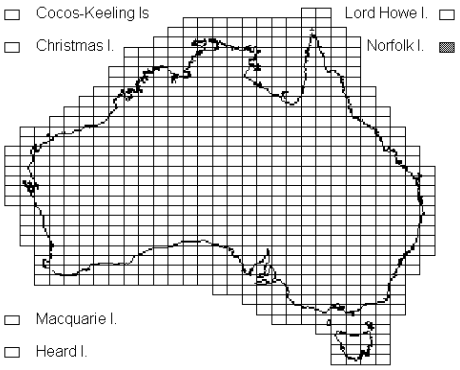
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	12	4
Broadcast surveys	8	4

* Searches at night with spotlight in areas less than 50 ha.

Norfolk Island green parrot

Common name	Norfolk Island green parrot, red-crowned parakeet (Norfolk Island)
Scientific name	*Cyanoramphus cookii (previously C. novaezelandiae cookii)*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

No similar species on Norfolk Island.

Movements

The species is regarded as sedentary and occurs in most habitats throughout the year (Higgins 1999). Individuals and flocks visit gardens (from Mt Pitt) at times when trees are fruiting (Higgins 1999).

Breeding season

Egg-laying has been recorded in all months of the year, peaking from December to March and declining between September and November (Hicks & Greenwood 1989; Lane et al. 1998; Higgins 1999; Hill in prep.).

Habitat

Occurs in tall, dense, remnant Norfolk Island pine rainforest and other native vegetation or eucalypt plantations, orchards and gardens near native forest (Hicks & Greenwood 1989; Higgins 1999; Garnett & Crowley 2000; Hill in prep.). Forages in all habitats but only nests in native tree species (Lane et al. 1998; Hill in prep.). Usually nests in a hollow or cavity in the limb, trunk or stump of living or dead trees, especially larger native trees, but sometimes at ground level (Hicks & Greenwood 1989; Lane et al. 1998; Higgins 1999; Garnett & Crowley 2000; Hill in prep.). Forages at all levels in habitats from ground to canopy, depending on location of seasonally available food (Higgins 1999). Adults prefer to feed in the canopy in forested areas; however, for three to five weeks after fledging, juveniles feed extensively on the ground eating fallen seeds of African olive and red guava (Lane et al. 1998; Higgins 1999; Garnett & Crowley 2000; Hill in prep.). Also feeds in highly modified or disturbed areas on exotic plants (for example, fruit trees in orchards and gardens), especially where native vegetation has been removed (Forshaw & Cooper 1989; Higgins 1999; Hill in prep.). Generally roosts in concealed areas, including in holes in trees, rock crevices, burrows, under overhanging rocks and vegetation, and in thick vegetation such as epiphytes, tussocks, sedges and ferns; often in nesting sites (Higgins 1999).

Dispersion

Gregarious, usually in pairs, family parties or small groups (Higgins 1999).

Detectability

Tame but generally quiet and inconspicuous. Detection by calls and sighting. Calls are loudest when in flight (Higgins 1999).

Recommended methods

Area searches or transect surveys in suitable habitat. Detection by sighting and call. The population is monitored by the federal environment department (contact the Conservator, Norfolk Island). Most nest sites are known and improved by Department of Environment and Heritage.

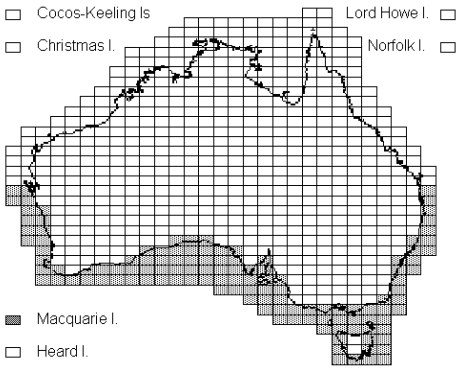
Survey effort guide

Methods	Hours	Days
Area searches and transect surveys*	8	4

* In areas less than 50 ha.

Northern giant petrel

Common name	Northern giant petrel
Scientific name	*Macronectes halli*
Family	Psittacidae
EPBC Act status	Vulnerable; Marine



Distinctiveness

Similar to the southern giant petrel, which also breeds on Macquarie Island (Bourne & Warham 1966).

Movements

Some adults remain near breeding colonies throughout year. Immatures undertake long movements. Juveniles leave breeding areas from late January to March (Macquarie Island, mid-March). Adult movements in winter poorly known but some may travel widely. Juveniles apparently undertake circumpolar movements. Chicks banded at Macquarie Island have been recovered eastwards. Sightings associated with cold fronts passing across South Pacific suggest trans-oceanic journeys, particularly by immatures. High banding recovery rates in Australian waters during winter suggest that these may be important wintering areas for Macquarie Island birds. No banding recoveries south of 50 °S; 95 per cent of banding recoveries from Macquarie Island were between 25 °S and 45 °S (Marchant & Higgins 1990). In south-eastern Australian waters, birds (mostly immatures) were recorded in all months but were most common from May to September with peak numbers in July (Reid et al. in press).

Breeding season

Breeding pairs establish their nest sites in August and lay their single egg between August and October, which hatches 60 days later. At Macquarie Island, eggs are laid from 10 October to 27 October and hatch from 15 December to 2 January.

Habitat

Marine, oceanic; mainly in subantarctic waters, but regular in Antarctic waters of south-west Indian Ocean, Drake Passage and west of Antarctic Peninsula. Range extends into subtropical waters mainly in winter and spring. Frequents both oceanic and inshore waters near breeding islands and in non-breeding range; during first year, mainly continental shelves, slopes and cold eastern boundary currents off South America, South Africa, Australia and New Zealand. Possibly more oceanic from second year on. Attracted to land at sewage outfalls and scavenge at colonies of penguins and seals (Marchant & Higgins 1990). Breeds on subantarctic islands, breeding range extending into Antarctic zone at South Georgia. Nests in coastal areas where vegetation or broken terrain offers shelter. Tussock-grass (*Poa* spp) widespread at many breeding sites. Feeds from sea surface while swimming, or dives to 2 m depth (Marchant & Higgins 1990).

Dispersion

Gregarious on breeding grounds but also nests solitarily at Macquarie Island. At sea, congregates around food or when washing and preening (Marchant & Higgins 1990).

Detectability

Conspicuous at sea. Often follows ships.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

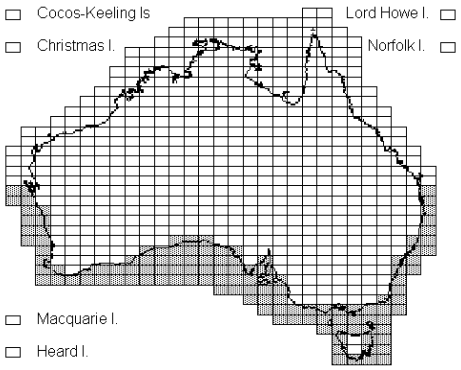
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land area searches and transect**	12	4

* Most effective method to use during rough weather.

** In areas up to 10 ha.

Northern royal albatross

Common name	Northern royal albatross
Scientific name	*Diomedea sanfordi*
Family	Diomedeidae
EPBC Act status	Endangered



Distinctiveness

May be confused with the southern royal albatross *D. e. epomophora* with which it was considered conspecific until recently.

Movements

Range widely over the Southern Ocean at latitudes between 36 °S and 52 °S. Adult birds thought to undertake long-range migrations between breeding seasons. Individuals disperse to the southern Atlantic and Pacific Oceans near the southern portion of South America as well as the southern Indian Ocean and south-eastern Australia (RPAGP 2001).

Breeding season

No breeding in Australian territory.

Habitat

Regularly recorded feeding in Tasmanian and South Australian waters, and less regularly off New South Wales. Non-breeding range extends to south-west Atlantic. Breeding on Chatham Islands and Taiaroa Head, New Zealand (EABG 1999; Garnett & Crowley 2000).

Dispersion

Normally widespread and solitary or in small groups at sea.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. The use of berley during shipboard surveys may help to attract birds and draw them in for closer observation. On land, observation from onshore vantage points using telescopes. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

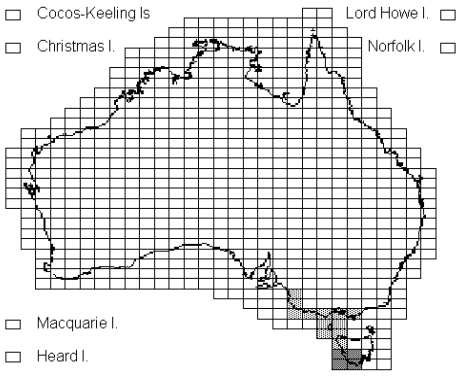
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective method to use during periods of rough weather.

Orange-bellied parrot

Common name	Orange-bellied parrot
Scientific name	*Neophema chrysogaster*
Family	Psittacidae
EPBC Act status	Critically endangered



Distinctiveness

Usually distinctive within core breeding habitat, however often confused with blue-winged and elegant parrots (Higgins 1999).

Movements

Migratory. Breeds south-west Tasmania and migrates north, along western and north-western coast of Tasmania through western Bass Strait to spend non-breeding period on mainland Australia between Spencer Gulf in South Australia, and Sydney in New South Wales, although the majority of the population is centred on the area between Gippsland in Victoria, and the Coorong in South Australia. Returns to Tasmania via same (reverse) route. Northward migration protracted (late January–July); southward migration rapid (September to November). Numbers, which are recorded at regularly-used sites on passage, vary unpredictably (Brown & Wilson 1984). Occasionally some birds stay in Tasmania for entire non-breeding season (Higgins 1999).

Breeding season

Breeds November to mid-February (Brown & Wilson 1984; North). Eggs, late November and mid-December (Holdsworth pers. comm.). At Melaleuca, Tasmania, between 1959 and 1997, first birds usually arrived between 29 September and 15 October (Brown & Wilson 1984; M. Holdsworth) and most have arrived by early November; inspects nests soon after arrival; occupies nests from late October; most young fledge, late January to mid-February; adults depart the breeding area late February to early March; juveniles leave mid-March to late April (Brown & Wilson 1984).

Habitat

Breeds usually within 5 km of high-tide level. Inhabits near-coastal buttongrass *Gymnoschoenus sphaerocephalus* plains and sedgelands, with patches of Smithton peppermint *Eucalyptus nitida* forest (Milledge 1972; Brown 1980, 1984; Brown et al. 1985; Starks et al. 1992; Tas. Bird Rep. 7). Nests in hollows in limb or trunk of mature eucalyptus trees; usually Smithton peppermint, and sometimes swamp gum *E. ovata*; in forests and copses near buttongrass plains (Hinsby 1947; Brown & Wilson 1982; Brown 1984; Stephenson 1991). At Melaleuca, has used nest boxes since 1991 (M. Holdsworth). On passage in western and north-west Tasmania, occurs in dunes, heathland, coastal grasslands and pasture and, in north-west Tasmania,

in saltmarsh (Brown 1980, 1984; Brown & Wilson 1982; Brown et al. 1985; Stephenson 1991; Tas. Bird Reps). On mainland Australia, mostly within 3 km of coast (Starks et al. 1992) but a few recent records up to 10 km inland. In Victoria, mostly in sheltered coastal habitats such as bays, lagoons and estuaries, or, rarely, saltworks; in low samphire herbland dominated by beaded glasswort *Sarcocornia quinqueflora*, sea heath *Frankenia pauciflora* or Sea-blite *Suaeda australis*, and in taller shrubland dominated by shrubby glasswort *Sclerostegia arbuscula*; sometimes in low samphire dominated by grey glasswort *Halosarcia halocnemoides*, or in *Chenopodium* herbfields (Belcher 1914; Watson 1955; Carr & Kinhill Planners 1979; Yugovic 1984; Loyn *et al* 1986, 1994; Hewish & Starks 1988; Starks 1988, 1992, 1993, 1995; Stephenson 1991; Forshaw 1969; P.W. Menkhorst). Also occurs on grassy fairways of golf courses adjacent to *Sclerostegia* shrubland; sewage-filtration paddocks; grassy tracks around edges of sewage-treatment ponds or other grassy areas near saltmarsh; and in weedy pastures and seed crops such as sunflower and opium poppy (Wheeler 1950; Jarman 1965; Forshaw 1969; Jessop & Reid 1986; Loyn et al. 1986; Starks 1988, 1992, 1994, 1995; Eckert 1990; Holdsworth pers. comm.).

Dispersion

Usually seen singly or in pairs or family parties on breeding grounds; in winter areas, typically encountered in small flocks, sometimes singly and in pairs (Higgins 1999).

Detectability

Cryptic, usually difficult to approach. Contact call in flight and alarm call is diagnostic. Sometimes found in association with other *Neophema* parrots (Higgins 1999).

Recommended methods

Breeding range searches are generally focused on nesting activity using point observations adjacent to potential nesting habitat (October to January). Migratory and winter habitat searches are conducted using area searches and point observations in suitable habitat by individual observers or small teams on foot. Area searches are employed during co-ordinated counts and incidental searches and rely mainly on flushing birds. Point observations are particularly useful at known or potential roost sites at dawn and dusk. Detection using only sight rarely confirms species identity in the first instance. It is therefore critical that observers are familiar with flight and alarm calls to distinguish from other *Neophemas.* The summer breeding population has been monitored at Melaleuca, south-west Tasmania, since 1979 by Department of Primary Industries, Water and Environment staff and volunteers using supplementary seed to attract birds to an observation point (OBP Recovery Team 1999); a national winter count on a weekend in late July has been conducted on the mainland each year since 1979 (Starks et al. 1992; Starks & Holdsworth in prep.).

Survey effort guide

Methods	Hours	Days
Area searches*	20	10
Roost site point observations**	60	20
Breeding range point observations***	1	1

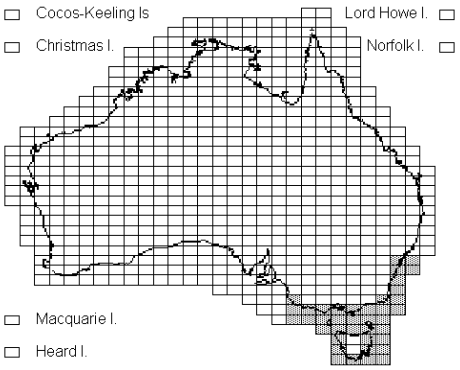
* In areas of less than 50 ha in suitable habitat at appropriate times of year

** 1 hour before dusk to half hour after. Half hour before dawn to one hour after.

*** 1 per 100 m forest edge, 1 per 200 m in breeding period.

Pacific albatross

Common name	Pacific albatross
Scientific name	*Thalassarche sp. nov.*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Very similar to and difficult to distinguish from Buller's albatross *D. bulleri* with which it was regarded as a conspecific until recently.

Movements

Poorly known due to the fact that until recently it has been regarded as a conspecific of Buller's albatross. During the breeding season most records from near nesting islands (Chatham Islands) and east of New Zealand. During the non-breeding season birds are thought to disperse from Australian waters towards South America and to north-east New Zealand (RPAGP 2001).

Breeding season

No breeding on Australian territory. Breeding season presumed to last from September to June when offspring fledge (RPAGP 2001).

Habitat

Foraging range mostly limited to the Pacific Ocean and Tasman Sea, although birds do reach the east coast of the Australian mainland. Breeds on Chatham and Three Kings Islands, New Zealand (EABG 1999).

Dispersion

At sea usually solitary until mid-April but more gregarious in autumn. Nests in colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea although difficult to distinguish from other species.

Recommended methods

At sea, shipboard surveys. The use of berley during shipboard surveys may help to attract birds and draw them in for closer observation. On land, observation from onshore vantage points (using telescopes). Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

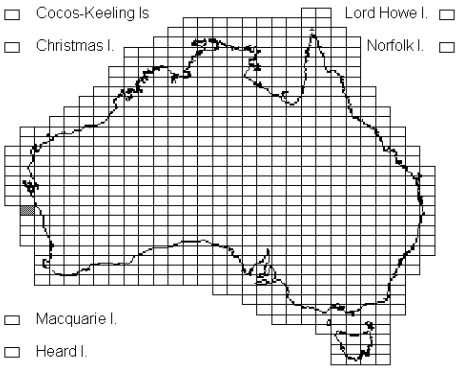
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective method to use during rough weather.

Painted button quail (Houtman Abrolhos)

Common name	Painted button quail (Houtman Abrolhos)
Scientific name	*Turnix varia scintillans*
Family	Turnicidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species in the Houtman Abrolhos.

Movements

Resident, though numbers in a locality may vary between years, possibly due to seasonal factors such as rainfall, availability of food and breeding success (Marchant & Higgins 1993).

Breeding season

Eggs are laid from April to October (Storr et al. 1986; Johnstone & Storr 1998).

Habitat

Occupies all available habitats on the islands, excluding bare limestone pavements. Favours low dunes with open hummock grassland *Spinifex longifolius* and open chenopod flats with grey saltbush *Atriplex cinerea* and *Halosarcia halocnemoides* (Johnstone & Storr 1998). On West Wallabi Island mainly occurs in low dunes covered with spinifex and in more open parts of the saltbush and samphire flats; also dense tangles of *Nitraria* covering the old guano workings. On North Island, mainly coastal dunes (R. Johnstone 2002 pers. comm.).

Dispersion

Usually seen singly or in pairs (Marchant & Higgins 1993).

Detectability

Mainly nocturnal or crepuscular. Makes characteristic circular depressions (platelets) in leaf litter when feeding. Advertising females give low boom, often at night (Marchant & Higgins 1993).

Recommended methods

Area searches by day in suitable habitat for flushing birds and for signs of presence including circular feeding depressions. Searches by night with spotlight for bright red eye shine and flushing birds.

Survey effort guide

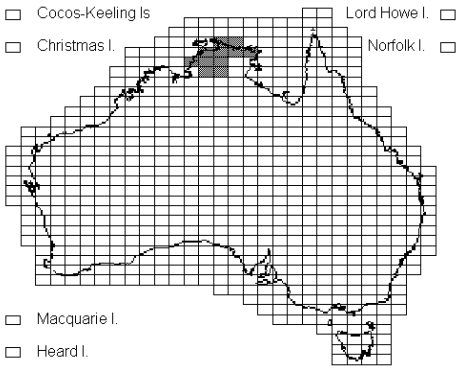
Methods	Hours	Days
Area searches or transect surveys *	20	4
Flushing**	12	4

* In areas less than 50 ha, by day and night with spotlights.

** During day and night with spotlights.

Partridge pigeon (eastern)

Common name	Partridge pigeon (eastern)
Scientific name	*Geophaps smithii smithii*
Family	Columbidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species in range.

Movements

Relatively sedentary, occupies a home range. If permanent water nearby, will occupy the same area throughout the year. Where local water sources are depleted late in the dry season, known to temporarily migrate on foot up to 10 km to the nearest available water. Following the onset of the wet season, walks back to the original home range (Fraser 2001).

Breeding season

Known to lay eggs in all months of the year, although the bulk of nesting occurs in the early to mid dry season (Fraser 2001). From an analysis of its reproductive organs, it reaches the peak of its sexual cycle in the middle of the dry season (Frith 1982).

Habitat

Primarily open forest and woodland dominated by Darwin stringybark *Eucalyptus tetrodonta* and Darwin woollybutt *E. miniata* that has a structurally diverse understorey (Braithwaite 1985; Higgins & Davies 1996; Garnett & Crowley 2000). Prefers to feed in recently burnt areas but shelter, roost and nest in vegetated areas.

Dispersion

Gregarious, often in small flocks but also singly or in pairs. In one study, home range was about 8 ha during the dry season and expanded to more than 30 ha when seed became scarce during the early wet season (Fraser 2001).

Detectability

Not overly cryptic, although can be overlooked due to dull plumage and ground-dwelling habit. Flushes readily when closely approached.

Recommended methods

Area searches or transect surveys of suitable habitat with detection by flushing or call. Flushing surveys with groups of people walking in a line through savanna is a useful technique and has been used in areas of Kakadu NP during early dry season. Also targeted searches and subsequent watches of waterholes for presence in late dry season.

Survey effort guide

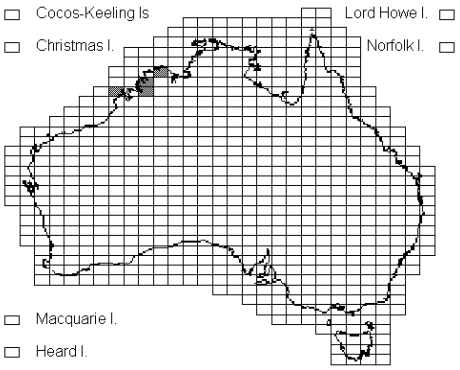
Methods	Hours	Days
Area searches or transect surveys *	20	5
Flushing surveys*	15	5
Targeted searches**	20	10

* In areas of less than 50 ha.

** Targeting waterholes in suitable habitat during dry season.

Partridge pigeon (western)

Common name	Partridge pigeon (western)
Scientific name	*Geophaps smithii blaauwi*
Family	Columbidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species in range.

Movements

Very poorly known. Probably disperses locally in response to seasonal changes in availability of food and water (Higgins & Davies 1996). No evidence of large-scale seasonal movement (Blakers et al. 1984).

Breeding season

Eggs laid between April and June (Hill 1911; Johnstone 1981; Higgins & Davies 1996; Johnstone & Storr 1998).

Habitat

Occurs primarily in open woodland, particularly on the ecotone between the rugged, sandstone King Leopold Ranges and abutting alluvial flats. The ground cover is mostly tall grasses, though the pigeons are usually seen feeding in recently burnt areas, by roads and on short grass. Patchiness of the habitat may be important (Johnstone 1981; Garnett & Crowley 2000). Nests on the ground among tussocks of grass (Frith 1982). Forages on the ground, usually with open ground-cover of short grasses, or on bare ground (Higgins & Davies 1996). Drinks at freshwater springs, pools and waterholes, sometimes among rocks or in mostly dry creek beds (Frith 1982; Higgins & Davies 1996). Usually roosts on the ground among thick ground-cover but occasionally on the lower branches of trees (Higgins & Davies 1996).

Dispersion

Gregarious, often in small flocks but also singly or in pairs (Higgins & Davies 1996).

Detectability

Not overly cryptic, although can be overlooked due to sober plumage and ground-dwelling habit. Flushes readily when approached closely.

Recommended methods

Area searches or transect surveys of suitable habitat with detection by flushing or call. Flushing surveys with groups of people walking through savanna useful techniques and used in areas of Kakadu NP during early dry season for nominate subspecies. Also targeted searches and subsequent watches of waterholes for presence in late dry season.

Survey effort guide

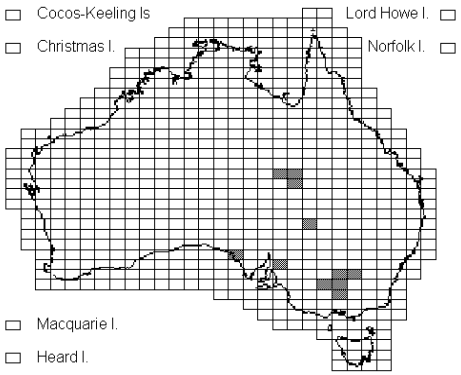
Methods	Hours	Days
Area searches or transect surveys*	20	5
Flushing surveys*	15	5
Targeted searches**	20	10

* In areas of less than 50 ha.

** Targeting waterholes in suitable habitat during dry season.

Plains wanderer

Common name	Plains wanderer
Scientific name	*Pedionomus torquatus*
Family	Pedionomidae
EPBC Act status	Vulnerable



Distinctiveness

Adult female is unmistakable. Adult male and juveniles could be confused with slightly smaller little *Turnix sylvatica* and red-chested *T. pyrrhothorax* button quails and the similarly-sized stubble quail *Coturnix pectoralis.*

Movements

Sedentary, unless displaced by changes to habitat (for example, burning, cultivation, overgrazing, drought) (Baker-Gabb et al. 1990). Although the longest distance a banded bird has been recorded moving is 40 km (Baker-Gabb et al. 1990), the majority of birds are recaptured within 400 m of their banding site. On occasions, such as during and after droughts, some birds must move considerably greater distances to survive and then recolonise grasslands in better times (Baker-Gabb 2002).

Breeding season

Breeding has been recorded in most months but generally takes place in spring, with second and even third clutches laid in summer if sufficient rain falls (Marchant & Higgins 1993).

Habitat

Sparse lowland native grasslands in inland eastern Australia. Favours grasslands typically with the following conditions: about 50 per cent bare ground and 10 per cent fallen litter, with the remaining 40 per cent made up of short herbs and grasses; grass tussocks spaced 10–20 cm apart; most of the vegetation below 5 cm high but some up to a maximum of 30 cm (important for concealment). Habitat structure appears to be more important than floristics (Baker-Gabb et al. 1990).

Dispersion

Usually observed alone, occasionally as pairs in breeding season. Neighbouring pairs live 250–400m apart. Within sparse native grasslands that are not overgrazed, plains wanderers in the New South Wales Riverina occupy home ranges averaging 12 ha, which overlap extensively (55 per cent) with that of their mate but not with other plains wanderers (Baker-Gabb et al. 1990). This means that in the Riverina, the ecological requirements of plains wanderers are about 9 ha of suitable habitat per bird in average seasons. Home range size varies from year to year depending on seasonal conditions.

Detectability

Forages during the day but is extremely cryptic and difficult to detect (Marchant & Higgins 1993). Detectability increases markedly at night (Baker-Gabb et al. 1990).

Recommended methods

Identify suitable areas of sparse native grassland during the day. NPWS (2002) contains photographs of grasslands that are rated as too sparse, ideal and too dense. Mark these areas with poles and reflective tape to guide nocturnal surveys if necessary. Transect surveys over suitable grassland habitat at night from a very slow-moving (<5 kph) vehicle with a hand-held spotlight and vehicle headlights is the most effective method. Birds within close range (<20 m) of vehicle are disturbed and usually walk a short distance or stand on tip-toes enabling them to be detected. Surveys should be done on nights where there is no wind or only a light breeze, and either no rain or light showers.

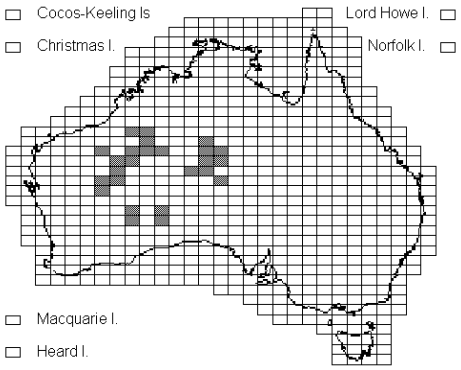
Survey effort guide

Methods	Hours	Days
Transect surveys*	12	3

* In areas of less than 50 ha, from vehicles with spotlights at night. Survey nights should ideally be spaced a week apart.

Princess parrot

Common name	Princess parrot, Alexandra's parrot
Scientific name	*Polytelis alexandrae*
Family	Psittacidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species.

Movements

Poorly known. Said to be nomadic or possibly irruptive, or both (Carter 1993; Blyth & Burbidge 1997; Higgins 1999). Evidence suggests they may be dispersive, though little information is available and thus patterns of movement are mostly speculative. Their core range appears to be within the Great Sandy Desert. Some occurrences are attributed to movements away from areas in drought and it has been suggested that the presence of birds along watercourses in the Central Ranges, Northern Territory, were possibly a result of a drought elsewhere (Carter 1993; Higgins 1999; Garnett & Crowley 2000).

Breeding season

Breeds between the months of September and November but are said to be capable of breeding at any time of the year following rains (Forshaw 1981; Higgins 1999).

Habitat

Occurs in lightly wooded country of arid western and central Australia. Usually seen in groves of desert oak *Allocasuarina decaisneana*, open mallee-spinifex and open marble gum *E. gongylocarpa* woodland. Commonly found in swales between sand dunes, in shrubs such as *Grevillea*, *Hakea*, *Cassia* and *Eremophila* among scattered trees (mainly eucalypts), and with ground-cover of *Triodia*. Less often occurs on dune slopes and crests, in stands of eucalypts, open desert oak woodland, or savanna woodland (Higgins 1999). Nests in hollows in eucalypts, usually river red gums *E. camaldulensis* growing beside watercourses, or in desert oaks away from water (Higgins 1999). Said to loaf in large, densely foliaged trees, especially desert oak and eucalypts, on dune slopes and in swales between dunes (Carter 1993). Also perches in trees when flushed from the ground (Higgins 1999).

Dispersion

Gregarious, usually seen in small groups (Higgins 1999).

Detectability

Active, noisy and conspicuous in the early morning but furtive and difficult to detect when resting quietly in the heat of the day. Distinctive voice, usually uttered in flight or before leaving roost (Higgins 1999).

Recommended methods

Area searches or transect surveys of suitable habitat in the early morning with detection by sighting or call. Also targeted searches and subsequent watches of waterholes for presence in late dry season.

Survey effort guide

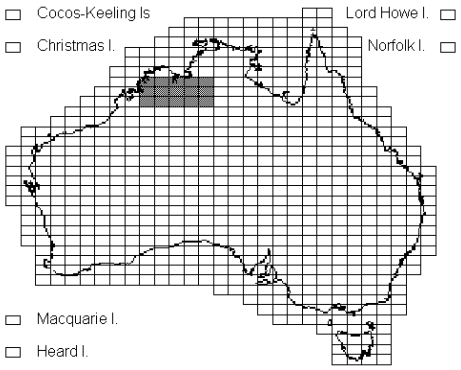
Methods	Hours	Days
Area searches or transect surveys*	20	10
Targeted searches**	20	10

* In areas of less than 50 ha.

** Targeting waterholes in suitable habitat during dry season.

Purple-crowned fairy wren (western)

Common name	Purple-crowned fairy wren (western)
Scientific name	*Malurus coronatus coronatus*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

No similar species in range.

Movements

Sedentary (Rowley 1988; Rowley & Russell 1993, 1997; Higgins et al. 2001).

Breeding season

Breeds in most months but most laying occurs from July to September, although there may be a second peak of laying from March to May (Rowley & Russell 1997; Higgins et al. 2001).

Habitat

Occupies dense riparian vegetation (see Blakers et al. 1984; Rowley 1988, 1993, Rowley & Russell 1993, 1997; Higgins et al. 2001) usually restricted to linear strips of vegetation within 10 m of permanent water and occurs in dense thickets of canegrass or river pandanus *Pandanus aquaticus*, or stands comprising mixtures of the two. Canegrass is a generic term applied by early settlers and present day pastoralists to a variety of species, including bamboo *Bambusa arnhemica*, and native grasses—for example, *Mnesithea rottboellioides*, which form tall, dense thickets close to permanent water. At the Drysdale River, occupied areas support twice as many pandanus stems as unoccupied areas. Habitats usually support emergent trees, including river red gum *Eucalyptus camaldulensis*, coolibah *E. microtheca*, cadjeput *Melaleuca leucadendron* and fig *Ficus*, which provide important refuge when rivers are flooded and the nesting and feeding habitat is inundated. In some areas (for example, Victoria River Crossing), abundant in dense grasslands at some distances (100 m) from the river and are common in some areas with a dense covering of weeds—for example, *Jatropha gossypifolia*, *Ricinus communis* and *Xanthium strumarium* (Higgins et al. 2001).

Dispersion

Gregarious, usually seen in pairs or small groups. At the Drysdale River, Western Australia, recorded at a density of 10.1 birds/km (range 7.1–11.9 between 1982 and 1987) of river frontage (Rowley & Russell 1993).

Detectability

Shy but inquisitive. Distinctive loud call (Higgins et al. 2001).

Recommended methods

Area searches of suitable riparian habitat in the early morning, with detection by sighting or call. Experienced observers can distinguish calls from those of other malurid species. Also broadcast (playback) surveys are effective at soliciting call responses.

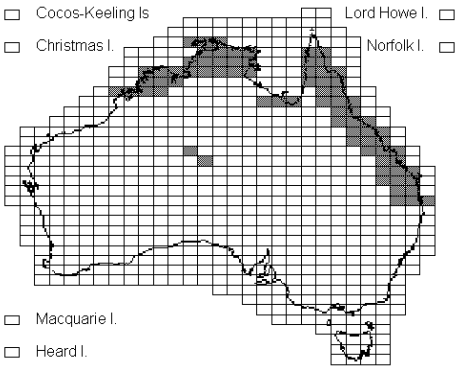
Survey effort guide

Methods	Hours	Days
Area searches*	12	3
Broadcast surveys*	12	3

* In areas of less than 50 ha. Canoes may be used to access habitat where riverside land access is not feasible.

Red goshawk

Common name	Red goshawk
Scientific name	*Erythrotriorchis radiatus*
Family	Accipitridae
EPBC Act status	Vulnerable



Distinctiveness

May be confused with brown falcon *Falco berigora*, square-tailed kite *Lophoictinia isura*, adult female swamp harrier *Circus approximans*, juvenile and immature black-breasted buzzard *Hamirostra melanosternon* and juvenile spotted harrier *Circus assimilis* (Marchant & Higgins 1993).

Movements

In winter in eastern Australia, some birds appear to move from their nest areas in the ranges to coastal plains, where they are associated with permanent wetlands (Czechura & Hobson 2000). Juveniles disperse widely, even reaching suitable habitat far inland.

Breeding season

In northern Australia, they start nest-building in May, lay eggs from July to September, and fledge young from October to December (Aumann & Baker-Gabb 1991; Baker-Gabb pers. comm.). The fledged young then remain around the nest area for another month or so (Baker-Gabb pers. comm.).

Habitat

Coastal and subcoastal tall, open forest and woodlands, tropical savannas traversed by rivers lined with timber, and along the edges of rainforest (Marchant & Higgins 1993). Nests are located above 20m in tall trees (>30 m) that are usually within groups of the tallest trees (>25 m) in a given region of sub-coastal woodlands. Further inland, trees tall enough for nesting are restricted to alongside major rivers' banks (Debus & Czechura 1988; Aumann & Baker-Gabb 1991; Baker-Gabb pers. comm.). Nests are large (c.1.2 x 0.7 m), flat (0.3–0.5 m), resembling a black-breasted buzzard's nest in size and composition but are readily separated because buzzard nests are usually built in a dead tree or on a dead limb in a live tree. Red goshawk nests are often built where a large, horizontal limb forks to provide support, usually with sufficient clearance for the birds to fly in with sticks up to 2 m long (Baker-Gabb pers. comm.).

Dispersion

Usually seen singly but also in pairs and family groups. Many pairs appear resident on territories year-round. Home range of up to 200 km^2 (Aumann & Baker-Gabb 1991). Once an active nest has been located, there is not likely to be another within 6.5 km (D Baker-Gabb unpublished data).

Detectability

Very secretive. Generally silent but voice distinctive (Marchant & Higgins 1993). Presence most likely detected by location of nests (see above).

Recommended methods

Search for their characteristic nests within patches of the tallest forest (see above). In sub-coastal woodland, these areas can initially be identified from aerial photos and then searched during follow-up ground surveys. Further inland requires ground searches along river banks for nests within the tallest trees. Driving slowly through tropical woodland tracks and scanning groups of tall trees for nests can also be effective. In eastern Australia's ranges, searching for nests is more difficult but soaring birds can sometimes be located from vantage points such as mountain tops. Some success has been had surveying this species using call playbacks during the breeding season.

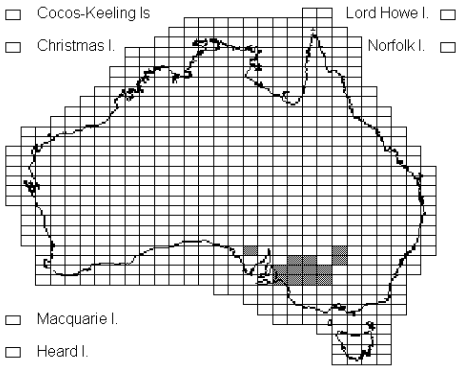
Survey effort guide

Methods	Hours	Days
Area searches*	80	10

* 1. Use of vehicles may be warranted in some instances to cover larger areas, 2. The amount of effort required to find one nest. 3. The effort required for 50 ha is 50 hours over eight days.

Red-lored whistler

Common name	Red-lored whistler
Scientific name	*Pachycephala rufogularis*
Family	Pachycephalidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to Gilbert's whistler *P. inornata* and female golden whistler *P. pectoralis*.

Movements

Very little is known. Described as resident and sedentary (Higgins & Peter 2002, and references therein), but some autumn and winter movements possibly occur (Parker 1984). Colour-banded birds (n=6) were monitored in the Big Desert, Victoria, and at least four birds were recorded in the same area regularly throughout the year (Woinarski 1987).

Breeding season

Breeds from August to October (Parsons & McGilp 1935; Higgins & Peter 2002).

Habitat

Mainly inhabits mallee scrub, shrubland or heathland, usually with a dense understorey and often in vegetation regenerating 5–40 years after fire (Carpenter & Matthew 1986; Woinarski 1987; Matthew et al. 1996; Sluiter & O'Neill 1996). Mostly recorded where the canopy is sparse or open (10 per cent projective foliage cover; 2–5 m tall) and comprised of mallee eucalypts such as lerp mallee *Eucalyptus incrassata*, white mallee *E. dumosa* or red mallee *E. socialis*, usually with a low, dense shrubby understorey (1.5 m tall; 30–40 per cent projective foliage cover), and a ground cover usually of *Triodia* and species such as *Westringia rigida*, *Ptilotus* spp. and *Stipa* spp. (Matthew et al. 1995, 1996; Sluiter & O'Neill 1996). Very occasionally recorded in tall mallee (Higgins & Peter 2002). During the non-breeding season, very occasionally occurs in various other habitats, such as open eucalypt forest and banksia scrub (Hackett & Hackett 1986) and black box woodland (Cooper & McAllan 1995).

Dispersion

Resident or sedentary but some movements may occur after breeding. Usually seen singly or in twos, rarely threes (Higgins & Peter 2002).

Detectability

Unobtrusive and elusive. Heard more often than seen. Usually located by loud call that travels long distances (Higgins & Peter 2002).

Recommended methods

Area searches or transect surveys in suitable habitat in the early morning with detection by call and sighting. Broadcast (playback) surveys likely to be effective at soliciting responses during the breeding season.

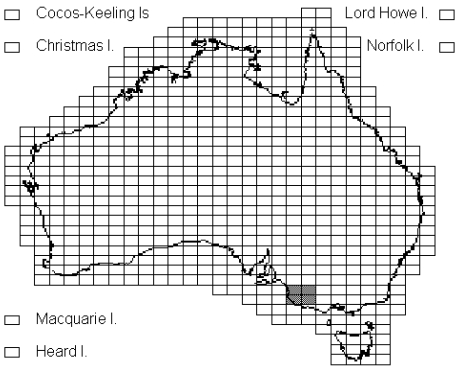
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	15	5
Broadcast surveys*	15	5

* In areas of less than 50 ha.

Red-tailed black cockatoo (south-eastern)

Common name	Red-tailed black cockatoo (south-eastern)
Scientific name	*Calyptorhynchus banksii graptogyne*
Family	Cacatuidae
EPBC Act status	Endangered



Distinctiveness

From a distance, can be confused with other black cockatoos within its range—for example, yellow-tailed black cockatoo *C. funereus* and gang-gang cockatoo *Callocephalon fimbriatum*.

Movements

Does not make annual movements but apparently move throughout their range in response to changes in the availability of stringybark and buloke seed. In some years, most birds occur in the northern part of the range as they feed on buloke and *Eucalyptus arenacea*, and in other years most occur in the southern part of the range and feed on *E. baxteri* (P. Koch, 2002, pers. comm.).

Breeding season

The breeding season starts in September and nests with eggs are frequently found up to December, however, may nest successfully in any season (Burnard & Hill 2001).

Habitat

Restricted to stringybark woodlands occurring on deep aeloian sands in the Glenelg Plain, Wimmera and Naracoorte Plain Bioregions and adjacent woodlands of *E. camuldulensis, E. leucoxyon* and *Allocasurina luehmannii.*

Dispersion

Gregarious and often in large flocks; also in pairs and trios (Higgins 1999).

Detectability

Active, noisy and conspicuous. Said to be less wary when feeding than at other times. Generally does not allow close approach. Loud contact and flight calls (Higgins 1999).

Recommended methods

Area searches or transects on foot through suitable habitat, detecting birds by sight and call. Also road transects by vehicle or aerial transects in extensive areas. Targeted surveys of remnants with suitable food resources in agricultural areas.

Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	16	8
Aerial surveys**	4	2
Targeted searches***	20	10

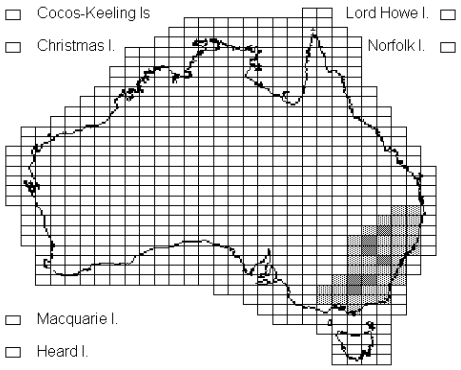
* In areas of less than 50 ha, from vehicles where appropriate.

** As long as is required to conduct sufficiently close transects over the area.

*** Targeting remnants with suitable food resources in cleared agricultural areas.

Regent honeyeater

Common name	Regent honeyeater
Scientific name	*Xanthomyza phrygia*
Family	Meliphagidae
EPBC Act status	Endangered



Distinctiveness

Unlikely to be mistaken for any other species (Higgins & Peter 2002).

Movements

Very complex movement patterns, mainly governed by the flowering of a small number of eucalypt species (Higgins et al. 2001). Highly mobile (Ley et al. 1996) and capable of travelling large distances in search of nectar resources. Franklin et al. (1987, 1989) identified two main trends: (1) movement extending into parts of northern New South Wales and south-east Queensland during autumn, contracting to core breeding areas on inland slopes of Great Divide in north-west, central-west and south-west New South Wales and north-east Victoria, in late winter; (2) corresponding movement out of southern Victoria and high country of south-east Australia, from late autumn to early spring. There is no evidence to suggest that they are sedentary or resident (Franklin et al. 1989).

Breeding season

Throughout their range, breeds from May to March, mostly September to November (Higgins et al. 2001).

Habitat

Mostly occurs in box-ironbark eucalypt associations. Prefers the wettest, most fertile sites within these associations such as along creek flats, broad river valleys and foothills. In New South Wales, riparian forests of river oak with needle-leaf mistletoe are also important for feeding and breeding. At times of food shortage, uses other woodland types and wet lowland coastal forest dominated by swamp mahogany *E. robusta* or spotted gum *Corymbia maculata* (Franklin et al. 1989; Webster & Menkhorst 1992; Geering & French 1998; Oliver et al. 1998).

Dispersion

Usually seen singly, in twos and in small groups. Larger concentrations can occur at good nectar sources. Nests solitarily or in loose congregations (Geering & French 1998; Oliver et al. 1998).

Detectability

Can be conspicuous in the breeding season and when larger groups form at good nectar sources. At other times are often inconspicuous, calling quietly and being difficult to locate in the crowns of trees (Higgins et al. 2001; D. Geering pers. comm.). Detection usually by call, although calls appear to differ between birds in south and north of range (D. Geering pers. comm.). May mimic calls of other birds (Higgins et al. 2001). Respond to playback calls immediately before and during the breeding season (Geering 1997).

Recommended methods

Area searches in suitable habitat, preferably in the morning but other times may also be appropriate. Detection by call is possible when birds are most vocal (outside the breeding season). Otherwise, detection is by sighting. Targeted searches of woodland patches with heavily flowering trees is useful, especially around waterpoints such as dams and creeklines. Also check among flocks of other blossom nomads such as lorikeets and other honeyeaters. Broadcast surveys immediately before and during the breeding season may also be useful.

Survey effort guide

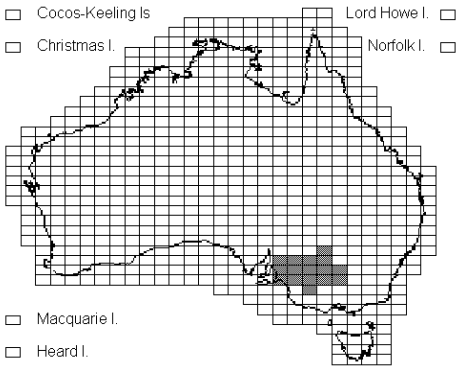
Methods	Hours	Days
Area searches*	20	10
Targeted searches**	20	5

* In areas of less than 50 ha.

** Targeting areas of heavily flowering trees and flocks of other blossom feeders.

Regent parrot (eastern)

Common name	Regent parrot (eastern)
Scientific name	*Polytelis anthopeplus monarchoides*
Family	Psittacidae
EPBC Act status	Vulnerable



Distinctiveness

Normally unmistakable although with a fleeting view, could be confused with yellow form of crimson rosella (subspecies *flaveolus*).

Movements

Poorly understood. Variously considered nomadic, resident and at least partially sedentary (Higgins 1999). No large-scale seasonal or regular movements have been reported, however disperses from riparian breeding habitats to mallee areas following breeding (Burbidge 1985; Webster 1991; Forshaw 1981).

Breeding season

Breeds from August to December (Higgins 1999).

Habitat

Occurs in riverine river red gum woodlands, adjacent black box, belah, buloke and cypress pine woodlands, and mallee woodlands and shrublands (Beardsell 1985; Burbidge 1985; Webster 1991; Emison et al. 1987). Often occurs in farmland, usually with remnant patches of woodland along roadsides or in paddocks and rarely in more extensively cleared areas.

Dispersion

Gregarious, usually in pairs or small parties, and occasionally flocks in the non-breeding season. Breeds in loose colonies. Forages up to 20km from nesting area (Higgins 1999).

Detectability

Generally rather noisy and conspicuous but quiet when feeding; distinctive penetrating flight call usually heard well before birds come into view (Higgins 1999).

Recommended methods

Area searches in suitable habitat in the early to mid-morning (sunrise to 10 am) or late afternoon (4pm to sunset). Morning surveys may be best as the species' movements are more coordinated at this time. Detection by calls and sighting. Targeted searches in areas of hollow-bearing trees during breeding season, especially river red gums along watercourses. Use of boat transects along rivers may be effective.

Survey effort guide

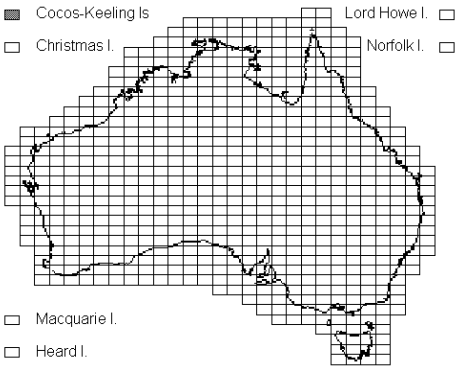
Methods	Hours	Days
Area searches*	12	4
Targeted searches**	12	4

* In areas of less than 50 ha.

** Targeting areas of hollow-bearing trees during breeding season.

Round Island petrel

Common name	Round Island petrel
Scientific name	*Pterodroma arminjoniana*
Family	Procellariidae
EPBC Act status	Critically endangered



Distinctiveness

Identification at sea difficult due to variation in plumage. Easily confused with herald petrel *P. heraldica* with which it was considered conspecific in the past, as well as with other gadfly petrels.

Movements

Poorly known although suspected of being dispersive or migratory. Recorded during April at Cocos (Keeling) Islands (Marchant & Higgins 1990).

Breeding season

Laying occurs throughout the year at Round Island with a peak during July to October (Marchant & Higgins 1990). In Australian territories it probably breeds on North Keeling Island (Garnett & Crowley 2000) but confirmation required.

Habitat

Forages in waters around Cocos (Keeling) Islands, mostly south of the Equator. Breeds on the rocky Round Island but also may nest among shrubs on sand cays (Marchant & Higgins 1990; Garnett & Crowley 2000).

Dispersion

May occur at sea as individuals, pairs or small flocks of up to 15, often in mixed feeding flocks with other species.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys. On land, observation from onshore vantage points using telescopes. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

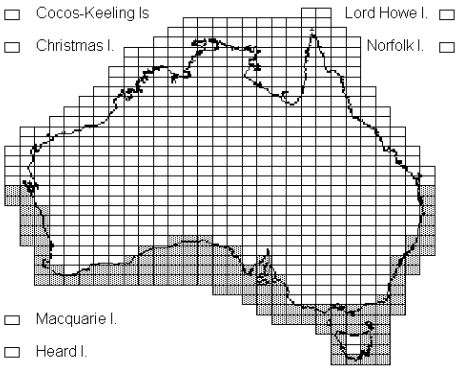
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective during rough weather.

Salvin's albatross

Common name	Salvin's albatross
Scientific name	*Thalassarche salvini*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to the shy albatross *T. cauta* with which it was previously considered conspecific.

Movements

Present throughout the year over shelf waters around New Zealand although disperses widely during winter, principally eastwards to the west coast of South America over the Humboldt Current. Small numbers of non-breeding adults reported regularly from south-east Australian waters (RPAGP 2001).

Breeding season

No breeding in Australian territory. Breeds annually with adults returning to colonies in September. Chicks fledge by early April (RPAGP 2001).

Habitat

Forages primarily in shelf waters over most of the southern Pacific Ocean, where particularly common in Humboldt Current off South America. Also visits Indian and South Atlantic Oceans (Marchant & Higgins 1990). Breeding on islands south of New Zealand, as well as Cozet Islands, Indian Ocean (Garnett & Crowley 2000 and refs therein).

Dispersion

May be solitary or gregarious at sea. Often associates with mixed-species feeding-flocks of other albatrosses.

Detectability

Conspicuous at sea. Commonly follows fishing boats.

Recommended methods

At sea, shipboard surveys. The use of berley during shipboard surveys may help to attract birds and draw them in for closer observation. On land, observation from onshore vantage using telescopes. Detection of flying birds and nests. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

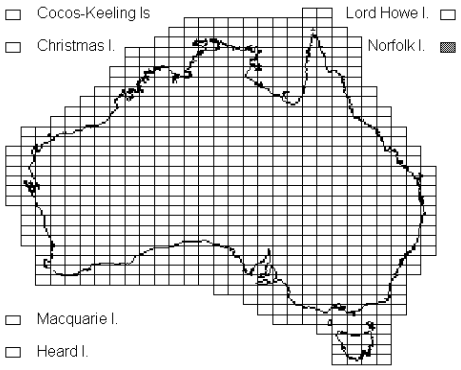
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most useful during periods of rough weather.

Scarlet robin (Norfolk Island)

Common name	Scarlet robin (Norfolk Island)
Scientific name	*Petroica multicolor multicolor*
Family	Petroicidae
EPBC Act status	Vulnerable



Distinctiveness

No similar species on Norfolk Island.

Movements

Present throughout year (Hermes 1985; Robinson 1997); presumably sedentary.

Breeding season

Late September to March (Moore 1981; Schodde et al. 1983; Robinson 1988, 1997)

Habitat

Mainly inhabit native rainforest, with lower densities in habitats dominated by Norfolk Island palms *Rhopalostylis baueri* or exotic African olives *Olea europaea*, and very occasionally in exotic eucalypt forest (Robinson 1988, 1997; Major 1989).

Dispersion

Usually seen singly or in twos. Resident and defend territories year-round. Territory sizes in rainforest, 0.42 ha (n=4); palm, 0.73 ha (n=2), resulting in denser, more contiguous population in rainforest; in olives, home range size is intermediate between rainforest and palm habitats (Robinson 1988).

Detectability

Usually quiet and unobtrusive but active when foraging and often tame and approachable. Call distinctive.

Recommended methods

Area searches or transect surveys early in the morning in suitable habitat. Likely to be most effective early in the breeding season. Detection by calls and sightings. Broadcast (playback) surveys likely to be effective at soliciting responses, especially in the breeding season.

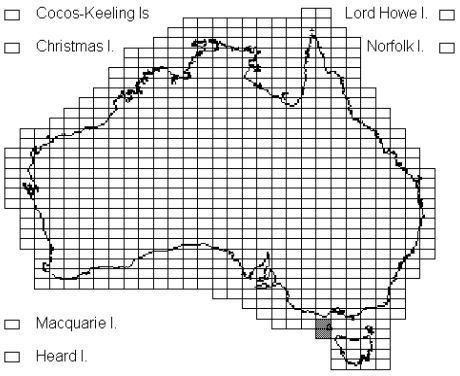
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	8	4
Broadcast surveys	6	3

* In areas of less than 50 ha.

Scrubtit (King Island)

Common name	Scrubtit (King Island)
Scientific name	*Acanthornis magnus greenianus*
Family	Pardalotidae
EPBC Act status	Critically endangered



Distinctiveness

May be confused with the Tasmanian scrubwren *Sericornis humilis*, especially when seen fleetingly.

Movements

The subspecies is endemic to King Island in restricted habitat (for example, McGill 1970; Green & McGarvie 1971; McGarvie & Templeton 1974; Thomas 1974; Garnett & Crowley 2000; Higgins & Peter 2002); so there is likely to be little movement (Higgins & Peter 2002).

Breeding season

The nominate subspecies (*A. m. magnus*) exhibits the capacity to breed from September to January but usually breeds from October to November (Campbell 1900; McGill 1970; Higgins & Peter 2002).

Habitat

Has been found in fern gullies in remnant patches of wet sclerophyll forest and tall, undisturbed swamp paperbark *Melaleuca ericifolia* scrub in gullies (Green & McGarvie 1971; McGarvie & Templeton 1974; Green 1989; Garnett & Crowley 2000; Higgins & Peter 2002). Most recent records are from old-growth swamp paperbark forest (M. Holdsworth pers. comm.).

Dispersion

Usually seen singly or in pairs. Probably maintains a territory throughout the year (Higgins & Peter 2002).

Detectability

Usually shy and inconspicuous, though often calls from perch when disturbed. Approaches in response to squeaking by observers (Higgins & Peter 2002).

Recommended methods

Area searches and transect surveys early in the morning in suitable habitat. Likely to be most effective early in the breeding season. Detection by calls and sightings. Broadcast (playback) surveys also likely to be effective, especially during the breeding season.

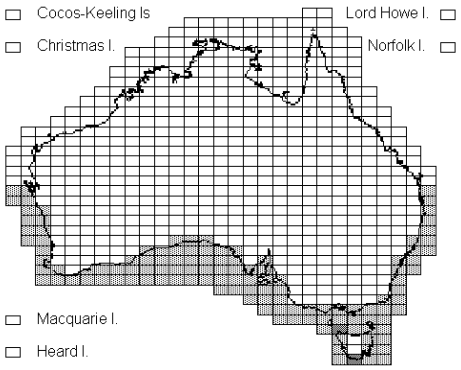
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	10	5
Broadcast surveys	6	3

* In areas of less than 50 ha.

Shy albatross

Common name	Shy albatross
Scientific name	*Thalassarche cauta*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Difficult to distinguish from white-capped *T. steadi* and Salvin's *T. salvini* albatross (Marchant & Higgins 1990).

Movements

Non-breeding adults rarely travel more than 700km from the breeding islands and breeding birds rarely more than 200km but immatures migrate as far (north) as southern Queensland and waters off south-west Australia.

Breeding season

Around Tasmania, eggs laid from mid-September and young fledge by April (Marchant & Higgins 1990).

Habitat

Marine. Feeds in pelagic waters to shelf edge-zone, ranging well inshore over continental shelf and entering harbours and bays; commonly observed from land. Largest concentrations occur over rises, along shelf-break and over outer continental shelf. Endemic to Australian territory and breeding on Albatross Island in Bass Strait, and Mewstone and Pedra Branca, off southern Tasmania (Marchant & Higgins 1990).

Dispersion

Solitary or gregarious at sea. Breeds in dense colonies on islands (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land. Follows fishing vessels in flocks.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys, and observation from onshore vantage points (using telescopes). Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

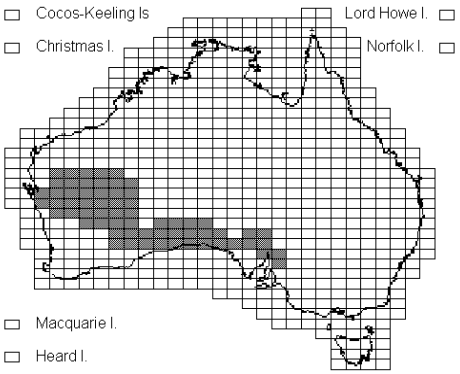
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land area searches or transect surveys**	15	3

* Most effective during periods of rough weather.

** In areas up to 10 ha, during breeding season.

Slender-billed thornbill (western)

Common name	Slender-billed thornbill (western)
Scientific name	*Acanthiza iredalei iredalei*
Family	Pardalotidae
EPBC Act status	Vulnerable



Distinctiveness

May be mistaken for western thornbill *A. inornata* but current ranges do not overlap.

Movements

Probably sedentary, although almost nothing known about movements or home range.

Breeding season

In Western Australia, breeding has been recorded July to September (Storr 1985a; 1985b; Recher & Davis 2000) but probably occurs at other times of year depending on seasonal conditions (Recher & Davis 2000).

Habitat

Primarily in chenopod shrublands, often associated with saltlakes, though also recorded in mangrove-fringed samphire shrublands or thickets of other vegetation (Storr 1986; 1987; Matthew 1994; Recher & Davis 2000).

Dispersion

Gregarious, usually seen in small flocks of up to 20–30 birds in non-breeding season and more often in pairs when breeding.

Detectability

Quiet and inconspicuous. Said to be shy and less inquisitive than other thornbills. Most readily detected by listening for their calls and is probably attracted to playback calls.

Recommended methods

Area searches or transect surveys early in the morning in suitable habitat. Detection by calls and sightings. Probably most effective during the breeding season. Broadcast (playback) surveys for soliciting call responses may also be useful, especially during the breeding season.

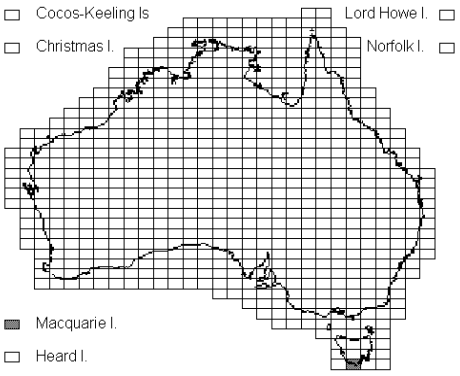
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	10	5
Broadcast surveys*	6	3

* In areas less than 50 ha, most effective during breeding season.

Soft-plumaged petrel

Common name	Soft-plumaged petrel
Scientific name	*Pterodroma mollis*
Family	Procellariidae
EPBC Act status	Vulnerable; marine



Distinctiveness

Similar to the white-headed petrel *P. lessonii*, mottled petrel *P. inexpectata* and grey petrel *Procellaria cinerea*. Rare dark morph closely resembles Kerguelen petrel *Lugensa brevirostris* (Marchant & Higgins 1990).

Movements

Dispersive or migratory from breeding islands but movements in non-breeding season poorly documented.

Breeding season

No breeding on Australian territory. Generally September to April. Birds return to colonies from August or September (Tristan da Cunha) to November (Marchant & Higgins 1990). At Antipodes Islands, pre-laying exodus, 22 November to 5 December (Imber 1983). Laying, November to December and fledging generally April to May (Marchant & Higgins 1990).

Habitat

Marine; oceanic; in subantarctic, Antarctic and subtropical waters. Mainly subantarctic but over wide range of sea surface-temperatures (0 to 21 °C; off south-east Australia, 9.8 to 21 °C; Reid et al. 2002). In Weddell Sea, attracted to areas with icebergs, surface-temperature 0.7 to 1 °C. Birds breeding at Iles Crozet forage mainly to north of islands, over subtropical waters (Marchant & Higgins 1990).

Dispersion

Generally gregarious, seen at sea in small flocks throughout the year. Breeds in small colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land.

Recommended methods

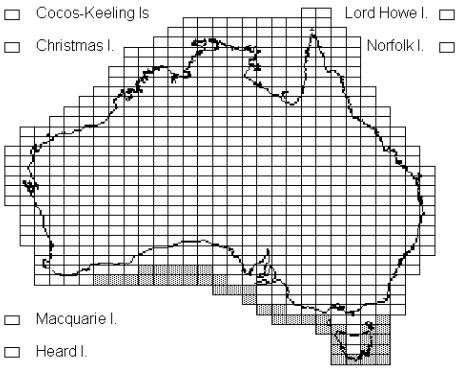
At sea, shipboard surveys in non-breeding season. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

Methods	Hours	Days
Shipboard surveys	20	4

Sooty albatross

Common name	Sooty albatross
Scientific name	*Phoebetria fusca*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Can be confused with light-mantled sooty albatross *P. palpebrata*..

Movements

Dispersive or migratory from breeding islands but movements in non-breeding season poorly documented.

Breeding season

No breeding in Australian territory.

Habitat

Marine; pelagic in subtropical and subantarctic waters. Foraging in waters off southern Australia. Breeds on islands in the southern Indian and Atlantic Oceans (Marchant & Higgins 1990; EABG 1998)

Dispersion

At sea usually solitary or in small groups. Nests in loose colonies or small groups, occasionally solitarily (Marchant & Higgins 1990).

Detectability

Conspicuous at sea. Regularly follows ships but only for short period (Marchant & Higgins 1990).

Recommended methods

At sea, shipboard surveys in the non-breeding season. On land, observation from onshore vantage points using telescopes. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

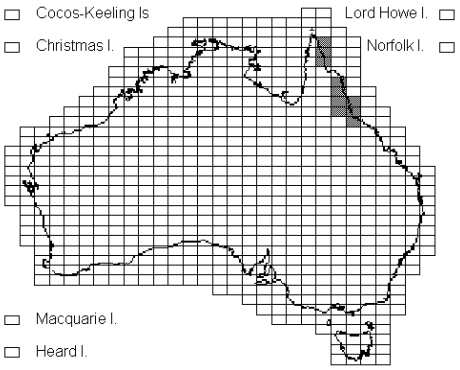
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most useful during periods of rough weather.

Southern cassowary (Australian)

Common name	Southern cassowary (Australian)
Scientific name	*Casuarius casuarius johnsonii*
Family	Casuariidae
EPBC Act status	Endangered



Distinctiveness

Unmistakable.

Movements

Little known, however considered sedentary although locally nomadic within their large home ranges. Dispersal across open country occurs, particularly after disturbance of forest by cyclones, even across water barriers. Dispersal is presumed primarily to occur in sub-adults, as adults are thought to be sedentary once they have established a home territory (Marchant & Higgins 1990).

Breeding season

The breeding season coincides with average maximum availability of fruit—that is, from early June to October, but has occurred at other times (Marchant & Higgins 1990).

Habitat

Generally requires complex tropical vegetation consisting of dense tropical rainforest and associated habitats such as woodlands, including melaleuca woodland and swamps that can provide a year-round supply of fleshy fruit. Use of habitats such as savannas, mangroves, exotic fruit plantations and open ground, is intermittent. Occurs at all altitudes but are more common in lowland rainforests. Often seen by roadsides, particularly in the early morning and late afternoon. Roosts on the ground in forest areas. Foraging areas are apparently used regularly and reached by well-worn tracks. All nests have been recorded in rainforest or woodland mosaics with rainforest elements, on the ground, usually near the base of a large tree or stump. Eggs are laid on the bare ground and adult gathers twigs and vegetation around itself during incubation (Marchant & Higgins 1990; Bentrupperbaumer 1997; Garnett & Crowley 2000).

Dispersion

Home ranges may be 0.5–5 km in size in coastal lowlands and up to 12 km in upland regions. Males, who are responsible for parental care, occupy home ranges with limited overlap with other male territories. Female ranges tend to overlap more with male territories. May move further afield in times of short food supply such as after Cyclone Winifred (Francis Crome, 2002, pers. comm.). Home ranges in the Kennedy Bay National Park area were a mean of 75.3 ha (SE 10.46, n=8), with females having a slightly smaller home range than males (Bentrupperbaumer 1997).

Detectability

Shy and wary of humans. May be surprisingly cryptic given their large size. Voice is loud and distinctive.

Recommended methods

Area searches or transect surveys in suitable habitat. Detection by sightings, calls and presence of sign including dung and footprints.

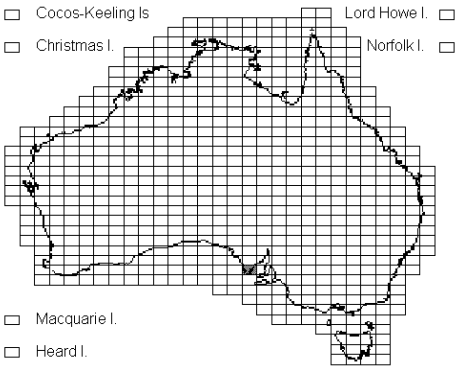
Survey effort guide

Methods	Hours	Days
Area searches and transect surveys *	20	10

* In areas less than 50 ha.

Southern emu wren (Eyre Peninsula)

Common name	Southern emu wren (Eyre Peninsula)
Scientific name	*Stipiturus malachurus parimeda*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Unmistakable within restricted range of species.

Movements

No information but probably sedentary (Higgins et al. 2001).

Breeding season

No information but probably spring to summer (Higgins et al. 2001).

Habitat

Recorded in three different heath habitats: (1) lightly grazed wet heath of short-leaved tea-tree *Melaleuca brevifolia* with various sedges including *Juncus* spp. and scattered emergent *Eucalyptus leucoxylon*; (2) diverse drier heath of totem-poles *Melaleuca decussata*, sheoak *Allocasuarina* spp., Tate's grass-tree *Xanthorrhoea semiplana*, flame heath *Astroloma conostephioides*, and umbrella bush *Acacia ligulata*; and (3) dry heath with green tea-tree *Leptospermum coriaceum*, desert banksia *Banksia ornata* and ridge-fruited mallee *Eucalyptus incrassata* (Possingham 1993).

Dispersion

Usually seen in pairs or small family groups. Probably territorial year-round (Higgins et al. 2001).

Detectability

Shy and secretive; usually first detected by call, although voice feeble. Difficult to flush from cover (Higgins et al. 2001). Responds to playback (M. Pickett pers. comm.).

Recommended methods

Area searches or transect surveys early in the day in suitable habitat. Detection by calls and sightings, although call detection requires good hearing and calm conditions. Also broadcast (playback) surveys effective at soliciting responses, especially before and during the breeding season. Mist-netting with nets set low in dense, heathy habitat may be useful.

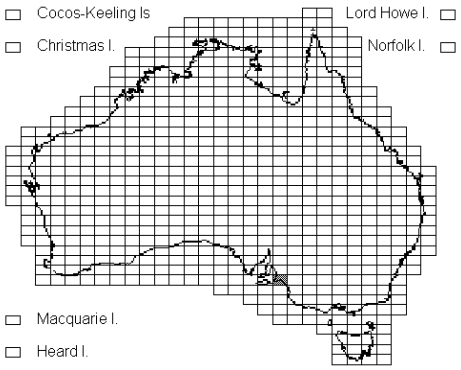
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	10	5
Broadcast surveys*	6	3
Mist-netting*	12	4

* In areas less than 50 ha.

Southern emu wren (Fleurieu Peninsula)

Common name	Southern emu wren (Fleurieu Peninsula), Mt Lofty southern emu wren
Scientific name	*Stipiturus malachurus intermedius*
Family	Maluridae
EPBC Act status	Endangered



Distinctiveness

Unmistakable within restricted range of species.

Movements

Little known but likely to be sedentary and largely confined to small, isolated swamp areas but probably has greater capacity to move where it occurs in coastal dry-heath habitats (MLRSERT 1998; M. Pickett pers. comm.).

Breeding season

Usually from mid-October to late January (data in SA Museum; P. Horton, pers. comm.), but clutches have been inferred as early as late August, and as late as February (Pickett 2000; M. Pickett, pers. comm.).

Habitat

Occurs in freshwater swamp and dry heath vegetation, typically with dense vegetation up to 1 m high (SAOA 1991; Littley & Cutten 1994).

Dispersion

Usually seen in pairs or small family groups. Probably territorial year-round. At Nangkita, Pickett (2000) estimated home ranges for non-breeding birds of between 0.3 and 6.5 ha; home ranges of breeding pairs ranged from 0.3–2.6ha.

Detectability

Shy and secretive; usually first detected by call, although voice feeble and good hearing required for detection. Difficult to flush from cover (Higgins et al. 2001). Will respond to playback calls (M. Pickett pers. comm.).

Recommended methods

Area searches or transect surveys early in the day in suitable habitat. Detection by calls and sightings, although call detection requires good hearing and calm conditions. Also broadcast (playback) surveys effective at soliciting responses, especially before and during the breeding season. Mist-netting with nets set low in dense, heathy habitat may be useful.

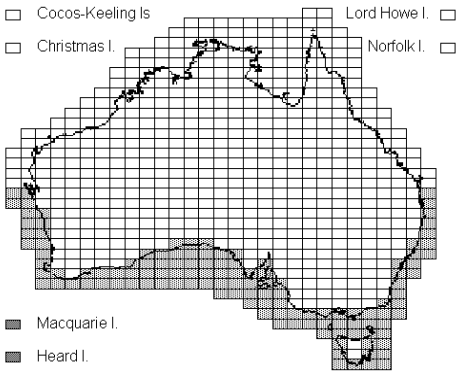
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	10	5
Broadcast surveys*	6	3
Mist-netting*	12	4

* In areas less than 50 ha.

Southern giant petrel

Common name	Southern giant petrel
Scientific name	*Macronectes giganteus*
Family	Procellariidae
EPBC Act status	Endangered; marine



Distinctiveness

Similar to the Northern giant petrel, which also breeds on Macquarie Island (Bourne & Warham 1966).

Movements

In summer, predominantly occurs in subantarctic to Antarctic waters, usually below 60 °S in the South Pacific and south-east Indian Oceans, or 53 °S in the Heard Island and Macquarie Island regions. Some adults are mainly sedentary, remaining close to their subantarctic breeding islands throughout the year. Nonetheless, numbers diminish at all sites over winter. Throughout the colder months, immatures and most adults disperse widely. Dispersal is circumpolar, extending north from 50 °S to the Tropic of Capricorn (23 °S) and sometimes beyond. Thus, in winter they are rare in the southern waters of the Indian Ocean and more common off South America, South Africa, Australia and New Zealand. The waters off south-east Australia may be particularly important wintering grounds (Marchant & Higgins 1990). In south-eastern Australian waters, birds (mostly immatures) were recorded in all months except February but most were recorded June to December (Reid et al. in press).

Breeding season

Breed annually between August and March on Macquarie Island (Gales et al. in press).

Habitat

Marine; Antarctic to subtropical waters. In summer, mainly over Antarctic waters, widespread south to pack-ice and on to Antarctic continent.

Dispersion

At sea, often solitary or in small groups, but converges on food sources. Gregarious on land, breeds in colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land. Regularly follows ships but not persistently.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points (the latter involves using telescopes). Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

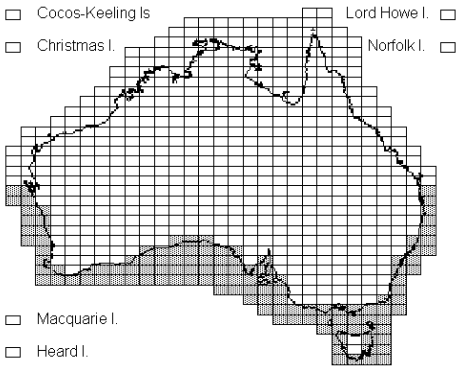
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land-based area searches or transects**	12	4

* Most effective method to use during rough weather.

** In areas up to 10 ha.

Southern royal albatross

Common name	Southern royal albatross
Scientific name	*Diomedea epomophora*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to the northern royal albatross *D. sanfordi* and wandering albatross *D. exulans*.

Movements

Migratory, possibly circumpolar, with records from all sections of the Southern Ocean (Marchant & Higgins 1990).

Breeding season

No breeding in Australian territory. Biannual; breeding starts in October and young fledge in October of following year (RPAGP 2001).

Habitat

Feeds pelagically in Southern Ocean, primarily between western Australia and South America. Often over the Australian continental shelf and shelf break. Breeds on islands off southern New Zealand (Marchant & Higgins 1990; Garnett & Crowley 2000).

Dispersion

Solitary or gregarious at sea. Breeds in colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea. Attends fishing vessels.

Recommended methods

At sea, shipboard surveys. On land, observation from onshore vantage points (using telescopes). Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

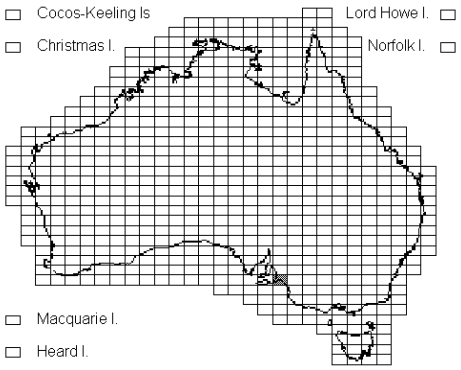
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	
Land-based sea observations*	8	

* Most effective during rough weather.

Spotted quail thrush (Mt Lofty Ranges)

Common name	Spotted quail thrush (Mt Lofty Ranges)
Scientific name	*Cinclosoma punctatum anachoreta*
Family	Cinclosomatidae
EPBC Act status	Critically endangered



Distinctiveness

No similar species within restricted range. No confirmed recent sightings.

Movements

Movements poorly known; probably sedentary or resident (Fletcher 1909; Howe 1931; Morris et al. 1981; Blakers et al. 1984; Emison et al. 1987; Taylor 1992; Higgins & Peter 2002).

Breeding season

Clutches from August to November with most from October to November (Ashby 1932; Ford 1983; Higgins & Peter 2002).

Habitat

Spotted quail thrushes (all subspecies) inhabit dry sclerophyll forests and woodlands, usually on stony ridges and slopes and with an open or sparse understorey with sparse to no ground cover (Ford & Howe 1980; Morris et al. 1981; Ford 1983; Blakers et al. 1984; Smith 1984; Storr 1984; Emison et al. 1987; Gosper 1992; Taylor 1992; Schodde & Mason 1999; Garnett & Crowley 2000; Higgins & Peter 2002).

Dispersion

Usually seen singly or in pairs (Higgins & Peter 2002).

Detectability

Unobtrusive, shy and elusive, rarely allowing close approach. High-pitched call may be inaudible to some observers and easily missed (Higgins & Peter 2002). Other subspecies are often detected running across vehicle tracks or roads (C. Tzaros pers. comm.).

Recommended methods

Area searches or transect surveys early in the morning in suitable habitat. Detection by calls and sightings. Probably most effective early in the breeding season.

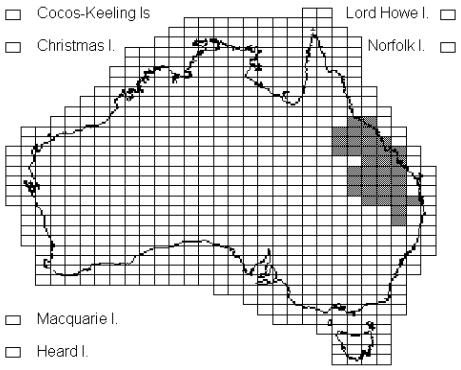
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	25	5

* In areas of less than 50 ha.

Squatter pigeon (southern)

Common name	Squatter pigeon (southern)
Scientific name	*Geophaps scripta scripta*
Family	Columbidae
EPBC Act status	Vulnerable



Distinctiveness

Similar to the northern subspecies, which it may meet in a hybrid zone in central Queensland (Ford 1986; Schodde & Mason 1997).

Movements

Poorly known. Apparently locally dispersive, with no evidence of long-distance seasonal movements (Frith 1982; Blakers et al. 1984; Higgins & Davies 1996). No information on home ranges.

Breeding season

Not well-known but probably breeds mostly in spring and summer (Higgins & Davies 1996).

Habitat

Inhabits the short, grassy understorey of eucalypt woodland, nearly always near permanent water (Higgins & Davies 1996; Garnett & Crowley 2000).

Dispersion

Usually seen in pairs or small flocks (Higgins & Davies 1996).

Detectability

Said to be tame and often easily approached (Higgins & Davies 1996) although may be wary and difficult to detect where not accustomed to humans.

Recommended methods

Area searches or transect surveys in suitable habitat. Flushing surveys also likely to be useful.

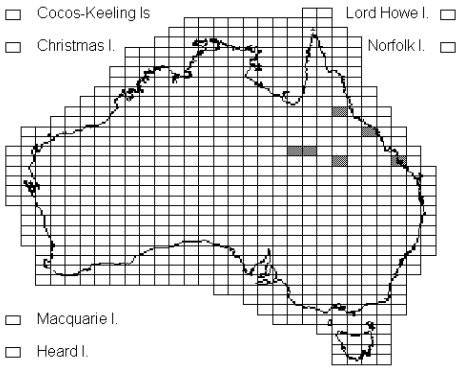
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	15	3
Flushing surveys*	10	3

* In areas of less than 50 ha.

Star finch (eastern)

Common name	Star finch (eastern)
Scientific name	*Neochmia ruficauda ruficauda*
Family	Passeridae
EPBC Act status	Endangered



Distinctiveness

Unlikely to be confused with any other species.

Movements

Poorly known. Described as sedentary, and records far outside the current range (for example, Gwydir River, Baldwin 1975) possibly involve persistence of relict populations rather than large-scale movements (Holmes 1996, 1998; Garnett & Crowley 2000).

Breeding season

In Queensland, eggs of Cape York subspecies *N. r. clarescens* have been recorded in March and April (Campbell 1900; Macgillivray 1918). For both subspecies, Holmes (1998) reports that breeding in Queensland coincides with the wet season. Nest records occur from November to April (see Storr 1973).

Habitat

All subspecies of the star finch are usually closely associated with permanent surface water or frequently inundated areas, including tall, rank grasslands and rushes within woodlands (Keast 1958; Storr 1977, 1980, 1984; Immelmann 1982; Blakers et al. 1984; Holmes 1996, 1998; Schodde & Mason 1999; Garnett & Crowley 2000). *N. r. ruficauda* mostly occupies riparian woodlands (Gould 1865; Macgillivray 1901, 1918; Barnard 1926; Holmes 1996, 1998; Garnett & Crowley 2000).

Dispersion

Always in pairs within flocks of up to 20, sometimes more. Roosts communally in thickets (Higgins & Peter in press).

Detectability

Frequently gives loud call, especially when in flight (Higgins & Peter in press).

Recommended methods

Area searches or transect-point surveys in suitable habitat, such as rank grasses in riparian areas with pandanus or corypha palm. Also check within flocks of other finches. Detection by calls and sighting. Broadcast (playback) surveys may be useful, especially in the morning and evening. Targeted searches and subsequent watches of waterholes may also be useful in the dry season.

Survey effort guide

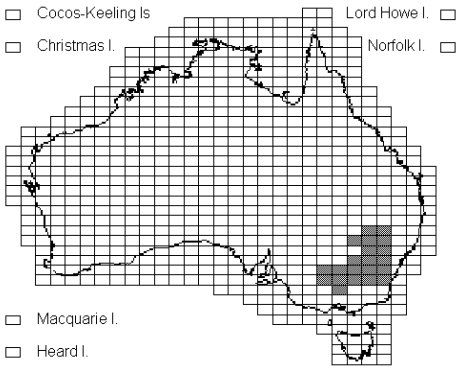
Methods	Hours	Days
Area searches or transect-point surveys *	15	5
Broadcast surveys*	15	3
Targeted surveys**	10	4

* In areas of less than 50 ha.

** Targeting waterholes, especially during dry season.

Superb parrot

Common name	Superb parrot
Scientific name	*Polytelis swainsonii*
Family	Psittacidae
EPBC Act status	Vulnerable



Distinctiveness

Distinctive and not normally confused with other species, though flying birds seen in silhouette could be confused with cockatiel *Nymphicus hollandicus* (Higgins 1999).

Movements

Make regular seasonal movements from breeding areas, though the relationship between breeding and non-breeding ranges is speculative. No strong evidence to differentiate dispersal from migration (Higgins 1999). Some birds remain in the breeding range throughout the year (Blakers et al. 1984), and they are variously considered nomadic (Sharrock 1981), resident (Schrader 1980), dispersive (Webster 1988; Webster & Ahern 1992), migratory (Schrader 1980), partly migratory (Higgins 1999) or partly nomadic (Hoskin 1991).

Breeding season

Breeds September to January (Higgins 1999).

Habitat

In the Riverina of Victoria and New South Wales, nests in loose colonies in riparian woodland of river red gum *Eucaluptus camaldulensis*. Forages in box eucalypt woodland, particularly that dominated by yellow box *E. melliodora* or grey box *E. microcarpa*. On the inland slopes of New South Wales, forages and breeds within box woodland. In winter, moves into box, box-pine *Callitris* spp, and boree *Acacia pendula* woodlands.

Dispersion

Gregarious, usually in family parties or small flocks. Roosts communally. Breeds solitarily or in loose colonies of up to nine nests (Higgins 1999).

Detectability

Active and conspicuous, though quiet in the heat of the day. Can be difficult to detect when quietly feeding in canopy. Voice distinctive; contact call usually uttered in flight (Higgins 1999).

Recommended methods

Area searches or transect surveys of suitable habitat, preferably in the early morning (sunrise to 10 am) and evening (4 pm to sunset). Morning surveys may be of greater value as the species' movements is more coordinated at this time. Detection by sighting or call, usually of flying birds. Vehicle-based transects appropriate in areas where most habitat is restricted to roadside remnants. Survey effort will need to be increased outside the breeding season, as dispersal makes the species more difficult to detect.

Survey effort guide

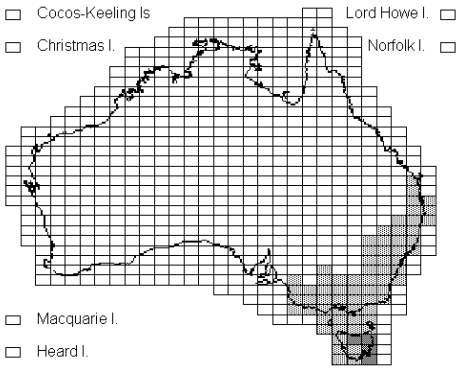
Methods	Hours	Days
Area searches or transect surveys*	12	4
Targeted searches**	12	4

* In areas of less than 50 ha.

**Targeting areas of hollow-bearing trees during breeding season.

Swift parrot

Common name	Swift parrot
Scientific name	*Lathamus discolor*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

Sometimes confused with musk lorikeets *Glossopsitta concinna* and scaly-breasted lorikeets *Trichoglossus chlorolepidotus* (Higgins 1999).

Movements

Migratory, breeds in Tasmania and moves to mainland Australia for non-breeding season (usually arriving between February and March), with most of population wintering in Victoria and New South Wales, with smaller numbers reaching south-east Queensland, Australian Capital Territory and south-east South Australia. Returns to Tasmania during spring (September to October) (Higgins 1999; Brereton 2002). Movements on mainland poorly understood but considered to be nomadic and irruptive, moving in response to food supply—especially areas of heavily flowering eucalypts (Higgins 1999).

Breeding season

Breeds from mid-September to late-January (Higgins 1999)

Habitat

On mainland, inhabits dry sclerophyll eucalypt forests and woodlands, in particular, temperate box ironbark woodlands. Also in forests of *Eucalyptus tereticornis, E. robusta, Corymbia maculata* and *C. gummifera* in coastal New South Wales/Queensland. Occasionally occurs in wet sclerophyll forests (Higgins 1999; Brereton 2002). In Tasmania, nests in tree hollows and frequents forests dominated by blue gum *Eucalyptus globulus* and swamp gum *E. ovata.*

Dispersion

Gregarious, usually in small parties, occasionally in large flocks; often or always roosts communally. Most nest in loose colonies; two or more nests can be in the same tree (Higgins 1999).

Detectability

Often noisy, active and conspicuous but can feed silently and become quite cryptic especially in the middle of the day (Kennedy & Tzaros in press). Typically allows close approach when feeding in trees. Often associates with lorikeets and honeyeaters at abundant food sources (Higgins 1999).

Recommended methods

Area searches or transect surveys of suitable habitat, preferably in the early morning and afternoon when birds are most active and vocal. Detection by sighting or call. Slow-moving vehicle transects also effective in expansive areas, detecting loud, distinctive 'clinking' call that can be heard over noise of engine. Targeted surveys of patches of heavily flowering eucalupts may be useful.

Timing: surveys on the mainland should be conducted between March and July. Surveys in Tasmania should be conducted between August and February.

Survey effort guide

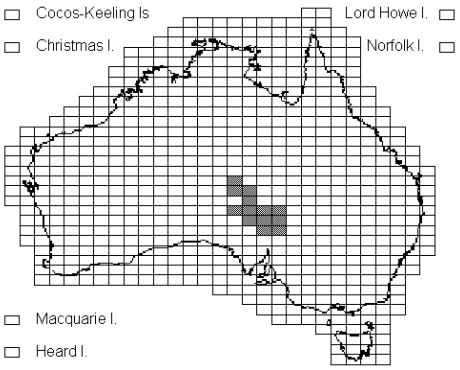
Methods	Hours	Days
Area searches or transect surveys*	20	8
Targeted surveys**	20	8

* In areas of less than 50 ha.

** Targeting areas of heavily flowering eucalypts.

Thick-billed grasswren (eastern)

Common name	Thick-billed grasswren (eastern)
Scientific name	*Amytornis textilis modestus*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Within range could be confused with Eyrean *A. goyderi* and short-tailed *A. merrotsyi* grasswrens.

Movements

Little information but probably sedentary (Schodde 1982). It is said that pairs keep to the same 4–5 ha throughout the year and do not congregate into locally nomadic parties after breeding (Schodde 1982) but the source of these statements is unknown. Observations of the population at Devonport Range, South Australia, 1989–94, indicates they are resident there (Gee et al. 1996).

Breeding season

Active nests have been recorded from late June to September (Whitlock 1924; Schodde 1982; Rowley & Russell 1997; Higgins et al. 2001). Breeding is also said to occur during January and April in response to sufficient rainfall (Schodde 1982; Rowley & Russell 1997), and it is suggested that this may allow pairs to raise a second brood in the one year (Schodde 1982).

Habitat

Occurs in chenopod shrublands, especially those supporting saltbush *Atriplex* spp. and bluebush *Maireana* spp., sometimes with widely scattered trees (Higgins et al. 2001).

Dispersion

Usually seen in pairs or small groups; sometimes singly. Probably territorial year-round (Higgins et al. 2001).

Detectability

Usually furtive and difficult to observe, though sometimes climbs briefly to a vantage point before disappearing into cover. Call soft and so high-pitched that difficult to hear, especially in windy conditions. Would probably respond to broadcast (playback) of territorial call (Higgins et al. 2001).

Recommended methods

Area searches and transect surveys early in the morning in suitable habitat. Detection by calls and sightings. Also responds to broadcast surveys, especially in the breeding season. Mist-netting may be useful in areas of low, dense vegetation, with bottom pocket of net set at ground level.

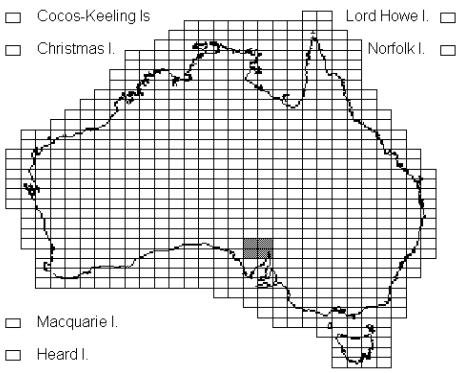
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	15	3
Broadcast surveys*	15	3
Mist-netting	15	3

* In areas of less than 50 ha.

Thick-billed grasswren (Gawler Ranges)

Common name	Thick-billed grasswren (Gawler Ranges)
Scientific name	*Amytornis textilis myall*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Within range could be confused with striated *A. striatus* and short-tailed *A. merrotsyi* grasswrens.

Movements

No information but probably sedentary (Higgins et al. 2001).

Breeding season

As in other subspecies, the breeding season is probably June to September (Schodde 1982; Higgins et al. 2001).

Habitat

Occurs in open chenopod shrublands, often where dense stands of dead finish *Acacia tetragonophylla* or blackbush *Maireana pyramidata* surrounding drainage lines (Matthew & Carpenter 1993; Higgins et al. 2001; J.S. Matthew pers. obs.). Also occurs in saltbush *Atriplex* spp. and bluebush *Maireana* spp. Shrublands, with a sparse or open overstorey of low trees or shrubs such as western myall *Acacia papyrocarpa*, black oak *Casuarina cristata*, Australian boxthorn *Lycium australe*, bullock bush *Alectryon oleaefolium* and sugarwood *Myoporum platycarpum* (Schodde 1982; Joseph & Black 1983; Matthew & Carpenter 1993; Rowley & Russell 1997; Higgins et al. 2001).

Dispersion

Usually seen in pairs or small groups; sometimes singly. Probably territorial year-round (Higgins et al. 2001).

Detectability

Usually furtive and difficult to observe, though sometimes climbs briefly to a vantage point before disappearing into cover. Call soft and so high pitched that difficult to hear especially in windy conditions. Would probably respond to broadcast (playback) of territorial call.

Recommended methods

Area searches or transect surveys early in the morning in suitable habitat. Detection by calls and sightings. Also broadcast surveys likely to be effective at soliciting responses, especially in the breeding season. Mist-netting may be useful in areas of low, dense vegetation with bottom pocket of net set at ground level.

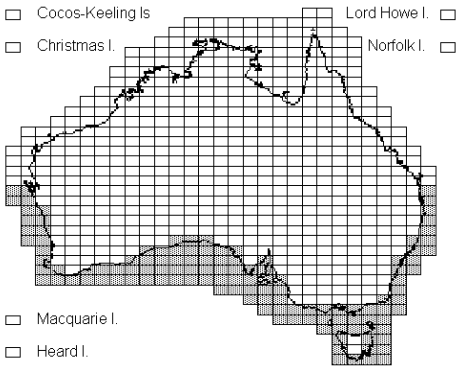
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	15	3
Broadcast surveys	15	3
Mist-netting	15	3

* In areas of less than 50 ha.

Tristan albatross

Common name	Tristan albatross
Scientific name	*Diomedea dabbenena*
Family	Diomedeidae
EPBC Act status	Endangered



Distinctiveness

May be confused with wandering albatross *D. exulans* with which it was previously considered as conspecific.

Movements

Poorly known. Wanders widely from breeding islands within South Atlantic Ocean and is rarely observed in Pacific and Indian Oceans (RPAGP 2001).

Breeding season

No breeding in Australian territory; confined to Inaccessible and Gough Islands in the Tristan da Cunha Group. Most eggs laid December to February and chicks fledge the following November to February (RPAGP 2001).

Habitat

Feeds pelagically, mainly in Southern and Atlantic Ocean almost to the Equator. Probably visits Australian waters on occasions but only one record (EABG 1999). Breeds on islands in the southern Atlantic Ocean (Gales1998 in Garnett & Crowley 2000).

Dispersion

At sea generally solitary or in loose groups, often with other albatross species at food sources.

Detectability

Conspicuous at sea and on land.

Recommended methods

At sea, shipboard surveys in the non-breeding season. On land, observation from onshore vantage points using telescopes. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

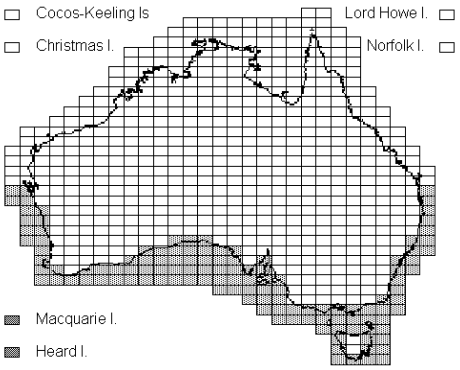
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective method to use during rough weather.

Wandering albatross

Common name	Wandering albatross
Scientific name	*Diomedea exulans*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Most easily confused with northern *D. sanfordi* and southern *D. epomophora* royal albatrosses. Also easily confused with tristan *D. dabbenena*, antipodean *D. antipodensis* and Gibson's *D. gibsoni* albatrosses, with which it was previously regarded as conspecific.

Movements

Migratory or dispersive (Marchant & Higgins 1990). Extremely wide ranging. Adults recorded to travel up to 15 200km between nest incubation bouts (RPAGP 2001).

Breeding season

Breeds on Macquarie Island as well as other subantarctic islands outside Australian jurisdiction. Breeding is biennial and lasts 55 weeks. Breeding is initiated between November and January and young fledge at about the same time the following year (RPAGP 2001).

Habitat

Feeding in pelagic offshore and inshore waters throughout the Southern Ocean, including waters off southern Australia. Non-breeding birds usually found between 30 and 50 °S. Breeds on subantarctic islands including Macquarie Island among grass tussocks, using large mud nests (Marchant & Higgins 1990).

Dispersion

Solitary or gregarious at sea. Breeds in colonies (Marchant & Higgins 1990).

Detectability

Conspicuous at sea and on land. Frequently attends fishing boats.

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys and observation from onshore vantage points using telescopes. Detection of flying birds and nests. Colony sites well documented (Department of Primary Industries, Water and Environment, Hobart). Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

Survey effort guide

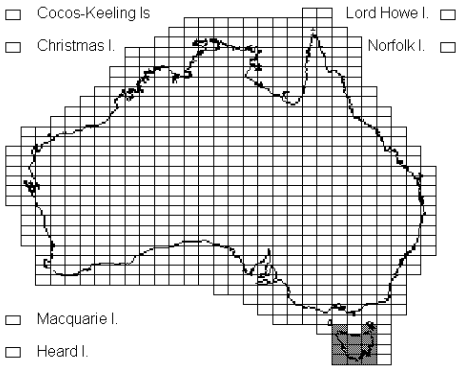
Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4
Land area searches or transect surveys**	15	3

* Most effective method to use during rough weather.

** In areas up to 10 ha, during breeding season.

Wedge-tailed eagle (Tasmanian)

Common name	Wedge-tailed eagle (Tasmanian)
Scientific name	*Aquila audax fleayi*
Family	Accipitridae
EPBC Act status	Endangered



Distinctiveness

Distinctive. No other similar species.

Movements

Established pairs are resident. Non-breeding and young birds are nomadic.

Breeding season

August to January inclusive (sometimes extending to late February). Peak laying occurs during September.

Habitat

Forages in a wide variety of habitats including coastal heath, dry woodland, sub-alpine forest, temperate rainforest, old-growth forest, dwarf coniferous forest, grasslands and cleared lands. Most nests built in emergent trees in old-growth eucalypt forest where slopes provide shelter from strong winds and are exposed to the early morning sun. Same nest may be used for up to 50 years (Garnett & Crowley 2000).

Dispersion

Usually observed singly, in pairs, or family parties. Pair typically roosts together. Appear to be territorial year-round. Nesting density estimated as between one per 20–30 km^2 in lowland eastern and northern Tasmania, and one per 1200 km^2 in highland western Tasmania (references in Garnett & Crowley 2000).

Detectability

Conspicuous when soaring, or perched in exposed situations but cryptic when in forest. Wary when approached. Often seen soaring. Detectability is highest at the onset of the breeding season when pair bonding, mating and territorial displays occur.

Recommended methods

Area searches or transect surveys in suitable habitat. Detection by sighting of soaring or perched bird or nests. Over larger areas, aerial survey suitable to detect soaring birds and nests. Locations of most active nests are known (contact Nature Conservation Branch, Department of Primary Industries, Water and Environment).

Survey effort guide

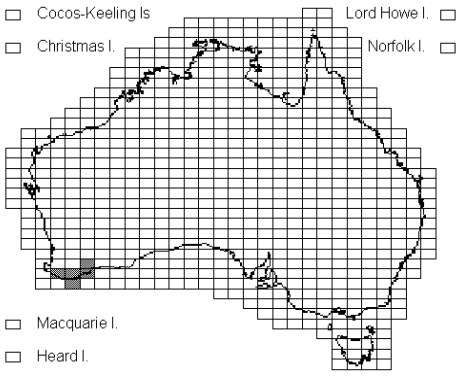
Methods	Hours	Days
Area searches or transect surveys *	20	10
Aerial surveys**	4	2

* In areas of less than 50 ha. Most effective if replicated within and across seasons, especially during periods of highest detectability.

** As long as is required to conduct sufficiently close transects over the area.

Western bristlebird

Common name	Western bristlebird
Scientific name	*Dasyornis longirostris*
Family	Pardalotidae
EPBC Act status	Vulnerable



Distinctiveness

Superficially similar to noisy scrub-bird *Atrichornis clamosus* (with which it shares habitat) if viewed fleetingly.

Movements

Sedentary; lives in pairs, in territories or fixed home ranges (McNee 1986; Smith 1987; Garnett & Crowley 2000). Capable of undertaking short, local movements and can recolonise areas burnt by fire (McNee 1986).

Breeding season

The breeding season is from July to October and the main period of laying probably August to September (Smith 1987; Higgins & Peter 2002).

Habitat

Restricted to low, dense, coastal heathland (McNee 1986; Smith 1987; Higgins & Peter 2002). Mainly inhabits dense, floristically diverse shrubby heathland, 0.5–1.5 m tall, comprising a wide variety of shrubs such as banksias, melaleucas, hakeas, and tea-trees, usually with abundant sedges, and sometimes with thickets of stunted eucalypts, especially mallee eucalypts (Smith & Moore 1977; McNee 1986; Smith 1987; Higgins & Peter 2002). Also occurs in grass-tree *Xanthorrhoea* spp. flats with dense heathland c. 1m tall and abundant sword-sedges *Anarthria* spp. (Whittell 1936). Shrubs accounted for 40–80 per cent of cover at sites where western bristlebirds were recorded in 1985 (McNee 1986).

Dispersion

In home ranges (or perhaps territories); usually occurs in pairs but also observed singly or in small family groups. At Two Peoples Bay, Western Australia, the home-range of a pair determined by mapping locations of singing birds, was estimated at 6.5 ha (range 6–8) and pairs spend at least 60 per cent of their time in a core area of 1–3 ha (Smith 1987). One radio-tracked bird at Two Peoples Bay had a home range of 6ha and another bird had a home range of 21 ha (Murphy 1994).

Detectability

Shy, elusive and rarely seen, though often heard, and usually detected only by vocalisation. Can be inquisitive. Call more between May and October than at other times, and most intense at dawn and, to a lesser extent, at dusk (Higgins & Peter 2002).

Recommended methods

Area searches or transect surveys of suitable habitat in the early morning or dusk, listening for unsolicited calls, more effective in the breeding season (Higgins & Peter 2002). Where density is low, broadcast (playback) surveys in suitable habitat early in the morning should be useful, listening for solicited responses. Again, most effective early in the breeding season.

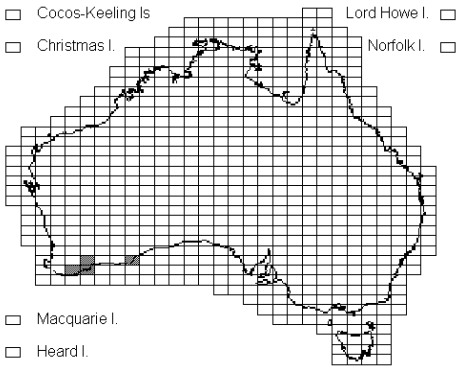
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	8	4
Broadcast surveys*	6	3

* In areas less than 50 ha, most effective at dawn during breeding season.

Western ground parrot

Common name	Western ground parrot
Scientific name	*Pezoporus wallicus flaviventris*
Family	Psittacidae
EPBC Act status	Endangered



Distinctiveness

Rock *Neophema petrophila* and elegant *N. elegans* parrots may occur in similar habitats and superficially resemble ground parrot (Higgins 1999) but confusion is unlikely by experienced observers.

Movements

Generally sedentary, though not well understood and movements not only restricted to post-breeding dispersal of young (B. Newbey pers. comm.). Present all year in Fitzgerald River National Park (A.H. Burbidge in Higgins 1999). Can move between patches of suitable habitat separated by intervening woodland. Can appear in regenerating areas five years after fires (Higgins 1999; McNee & Newbey 2003).

Breeding season

Poorly known. In 1988 in a low-rainfall area at the Short Road site in the Fitzgerald River National Park east of Albany, breeding probably began about July, with young birds caught in October, although historical records from higher rainfall areas are of eggs in October and November (Burbidge et al. 1989).

Habitat

Occurs in low coastal and near coastal heathlands, unburnt for at least five years (Higgins 1999). Mainly in dry stunted banksia, *Hakea*, *Allocasuarina* or mallee heathland often with understorey of sedges, including *Mesomelaena* growing on sandplains, frequently with scattered emergent stunted mallees. Historically also in swampy heathland, on grassy plains, and *Xanthorrhoea* flats (Higgins 1999). Suitability of habitat may be influenced by length of time since last fire, which in part determines density of vegetation and rates of seed production. Recolonisation after fire correlated with rate of growth of vegetation providing adequate cover (Higgins 1999). In Western Australia recorded in heaths six years post-fire but close to areas unburnt for 15 years and occasionally in vegetation about five years post fire (McNee, S. & Newbey, B.J. unpublished). Unknown how soon breeding begins post-fire (Burbidge et al. 1997). Rates of recovery after fires differ between regions and types of heathland. Sometimes recorded along cleared tracks, roadsides or firebreaks within suitable habitat (Higgins 1999).

Dispersion

Usually seen singly or in pairs. Individuals probably have highly overlapping home ranges. In eastern Australia, average home ranges of individuals of nominate subspecies *P. w. wallicus* were 9.2 ha and males (only tracked in winter) had smaller ranges than females (Higgins 1999). However, most Western Australian populations are believed to be at densities one order of magnitude less than birds in eastern Australia (Burbidge et al. 1997).

Detectability

Generally cryptic, shy and elusive and rarely detected on ground before birds flush. Most conspicuous before sunrise and after sunset, when engaged in distinctive flying and calling behaviour. Only occasionally calls at other times (Higgins 1999) and may call less frequently when a very low density (B. Newbey pers. comm.). Responds to playback calls (Newbey 2002; 2003; A. Burbidge pers. comm.).

Recommended methods

With multiple observers, point surveys of suitable habitat most useful with observers spaced about 400 m apart in fixed locations before sunrise and after sunset to detect distinctive calls. With lone observer, transect-point surveys during the same period. Note: it is very difficult for an observer to hear calls while moving through the heath. Broadcast (playback) surveys may also be useful, especially before and during the breeding season, and best done under overcast conditions but response to playback unpredictable.

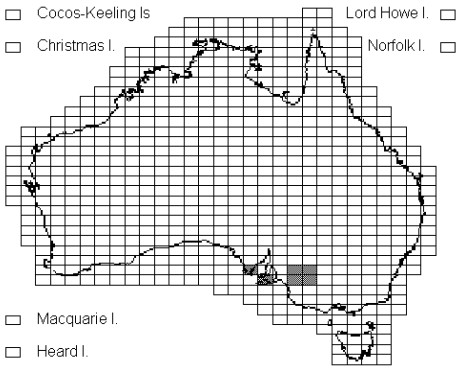
Survey effort guide

Methods	Hours	Days
Point surveys*	12	4
Broadcast surveys*	6	3

* In areas less than 50 ha, most effective before dawn or after dusk.

Western whipbird (eastern)

Common name	Western whipbird (eastern)
Scientific name	*Psophodes nigrogularis leucogaster*
Family	Cinclosomatidae
EPBC Act status	Vulnerable



Distinctiveness

Unmistakable within range.

Movements

Probably sedentary and territorial (Condon 1966).

Breeding season

Little information. Nesting has been recorded in September and October (Howe & Ross 1933; Bryant 1938; Howe & Burgess 1942; Woinarski et al. 1988).

Habitat

Occurs in mallee and thicket vegetation in coastal and inland areas of southern South Australia and possibly still persists in heathy mallee in western Victoria. Preferred habitats generally consist of a dense, shrubby understorey 1.5–2m tall below an open mallee eucalypt layer 2–5 m tall (Woinarski et al. 1988; Higgins & Peter 2002).

Dispersion

Usually seen singly or in pairs, occasionally small groups (Higgins & Peter 2002). In north-west Victoria, three pairs occupied an area of about 8.1 km^2; with a few hundred metres between two nests (Howe & Ross 1933). One male at Pinnaroo, South Australia, moved within a circular area of about 12 ha (McGilp & Parsons 1937).

Detectability

Timid, elusive and cryptic, occupies dense habitat and more often heard than seen. Distinctive song usually the only indication of presence. Both sexes responsive to broadcast (playback) of calls (Higgins & Peter 2002).

Recommended methods

Broadcast surveys effective at eliciting response, especially during the breeding season. Transect-point surveys of suitable habitat in the early morning or late afternoon to detect distinctive calls, also most effective during the breeding season.

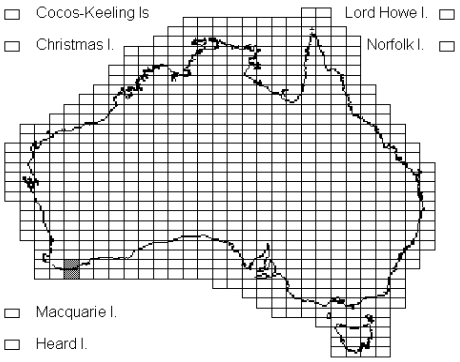
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	12	6
Broadcast surveys*	10	4

* In areas less than 50 ha, most effective at dawn or late afternoon during breeding season.

Western whipbird (western heath)

Common name	Western whipbird (western heath)
Scientific name	*Psophodes nigrogularis nigrogularis*
Family	Cinclosomatidae
EPBC Act status	Endangered



Distinctiveness

Unmistakable within range.

Movements

Territorial and probably sedentary (Webster 1966; Smith 1985), and does not appear to move far from natal territory (Smith 1985).

Breeding season

Eggs are laid from July to early September; three of 15 clutches started in second half of July, 10 started in August and two in first half of September (Higgins & Peter 2002).

Habitat

Occurs in heath-like thicket associations on coastal dune thickets and in low, dense mallee woodland with understorey of dense, stunted shrubs (Higgins & Peter 2002). At Two Peoples Bay, Western Australia, nesting habitat is dense, low heath, 4–50m from taller thickets of vegetation.

Dispersion

Usually seen singly or in pairs, occasionally small groups. A study of 23 colour-banded birds from 1971 to 1976, indicates they occupy overlapping home ranges, which cover an average area of 12.6 ha (n=13); 60 per cent of their time is spent in core areas ranging from 1.5–2.4ha within the home range. Some birds maintain home ranges from year-to-year. One pair was found to remain in the same home range for six years and another pair for five years (Smith 1991).

Detectability

Timid, elusive and cryptic, occupies dense habitat and more often heard than seen. Distinctive song usually the only indication of presence. Both sexes responsive to broadcast (playback) of vocalisations (Higgins & Peter 2002).

Recommended methods

Transect-point surveys of suitable habitat in the early morning or late afternoon to detect distinctive calls, most effective in spring. Broadcast surveys effective at eliciting response, especially in the breeding season.

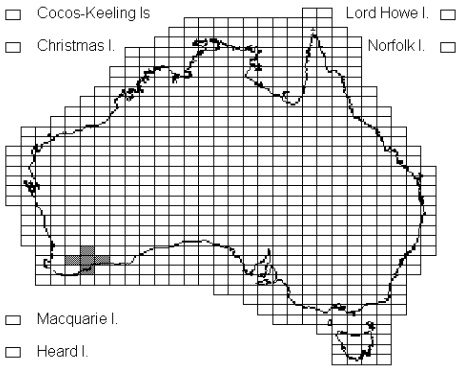
Survey effort guide

Methods	Hours	Days
Area searches*	12	6
Line transect surveys*	12	6
Broadcast surveys*	10	4

* In areas less than 50 ha, most effective at dawn or late afternoon during breeding season.

Western whipbird (western mallee)

Common name	Western whipbird (western mallee)
Scientific name	*Psophodes nigrogularis oberon*
Family	Cinclosomatidae
EPBC Act status	Vulnerable



Distinctiveness

Unmistakable within range.

Movements

Little known. Probably sedentary but possibly moves from one area of uncleared vegetation to another (McNee 1986).

Breeding season

Nests with eggs have been found at Gnowangerup and Ongerup from late July to October (Howe & Ross 1933; Whittell 1939).

Habitat

Occurs in mallee, often open mallee vegetation with a dense, tall shrub layer up to 1.5 m tall and dominated by such species as *Hakea*, *Lambertia*, *Dryandra* or banksia (Robinson 1975; McNee 1986; Higgins & Peter 2002).

Dispersion

Usually seen singly or in pairs, occasionally small groups (Higgins & Peter 2002).

Detectability

Timid, elusive and cryptic, occupies dense habitat and more often heard than seen. Distinctive song usually only indication of presence. Both sexes responsive to broadcast (playback) of vocalisations (Higgins & Peter 2002).

Recommended methods

Broadcast surveys effective at eliciting response, especially in the breeding season. Transect-point surveys of suitable habitat in the early morning or late afternoon to detect distinctive calls, also most effective in breeding season.

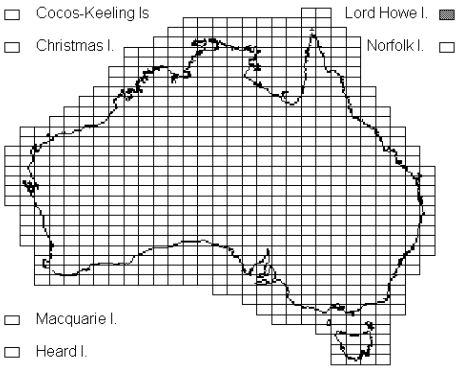
Survey effort guide

Methods	Hours	Days
Area searches*	12	6
Line transect surveys*	12	6
Broadcast surveys*	10	4

* In areas less than 50 ha, most effective at dawn or late afternoon during breeding season.

White-bellied storm petrel (Tasman Sea)

Common name	White-bellied storm petrel (Tasman Sea), white-bellied storm petrel (Australasian)
Scientific name	*Fregetta grallaria grallaria*
Family	Hydrobatidae
EPBC Act status	Vulnerable; marine



Distinctiveness

Similar to black-bellied *F. tropica*, Wilson's *Oceanites oceanicus*, and grey-backed *O. nereis* storm petrels (Marchant & Higgins 1990).

Movements

Migrate from breeding islands to subtropical and tropical seas but movements poorly understood (Marchant & Higgins 1990); possibly disperses as far as central Pacific Ocean (Harrison 1983).

Breeding season

Late summer. Pair recorded during day at nest site on Roach Island during October. Laying occurs late January to March (Hutton 1991) and downy young, near fledging, found 9 May (Marchant & Higgins 1990).

Habitat

Marine, oceanic; in subtropical and highly saline tropical waters of Pacific Ocean; rarely in subantarctic waters. In non-breeding season, migrates to tropics; recorded in Tasman Sea, as far south as 34 °S where warm surface water present. In Australia, recorded in non-breeding season near edge of continental shelf. Seen feeding 25 km offshore in New South Wales. Continental margin of north and central New South Wales may be a favoured feeding area of Lord Howe Island breeding birds (Marchant & Higgins 1990). Breeds on rocky or well-vegetated subtropical islands where loosely colonial and strictly nocturnal.

Dispersion

Poorly known. Loosely colonial. Not especially gregarious (Marchant & Higgins 1990).

Detectability

Most often seen ahead of or accompanying vessels. Returns to breeding colonies at night (Marchant & Higgins 1990).

Recommended methods

At sea, shipboard surveys. On land, area searches or transect surveys of potential nesting sites to locate burrows with follow-up spotlighting at night when birds are active at colony during the breeding season. Detection of landed birds by sight and vocalisation of flying birds. Colony sites well documented.

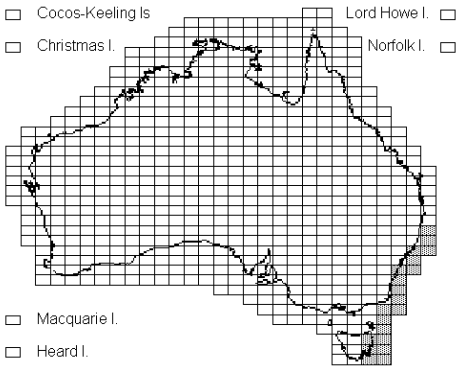
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land area searches or transect surveys*	10	2

* In areas up to 10 ha, during breeding season with follow-up spotlighting at night.

White-capped albatross

Common name	White-capped albatross
Scientific name	*Thalassarche steadi*
Family	Diomedeidae
EPBC Act status	Vulnerable



Distinctiveness

Difficult to distinguish from shy albatross *T. cuada* with which it was considered, until recently, to be conspecific.

Movements

Poorly known. No specific banding studies have been conducted. Adults are present in south-east Australian waters throughout the year (RPAGP 2001).

Breeding season

No breeding in Australian territory. On New Zealand islands laying starts in November and young fledge in August (RPAGP 2001).

Habitat

Marine. In Australian waters forages in pelagic waters of south-eastern Australia. Breeds on islands off southern New Zealand (Marchant & Higgins 1990; EABG 1999).

Dispersion

Solitary or gregarious at sea. Breeds in dense colonies on islands (Marchant & Higgins 1990).

Detectability

Conspicuous at sea.

Recommended methods

At sea, shipboard surveys. On land, observation from onshore vantage points using telescopes. Detection of flying birds. Surveys of beach cast birds may provide an opportunity to detect this species, though they provide little information on origins of specimens as bodies are usually displaced by currents and winds.

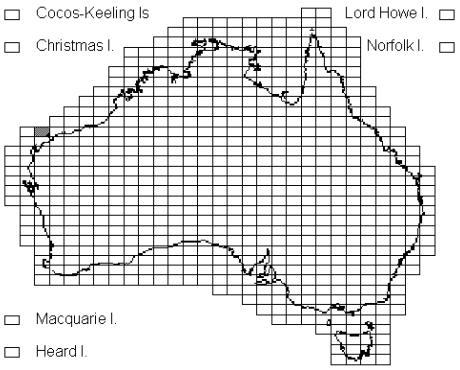
Survey effort guide

Methods	Hours	Days
Shipboard surveys	15	3
Land-based sea observations*	8	4

* Most effective method to use during rough weather.

White-winged fairy wren (Barrow Island)

Common name	White-winged fairy wren (Barrow Island), Barrow Island black-and-white fairy wren
Scientific name	*Malurus leucopterus edouardi*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

No other similar species on Barrow Island.

Movements

Regarded as resident on Barrow Island (Sedgwick 1978). It is also possibly sedentary and said to have never been recorded on other nearby islands or the mainland but confirmation required (see Higgins et al. 2001). Pruett-Jones & Tarvin (2001) considered it unlikely that it would disperse off of Barrow Island.

Breeding season

Schodde (1982) suggests that most egg-laying on Barrow Island occurs in June to August, whilst Storr (1984) specifies breeding season as April to September. However, appears to breed opportunistically following good rainfall.

Habitat

Occurs in hummock grasslands growing on sand plains, sandhills or interdunes, including grasslands of *Triodia*, with or without sea grass *Spinifex longifolius*, and with or without scattered and emergent shrubs, such as necklace acacia *Acacia coriacea* and bat's wing coral tree *Erythrina vespertilio* (Whitlock 1918, 1919; Sedgwick 1978; Wooller & Calver 1981; Storr 1984; Ambrose & Murphy 1994; Higgins et al. 2001). On Barrow Island, may prefer the lower country supporting dense grasslands of *Triodia* greater than 40 cm in height and augmented by scattered, as opposed to rockier, higher terrain with shorter spinifex (less than 40 cm), low or sparse shrubs, and a higher proportion of bare or stony ground (Sedgwick 1978). Only sporadically found on clay pans and not in creek beds or mangroves (Pruett-Jones & Tarvin 2001).

Dispersion

Gregarious; typically observed in small groups (Higgins et al. 2001).

Detectability

Male very conspicuous but wary and not easily approached; difficult to observe outside breeding season. Greatest vocal activity before dawn and during the breeding season (Higgins et al. 2001).

Recommended methods

Area searches or transect-point surveys early in the morning in suitable habitat. Detection by call and sightings. More effective in the breeding season. Broadcast (playback) surveys may be useful but mainland subspecies said to respond poorly (Higgins et al. 2001). Mist-netting with nets set low amongst *Triodia* may be useful.

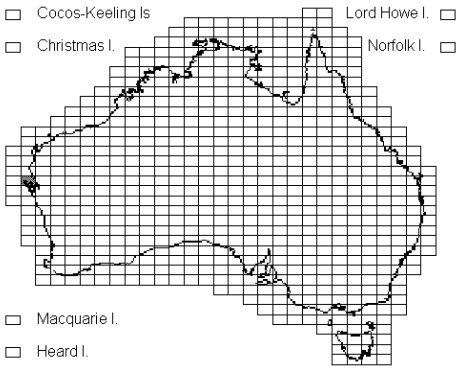
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys*	10	3
Broadcast surveys*	8	3
Mist-netting	12	4

* In areas less than 50 ha, most effective at dawn during breeding season.

White-winged fairy wren (Dirk Hartog Island)

Common name	White-winged fairy wren (Dirk Hartog Island), Dirk Hartog black-and-white fairy wren
Scientific name	*Malurus leucopterus leucopterus*
Family	Maluridae
EPBC Act status	Vulnerable



Distinctiveness

Females and juveniles similar to variegated fairy wren *M. lamberti*. Some very dark individuals of the mainland subspecies *M. l. leuconotus* are occasionally reported and, in poor light, could be confused with Dirk Hartog birds.

Movements

Regarded as resident on Dirk Hartog Island (Sedgwick 1978). Possibly sedentary and said to have never been recorded on other nearby islands or the mainland but confirmation is required (see Higgins et al. 2001).

Breeding season

Most egg-laying occurs July to September (Schodde 1982). The breeding season is specified to occur from June to the end of September (Whitlock 1919, 1921) or July to August (Storr 1985).

Habitat

Widespread from the coastal dunes to the summit of the island about 200 m above sea level (Whitlock 1921). Occurs in various habitats, including thickets of mallee eucalypts, thickets of low scrub dominated by acacia, *Diplolaena* and *Triodia*, broad flats of saltbush *Atriplex* spp., dense, low *Melaleuca* heath, dense, low heath of *Thryptomene* and clumps of *Triodia* and sea grass *Spinifex longifolius* (Carter 1917; Whitlock 1919, 1921; Wells & Wells 1974; Storr 1985; Garnett & Crowley 2000).

Dispersion

Gregarious; typically observed in small groups (Higgins et al. 2001).

Detectability

Male very conspicuous but wary and not easily approached; difficult to observe outside breeding season. Greatest vocal activity before dawn and during the breeding season (Higgins et al. 2001).

Recommended methods

Area searches and transect-point surveys early in the morning in suitable habitat. Detection by call and sightings. More effective during the breeding season. Broadcast (playback) surveys may be useful but mainland subspecies said to respond poorly (Higgins et al. 2001). Mist-netting with nets set low amongst dense vegetation may be useful.

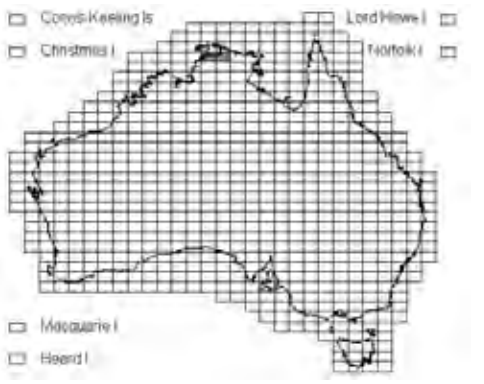
Survey effort guide

Methods	Hours	Days
Area searches or transect surveys *	10	3
Broadcast surveys*	8	3
Mist-netting	12	4

* In areas of less than 50 ha, most effective during breeding season.

Yellow chat (Alligator Rivers)

Common name	Yellow chat (Alligator Rivers)
Scientific name	*Epthianura crocea tunneyi*
Family	Meliphagidae
EPBC Act status	Endangered



Distinctiveness

Distinctive: unlikely to be confused with other taxa within its distribution.

Movements

Recorded throughout most of the year, though local seasonal movements have also been recorded. For example, at Oenpelli, Northern Territory, birds known to vacate wetlands as they dry up (Deignan 1964).

Breeding season

Unknown. possibly similar to that of other subspecies, for which eggs have been recorded in October (Storr 1985b) and March (Anon. 1994), young in nest in June (NRS) and fledglings in April (*Australian Atlas*).

Habitat

Grassy river floodplain depressions and channels (Deignan 1964; Armstrong 2004).

Dispersion

Usually seen in twos or small, loose groups (Higgins et. al. 2001). Concentrates around wetter areas at the end of the dry season (Armstrong 2004). Known from only a small number of sites within the area encompassing the floodplains from the Adelaide River to the East Alligator River (Armstrong 2004).

Detectability

Unknown.

Recommended methods

Area searches or transect-point surveys of all suitable habitat, preferably in the early morning or late afternoon, particularly during breeding season. Familiarisation with prominent calls will benefit detection.

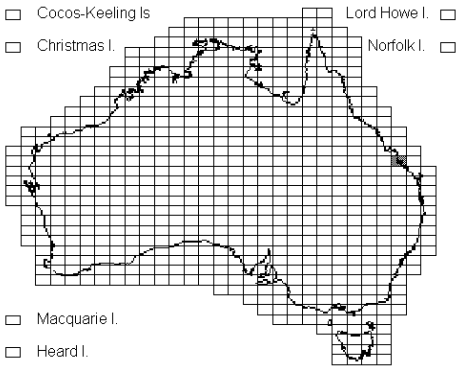
Survey effort guide

Methods	Hours	Days
Area searches*	12	4
Transect-point surveys*	10	3

* In areas of less than 50 ha, most effective during breeding season.

Yellow chat (Dawson)

Common name	Yellow chat (Dawson)
Scientific name	*Epthianura crocea macgregori*
Family	Meliphagidae
EPBC Act status	Critically endangered



Distinctiveness

No other similar species on Curtis Island.

Movements

The small populations on Curtis Island and adjoining mainland have been determined as resident (P. O'Neill pers. comm.).

Breeding season

Few records. Believed to breed during spring, summer and autumn (Houston et al. 2004; Jaensch et al. 2003). Two nests with fledglings found in October 2002 (Houston et al. 2004). Breeding may be weather-dependent (P. O'Neill pers. comm., Houston et al. 2004).

Habitat

Occurs in swampy grasslands, saline herbland and marine plains, typically near coast in areas within reach of only the very highest tides. Utilises dense reedbeds for shelter and nesting but moves into more open areas for foraging, including *Sporobolus virginicus* and *Paspalum distichum* grasslands and chenopod salt flats. Appears to require a mosaic of dense reedbeds, low, open vegetation and areas of mud, shallow water and chenopods (Houston et al. 2004). Breeding habitat is known to vary from saltmarsh vegetation (Twelve Mile Creek, Houston et al. 2004) to freshwater vegetation (Torilla Plain, Jaensch et al. 2003) and vegetation of intermediate salinity at Curtis Island (Houston et al. 2004) and Torilla Plain. However, all have in common an association with drainage lines, saline soils, the presence of extensive moist and/or muddy substrates and a location on marine plains with a connection to tidally influenced wetlands. Typical habitat at Curtis Island, Twelve Mile Creek and two of the three Torilla Plain localities is a network of braided drains flanked by rank vegetation (rushes, sedges or grass) that provides shelter adjacent to muddy substrates.

Dispersion

Most commonly observed as singles, pairs or family groups with immature offspring in the breeding season. Flocks of up to 30 individuals form in the dry season at Torilla Plains (W. Houston pers. comm.). No information on home range and territory size.

Detectability

Reasonably conspicuous in the breeding season when males call and engage in display flights up to 20 m high. Males also occasionally perch conspicuously while calling. Unfledged young hide from observers in reed beds (Houston et al. 2004). Preferred habitat may be difficult to access. Much less conspicuous in the non-breeding period.

Recommended methods

Area searches or transect-point surveys of all suitable habitat, preferably in the early morning or late afternoon, particularly during breeding season. Familiarisation with prominent calls will benefit detection.

Survey effort guide

Methods	Hours	Days
Area searches*	12	4
Transect-point surveys*	10	3

* In areas of less than 50 ha, most effective during breeding season.

REFERENCES FOR ALL SPECIES ACCOUNTS

Ambrose SJ, Murphy DP 1994, 'Synchronous breeding of land birds on Barrow Island, Western Australia, after cyclonic summer rains', *Emu,* vol. 94, pp. 55–58.

Anon. 1994, 'Birds from the black stuff', *Wingspan* vol. 14, pp. 14–16.

Armstrong M 2004, *The yellow chat Epthianura crocea tunneyi in Kakadu National Park'. Report to Parks Australia (North),* NT Department of Infrastructure Planning and Environment, Darwin.

Ashby E,1932, 'Bird notes'*. South Australian Ornithologist* vol. 11, pp. 232–233.

Aumann T, Baker-Gabb DJ 1991, 'A Management Plan for the Red Goshawk', *RAOU Report No. 75*.

Baker J. 1998, *Radio-tracking Eastern Bristlebirds at Jervis Bay*, Environment Australia, Canberra.

Baker J. 2000, 'The Eastern Bristlebird: cover dependent and fire-sensitive', *Emu*, vol 100, pp. 286–298.

Baker J 2001, Population density and home range estimates for the Eastern Bristlebird at Jervis Bay, south-eastern Australia, *Corella,* vol. 25, pp. 62–67.

Baker J, Clarke J 1999, 'Radio-tagging the Eastern Bristlebird: methodology and effects', *Corella* Vol. 23, pp. 25–32.

Baker-Gabb DJ 2002, *Recovery Plan for the Plains-wanderer Pedionomus torquatus 2002–2006: Conservation of lowland native grassland dependant fauna,* Environment Australia, Canberra.

Baker-Gabb DJ, Benshemesh J, Maher PN 1990, 'A revision of the distribution, status and management of the Plains-wanderer *Pedionomus torquatus', Emu* vol. 90, pp. 161–168.

Baldwin M. 1975, 'Birds of the Inverell District, NSW', *Emu, vol,* 75, pp. 113–120.

Baldwin M 1976, 'Distribution of the Black-throated Finch', *Australian Birds,* vol. 11, pp. 13–14.

Barnard CA 1925, 'A review of the birdlife on Coomooboolaroo Station, Duaringa District, Queensland, during the past fifty years', *Emu, vol.* 24, pp. 252–265.

Barnard HG 1914, 'Northern Territory birds', *Emu,* vol. 14, pp. 39–57.

Barnard HG (1926) 'Birds of the Cardwell district, Queensland', *Emu, vol.* 26, pp. 1–13.

Beardsell C 1985, *The Regent Parrot: A report on the nest-site survey in south-eastern Australia, September 1983 to January 1984,* Australian National Parks and Wildlife Service Report Series 1.

Becking JH 1976, 'Feeding range of Abbott's Booby *Sula abbotti* at the coast of Java', *Ibis*, vol. 118, pp. 989–590.

Bennett S 1985, 'The distribution and status of the Black-breasted Button quail *Turnix melanogaster', Emu, vol.* 85, pp. 157–162.

Benshemesh J 1997, 'Caring for Nganamara', *Wingspan, vol.* 7(4), pp. 16–21.

Benshemesh J 1999, *National Recovery Plan for Malleefowl,* Unpubl, report to Environment Australia, Canberra.

Benshemesh J 2000, *National Recovery Plan for Malleefowl*, Malleefowl Recovery Team and SA Department for Environment and Heritage, Adelaide.

Benshemesh JS, Emison WB 1996, 'Surveying breeding densities of Malleefowl using an airborne thermal scanner', *Wildlife Research* vol. 23, pp. 121–142.

Berney FL 1903, 'North Queensland notes on some migratory birds', *Emu, vol. 2,* pp. 210–211.

Blakers M, Davies SJJF, Reilly PN 1984, *The Atlas of Australian Birds*, Royal Australasian Ornithologists Union and Melbourne University Press, Melbourne.

Boekel C 1980, 'Birds of Victoria River Downs Station and of Yarralin, Northern Territory', *Part 1. Australian Bird Watcher*, vol. 8, pp. 171–193.

Boles WE, Longmore NW, Thompson MC 1994, 'A recent specimen of the Night Parrot, *Geopsittacus occidentalis', Emu,* vol. 94, pp. 37–40.

Boon WM, Daugherty CH, Chambers GK 2001, 'The Norfolk Island Green Parrot and New Caledonian Red-crowned Parakeet are distinct species', *Emu*, vol. 101, pp. 113-122

Bourne WRP, Warham J 1966, 'Geographical variation in the giant-petrels of the genus *Macronectes', Ardea*, vol. 54, pp. 45–67.

Brereton R 2002, *Swift Parrot Recovery Plan,* Tasmanian Department of Primary Industries, Water and Environment, Hobart.

Brereton R, Bryant SL, Rowell M 1997, *Habitat modelling of the Forty-spotted Pardalote and recommendations for management,* Tasmanian Department of Environment and Land Management, Hobart.

Britton PL, Britton HA 2000, 'The birds of Charters Towers, north Queensland', *Sunbird,* vol. 30, pp. 61–88.

Brooke M de L, Rowe G 1996, 'Behavioural and molecular evidence for specific status of light and dark morphs of the Herald Petrel *Pterodroma heraldica', Ibis,* vol. 138, pp. 420–432.

Brooker B 2000, 'The range and habitat characteristics of the Thick-billed Grasswren *Amytornis textilis* in the Shark Bay Region', *Wildlife Research*, vol. 27, pp. 245–256.

Brooker MG 1988, 'Some aspects of the biology and conservation of the Thick-billed Grasswren *Amytornis textilis* in the Shark Bay area, Western Australia', *Corella,* vol. 12, pp. 101–8.

Brothers N 1985, 'Breeding biology, diet and morphometrics of the King Shag, *Phalacrocorax albiventer purpurascens* at Macquarie Island', *Australian Wildlife Research*, vol. 12, pp. 81–94.

Brothers N, Pemberton D, Pryor H, Halley V 2001, *Tasmania's Offshore Islands: Seabirds and Other Natural Features,* Tasmanian Museum and Art Gallery, Hobart.

Brown PB, Wilson RI 1984, *The Orange-bellied Parrot Recovery Plan,* Tasmanian National Parks and Wildlife Service, Hobart.

Brown PB, Wilson RI 1982, 'The Orange-bellied Parrot', p in eds Groves, RH. & WDL. Ride 1982, *Species at Risk: Research in Australia*, Australian Academy of Science, Canberra.

Brown PB 1980, 'The status of parrot species in western Tasmania', *Tasmanian Bird Report,* vol. 9, pp. 4–12.

Brown PB 1984, 'The Orange-bellied Parrot', *Bird Keeping Australia,* vol. 27, pp. 82–87.

Brown PB 1986, *The Forty-spotted Pardalote in Tasmania*, Tasmanian National Parks and Wildlife Service, Hobart.

Brown PB, Wilson R., Loyn R, Lane B 1985, 'The Orange-bellied Parrot', *RAOU Report No. 14*.

Bryant CE 1938, 'The Mallee Whipbird', *Emu,* vol. 38pp. 338–339.

Bryant SL 1991, *The Forty-spotted Pardalote Recovery Plan: Management Phase,* Tasmanian Department of Parks, Wildlife and Heritage, Hobart.

Bulman C, Rounsevell DE, Woinarski JCZ 1986, 'The Forty-Spotted Pardalote: an RAOU Conservation Statement', *RAOU Report No. 17*.

Burbidge A 1985, *The Regent Parrot: A report on the breeding distribution and habitat requirements along the Murray River in south-eastern Australia* Australian National Parks and Wildlife Service, Report series No. 4. Canberra ACT,

Burbidge AA, Folley GL, Smith GT 1986, *The Noisy Scrub Bird*. Western Australian Department of Conservation and Land Management, Perth.

Burbidge AH, Blyth J, Danks A., Gillen K, Newbey B 1997, *Western Ground Parrot Interim Recovery Plan 1996 to 1999*, Western Australian Department of Conservation and Land Management, Perth.

Burbidge AH, Watkins D, McNee S 1989, *Project 118: Conservation of the Ground Parrot in Western Australia*, Unpublished report to WWF Australia.

Burnard T, Hill R 2001, *South-eastern Red-tailed Black-Cockatoo Recovery Plan*, Birds Australia, Melbourne.

Campbell AJ 1900, *Nests and Eggs of Australian Birds*, Published by author, Sheffield, UK.

Carpenter G, Matthew JS 1986, 'The birds of Billiatt Conservation Park', *South Australian Ornithologist,* vol. 30, pp. 29–37.

Carter M 1993, 'Alexandra's or Princess Parrot: Status and 'normal' range', *Wingspan,* vol. 12pp. 32–35.

Carter M 1994, 'Birds of Australia's Christmas Island', *Wingspan,* vol. 13pp. 18–21.

Carter T 1912, 'Notes on *Licmetis pastinator* (Western Long-billed Cockatoo)', *Ibis*, vol. (9) 6, pp. 627–634.

Carter T 1917, 'The birds of Dirk Hartog Island and Peron Peninsula, Shark Bay, Western Australia, 1916–1917', Ibis, vol. (10) 5, pp. 564–611.

Carter T 1924, 'Birds of the Broome Hill district', *Emu*, vol. 23, pp. 223–235.

Clarke R, Clarke M 1999, *Translocation Proposal for the Black-eared Miner*, Unpubl. report to the Black-eared Miner Recovery Team.

Clarke R, Bramwell M 1998, 'The Eastern Bristlebird *Dasyornis brachypterus* in East Gippsland, Victoria', *Australian Bird Watcher*, vol. 17pp. 245–253.

Condon HT 1966, 'The Western Whipbird. Preliminary notes on the discovery of a new subspecies on southern Yorke Peninsula, South Australia', *South Australian Ornithologist,* vol. 24, pp. 79–91.

Cooper C 2000, 'Food manipulation by southwest Australian cockatoos', *Eclectus,* vol. 8, pp. 3–9.

Cooper RM, McAllan IAW 1995, *The Birds of Western New South Wales,* Preliminary Atlas NSW Bird Atlassers, Albury, NSW.

Crowley GM, Garnett ST 2001, 'Food value and tree selection by Glossy Black-Cockatoos *Calyptorhynchus lathami', Austral Ecology,* vol. 26, pp. 116–126.

Czechura GV, Hobson RG 2000, *The Red Goshawk Erythrotriorchis radiatus in northern Queensland: status and distribution*, Report to Queensland Parks and Wildlife Service, Brisbane.

Danks A 1991, *The role of corridors in the management of an endangered passerine*,Surrey Beatty, Sydney.

Danks A 1993, 'What annoys a scrub-bird?', *Wingspan* vol. 12, pp. 6–7.

Danks A, Burbidge AA, Burbidge AH, Smith GT 1996, *Noisy Scrub-bird Recovery Plan*, Western Australian Department of Conservation and Land Management, Perth.

Davies SJJF 1966 'The movements of the White-tailed Black-Cockatoos (*Calyptorhynchus baudinii*) in south-western Australia', *Western Australian Naturalist,* vol. 10, pp. 33–42.

De Ravin JA 1975, 'The birds of Norfolk Island', *Australian Bird Watcher,* vol. 6, pp. 4–10.

Debus SJS, Czechura, GC 1988, 'The Red Goshawk *Erythrotriorchis radiatus*: a review', *Australian Bird Watcher,* vol. 12, pp. 175–199.

Deignan HG 1964, 'Birds of the Arnhem Land Expedition', Rec. *American-Australian Scientific Expedition to Arnhem Land*, vol. 4, pp. 345-426.

del Hoyo J, Elliott A, Sargatal J (Eds) 1992, *Handbook of the Birds of the World (Volume 1) Ostrich to Ducks*, Lynx Edicions, Spain.

Dostine P 1998, *Gouldian Finch Erythrura gouldiae Recovery Plan*, Gouldian Finch Recovery Team and Parks and Wildlife Commission Northern Territory, Darwin.

Downes, M. C., E.H.M. Ealey, A.M. Gwynn & P.S. Young 1959, *The birds of Heard Island,* Australian National Antarctic Research Reports (Series B).

Emison WB, Beardsell CM, Norman FI, Loyn RH, Bennett SC 1987, *Atlas of Victorian Birds*, Victorian Department of Conservation, Forests and Lands and Royal Australasian Ornithologists Union, Melbourne.

Fletcher JA 1909, 'Bird notes from Cleveland, Tasmania', *Emu,* vol. 9, pp. 79–83.

Ford H, Howe R 1980, 'The future of birds in the Mount Lofty Ranges', *South Australian Ornithologist,* vol. 28, pp. 85–89.

Ford J 1983, 'Evolutionary ecology and ecological relationships between quail-thrushes', *Emu*, vol. 83, pp. 152–172.

Ford J 1986, 'Avian hybridisation and allopatry in the region of the Einasleigh Uplands and Burdekin-Lynd Divide, north-eastern Queensland', *Emu,* vol. 86, pp. 87–110.

Ford, J, and Parker, S 1972, 'The occurrence of the yellow chat in south-western Queensland', *Sunbird*, vol. 3, pp. 15.

Forshaw J, Cooper WT 1981, *Australian Parrots*, Lansdowne Press, Melbourne.

Forshaw JM 1981, *Australian Parrots*, 2nd edn, Lansdowne Editions and Weldon Publishing, Sydney.

Franklin, D., Menkhorst, P & J Robinson 1987, 'Field surveys of the Regent Honeyeater *Xanthomyza phrygia* in Victoria', *Australian Bird Watcher,* vol. 12, pp. 91–95.

Franklin DC, Smales IJ, Quin BR, Menkhorst PW 1999, 'Annual cycle of the Helmeted Honeyeater *Lichenostomus melanops cassidix*, a sedentary inhabitant of a predictable environment', *Ibis*, vol. 141, pp. 256–268.

Franklin DC, Smales IJ, Miller MA, Menkhorst PW 1995, 'The reproductive biology of the Helmeted Honeyeater, *Lichenostomus melanops cassidix', Wildlife Research*, vol. 22, pp. 173–191.

Franklin DC, Menkhorst PW, Robinson JL 1989, 'Ecology of the Regent Honeyeater *Xanthomyza phrygia'*, *Emu*, vol. 89, pp. 140–154.

Frith HJ 1962a, 'Conservation of the Malleefowl *Leipoa ocellata* Gould (Megapodidae)', *CSIRO Wildlife Research,* vol. 7, pp. 33–49.

Frith HJ 1962b, *The Malleefowl: the Bird that Builds a Mound*, Angus and Robertson, Sydney.

Frith HJ 1982, *Pigeons and Doves of Australia*', Rigby, Melbourne.

Fullagar PJ 1976, 'Seabird islands: Cabbage Tree Island, New South Wales', *Australian Bird Bander*, vol. 14, pp. 94–97.

Fullagar PJ, Burbidge AA 1992, 'Seabird islands: Pelsaert Island, Houtman Abrolhos, Western Australia', *Corella,* vol. 16, pp. 47–58.

Gales R 1998, 'Albatross populations: status and threats', pp. 20–45 in *The Albatross: Biology and Conservation'*, eds. G Robertson and R Gales, Surrey Beatty and Sons, Chipping Norton.

Garnett S, Bredl R 1985, 'Birds in the vicinity of Edward River Settlement', *Sunbird,* vol. 15, pp. 6–23, 25–40.

Garnett ST, Crowley GM 2000, *The Action Plan for Australian Birds 2000*, Environment Australia and Birds Australia, Canberra.

Garnett ST, Crowley GM, Pedler LP, Prime W, Twyford KL, Maguire A 2000, *Recovery Plan for the South Australian subspecies of the Glossy Black-Cockatoo (Calyptorhynchus lathami halmaturinus): 1999–2003*, version 3.0, Department of Environment and Heritage, Adelaide.

Garnett ST, Pedler LP, Crowley GM 1999, 'The breeding biology of the Glossy Black-Cockatoo *Calytorhynchus lathami* on Kangaroo Island, South Australia', *Emu*, vol. 99, pp. 262–279.

Gee P, Gee I, Read J 1996, 'An annotated bird list from the Davenport Range, South Australia', *South Australian Ornithologist*, vol. 32, pp. 76–81.

Geering D, French K 1998, 'Breeding biology of the Regent Honeyeater *Xanthomyza phrygia* in the Capertee Valley, New South Wales', *Emu*, vol. 98, pp. 104–116.

Gibson JD, Sefton AR 1957, 'The Gould Petrel: Australian records', *Emu*, vol. 57, pp. 49–52.

Gibson, J.D. 1977, 'The birds of the County of Camden', *Australian Birds*, vol. 11, pp. 41–80.

Gibson-Hill CA 1947, 'Notes on the birds of Christmas Island', *Bulletin of the Raffles Museum,* vol. 18, pp. 87–165.

Gill HB 1970, 'Birds of Innisfail and hinterland', *Emu*, vol. 70, pp. 105–116.

Gore MJE 1968, 'A Check-list of the birds of Sabah, Borneo', *Ibis,* vol. 110, pp. 165–196.

Gosper DG 1992, 'Forest bird communities of the Richmond River District, New South Wales', *Corella*, vol. 16, pp. 78–88.

Gould PJ 1983, 'Seabirds between Alaska and Hawaii', *Condor*, vol. 85, pp. 286–291.

Green K 1997a, 'Biology of the Heard Island Shag *Phalacrocorax nivalis* 1. Breeding behaviour', *Emu,* vol. 97, pp. 60–66.

Green K 1997b, 'Biology of the Heard Island Shag *Phalacrocorax nivalis* 2. Breeding', *Emu,* vol. 97, pp. 67–75.

Green RH 1989, *Birds of Tasmania. Volume 3,* Potoroo Publications, Launceston.

Green RH, McGarvie AM 1971, 'The birds of King Island', *Records of the Queen Victoria Museum*, vol. 40, pp. 1–42.

Hackett J, Hackett M 1986, 'A Red-lored Whistler in the Manning Reserve, Mount Lofty Range', *South Australian Ornithologist*, vol. 30, pp. 52–53.

Halse SA, Burbidge AA, Lane JAK, Haberley B, Pearson GB, Clarke A 1995, 'Size of the Cape Barren Goose population in Western Australia', *Emu*, vol. 95, pp. 77–83.

Hardy JW 2002, 'A banding study of the Grey grasswren *Amytornis barbatus barbatus* in the Caryapundy swamp of South-western Queensland', *Corella*, vol. 26(4), pp. 106-109.

Harrison P 1983, *Seabirds: An Identification Guide,* Houghton Mifflin Harcourt, US.

Hartley SL, Kikkawa J 1994, *The population management of the Eastern Bristlebird (Dasyornis brachypterus),* Dept Environment & Heritage, QPWS, Brisbane.

Hatch JH 1977, 'The birds of Comet Bore (Ninety-mile Plain)', *South Australian Ornithologist,* vol. 27, pp. 163–172.

Hermes N 1985, *Birds of Norfolk Island*, Wonderland Publications, Norfolk Island.

Hicks J, Greenwood D 1989, 'Rescuing Norfolk Island's parrots', *Birds International,* vol. 1, pp. 35–47.

Higgins P.J. (Ed) 1999, *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 4. Parrots to Dollarbird*, Oxford University Press, Melbourne.

Higgins PJ, Peter JM (Eds) 2002, *Handbook of Australian, New Zealand and Antarctic Birds'. Vol. 6, Pardalotes to Spangled Drongo*, Oxford University Press, Melbourne.

Higgins PJ, Davies SJJF (Eds) 1996, *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 3, Snipe to Pigeons,* Oxford University Press, Melbourne.

Higgins PJ, Peter JM, Steele W 2001, *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 5. Tyrant-flycatchers to Chats,* Oxford University Press, Melbourne.

Hill FAR 1997, *The Christmas Island Goshawk Accipiter fasciatus natalis Recovery Plan*, Birds Australia, Melbourne.

Hill GF 1911, 'Field notes on the birds of Kimberley, north-west Australia', *Emu*, vol. 10, pp. 258–290.

Hindwood KA., Serventy DL 1941, 'The Gould Petrel of Cabbage Tree Island', Emu 41, pp. 1–20.

Hindwood KA 1940, 'The birds of Lord Howe Island', *Emu*, vol. 40, pp. 1–86.

Hinsby KB 1947, 'The Ornage-bellied Parrakeet', *Emu*, vol. 47, pp. 67–68.

Holmes G 1990, 'The biology and ecology of Coxen's Fig-Parrot', *RAOU Report Series 65.*

Holmes G 1995, *Coxen's Fig Parrot Survey*, A draft report to the Coxen's Fig-Parrot Recovery Team, June 1995, Coxen's Fig-Parrot Recovery Team.

Holmes G 1996, 'Distribution and status of the Southern Star Finch', *Sunbird*, vol. 26, pp. 49–59.

Holmes G 1998, 'A review of the distribution, status and ecology of the Star Finch *Neochmia ruficauda* in Queensland', *Australian Bird Watcher*, vol. 17, pp. 278–289.

Houston W, Porter G, O'Neill P, Elder R 2004, in press, 'The ecology of the critically endangered Yellow Chat *Epthianura crocea macgregori* on Curtis Island', *Sunbird*.

Howe FE 1931, 'Some observations on the domestic economy of the Genus *Cinclosoma* (Quail Thrushes', *Emu*, vol. 30, pp. 292–295.

Howe FE, Ross JA 1933, 'On the occurrence of *Psophodes nigrogularis* in Victoria', *Emu*, vol. 32, pp. 133–148.

Howe FE, Tregallas TH 1914, 'Rarer birds of the mallee', *Emu*, vol. 14, pp. 71–84.

Howe FE, Burgess W 1942, 'Ornithologists in the mallee', *Emu*, vol. 42, pp. 65–73.

Hughes P, Hughes B 1991, 'Notes on the Black-breasted Button-quail at Widgee, Queensland', *Australian Bird Watcher*, vol. 14, pp. 113–118.

Hull AFB 1909, 'The birds of Lord Howe and Norfolk Islands', *Proceedings of the Linnean Society of New South Wales,* vol. 34, pp. 636–693.

Hutton I 1991, *Birds of Lord Howe Island: Past and Present*, published by Author, Coffs Harbour, NSW.

Imber MJ 1983, 'The lesser Petrels of Antipodes Islands, with notes from Prince Edward and Gough Islands', *Notornis*, vol. 30, pp. 283–298.

Immelmann K 1965, *Australian Finches in Bush and Aviary*, Angus and Robertson, Sydney.

Immelmann, K 1982, *Australian Finches in Bush and Aviary*, Angus and Robertson, Sydney.

Izzard J, Watson WD 1980, 'A sight record of the Herald Petrel off northern New South Wales, *Australian Birds*, vol. 15, pp. 5–6.

Jaensch R, McCabe J, Houston W 2003, 'Mainland population of Yellow Chats discovered', *Wingspan*, vol. 6.

Johnstone RE 1981, 'Notes on the distribution, ecology and taxonomy of the Partridge Pigeon (*Geophaps smithii*) and Spinifex Pigeon (*Geophaps plumifera*) in Western Australia', *Records of the Western Australian Museum,* vol. 9, pp. 49–63.

Johnstone RE 1997, 'Current studies on three endemic Western Australian cockatoos', *Eclectus*, vol. 3, pp. 34–35.

Johnstone RE, Storr GM 1998, *Handbook of Western Australian Birds. Volume 1,* WA Museum, Perth.

Johnstone RE, Coate K 1992, 'Seabird islands: Wooded Island, Easter Group, Houtman Abrolhos, Western Australia', *Corella*, vol. 16, pp. 155–159.

Johnstone RE, Smith LA, Klomp NI 1990a, 'Wickham Island, Archipelago of the Recherche, Western Australia', *Corella*, vol. 14, pp. 131–132.

Johnstone RE, Smith LA, Klomp NI 1990b, 'Gulch Island, Archipelago of the Recherche, Western Australia', *Corella*, vol. 14, pp. 133–134.

Johnstone RE, Smith LA, Klomp NI 1990c, 'Skink Island, Archipelago of the Recherche, Western Australia', *Corella*, vol. 14, pp. 135–136.

Joseph L 1982, 'The Glossy Black-Cockatoo on Kangaroo Island', *Emu*, vol. 82, pp. 46–49.

Joseph L 1983, 'A peculiarity in the feeding behaviour of Glossy Black-Cockatoos', *Australian Birds*, vol. 17, pp. 73.

Joseph L 1989, 'The Glossy Black-Cockatoo in the south Mount Lofty Ranges', *South Australian Ornithologist*, vol. 30, pp. 202–204.

Joseph L, Black A 1983, 'Further notes on birds of the Gawler Ranges', *South Australian Ornithologist,* vol. 29, pp. 46–53.

Keast A 1958, 'Intraspecific variation in Australian finches', *Emu*, vol. 58, pp. 219–246.

King BR, Reimer DS 1991, 'Breeding and behaviour of the Herald *Petrel Pterodroma arminjoniana* on Raine Island, Queensland', *Emu,* vol. 91, pp. 122–125.

King BR 1984, 'The Herald Petrel *Pterodroma arminjoniana heraldica* breeding on Raine Island, Qld', *Emu*, vol. 84, pp. 246–247.

King BR 1996, *The status of seabirds in Queensland. Biodiversity Group*, Environment Australia, Canberra.

Knight BJ 1987, 'A population survey of the Lord Howe Island Pied Currawong', *Australian Birds*, vol. 21, pp. 28–29.

Lamb D, Turnbull M, Meyers N 1993, *Eastern Bristlebird Habitat Assessment in Southern Queensland and Northern New South Wales*, Australian National Parks & Wildlife Service.

Lane BA, Bezuijen MR, Greenwood D, Carr GW, Ward R 1998, *1998 Recovery Plan for Norfolk Island Parrot (Cyanoramphus novaezelandiae cookii*), Ecology Australia Pty Ltd, Melbourne.

Lane SG 1982, 'Avifauna of islands off Esperance, Western Australia, *Corella,* vol. 6, pp. 37–39.

Lavery HJ 1986, 'Breeding seasons of birds in north-eastern Australia, *Emu*, vol. 86, pp. 111–113.

Ley A, Cook S 2000, *The Black-throated Finch Poephila cincta in New South Wales*, Birds Australia Northern NSW Group, Armidale, NSW.

Ley AJ, Oliver DL, Williams B 1996, 'Observations of colour-banded Regent Honeyeaters *Xanthomyza phrygia', Corella*, vol. 20, pp. 88–92.

Littley T, Cutten J 1994, *Draft Recovery Plan for the Mt Lofty Ranges Southern Emu-wren (Stipiturus malachurus intermedius*), Conservation Council of South Australia Inc. Adelaide.

Longmore NW 1978, 'Avifauna of the Rockhampton area, Queensland', *Sunbird*, vol. 9, pp. 25–53.

Macgillivray W 1918, 'Ornithologists in North Queensland', *Emu*, vol. 17, pp. 180–212.

Major R 1989, *Reproductive output and recruitment of the Norfolk Island Scarlet Robin (Petroica multicolor multicolor) – Phase II.*

Marchant S, Higgins PJ (Eds) 1990, *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1. Ratites to Ducks*, Oxford University Press, Melbourne.

Marchant S, Higgins PJ (Eds) 1993, *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2. Raptors to Lapwings*, Oxford University Press, Melbourne.

Matthew J 1994, 'The status, distribution and habitat of the Slender-billed Thornbill *Acanthiza iredalei* in South Australia', *South Australian Ornithologist*, vol . 32, pp. 1–19.

Matthew J, Carpenter G 1993, 'Recent bird records from east of Lake Gairdner, Gawler Ranges, SA', *South Australian Ornithologist*, vol. 31, pp. 127–131.

Matthew JS, Carpenter G, Croft T 1996, 'Revision of the distribution of the Red-lored Whistler in South Australia', *South Australian Ornithologist*, vol. 32, pp. 103–107.

Matthew JS, Croft T, Carpenter G 1995, 'A record of the Red-lored Whistler on Eyre Peninsula', *South Australian Ornithologist*, vol. 32, pp. 39–40.

Mawson P 1997, 'A captive breeding program for Carnaby's Cockatoo *Calyptorhynchus latirostris', Eclectus*, vol. 3, pp. 21–23.

Mawson PR, Long JL 1994, 'Size and age parameters of nest trees used by four species of parrot and one species of cockatoo in south-west Australia', *Emu,* vol. 94, pp. 149–155.

McBride A, Hobcroft D 1984, 'A Herald Petrel off Sydney, New South Wales', *Australian Birds*, vol. 19, pp. 53–55.

McCutcheon AO 1976, 'A record of the Black-throated Finch at Berida, Gilgandra', *Australian Birds*, vol. 11, pp. 12.

McFarland DC 1994, 'Notes on the Lord Howe Currawong *Strepera graculina crissalis', Australian Bird Watcher*, vol. 15, pp. 310–315.

McGarvie AM, Templeton MT 1974, 'Additions to the birds of King Island', *Emu*, vol. 74, pp. 91–96.

McGill AR 1970, *Australian Warblers*, Bird Observers Club, Melbourne.

McGilp, J.N. & F.E. Parsons 1937, 'Mallee Whipbird *Psophodes nigrogularis*, and other mallee birds', *South Australian Ornithologist*, vol. 14, pp. 3–13.

McLaughlin J 1990, 'Surveys and observations of the Black-eared Miner *Manorina melanotis* in Victoria, 1989–1990', *RAOU Report No. 71.*

McMahon ARG, Franklin DC 1993, 'The significance of Mountain Swamp Gum for Helmeted Honeyeater populations in the Yarra Valley', *Victorian Naturalist*, vol. 110, pp. 230–237.

McNee SA, Newbey BJ 2003, *Search for the Western Ground Parrot in Cape Arid and nearby areas May 2003,* Unpublished report to the WA South Coast Threatened Birds Recovery Team.

McNee S 1986, 'Surveys of the Western Whipbird and Western Bristlebird in Western Australia, 1985', *RAOU Report No. 18*.

Menkhorst P, Smales I, Quin B 1999, *Helmeted Honeyeater Recovery Plan 1999–2003*, Prepared in conjunction with the Helmeted Honeyeater Recovery Team, Natural Heritage Trust, Canberra.

Miskelly CM 2001, 'Effect of plumage wear on field identification of White-naped Petrels, *Pterodroma cervicalis', Emu,* vol. 101, pp. 167–168.

MLSERT (Mt Lofty Southern Emu-wren Recovery Team) 1998, *Draft Recovery Plan for the Mt Lofty Ranges Southern Emu-wren Stipiturus malachurus intermedius 1999–2003*, Mt Lofty Ranges Southern Emu-wren Recovery Team, Conservation Council of South Australia Inc. Adelaide.

Mooney PA, Pedler LP 2004, *Recovery Plan for the South Australian subspecies of Glossy Black-Cockatoo (Calyptorhynchus lathami halmaturinus): 2004–2009*, Unpubl. report to Department of the Environment and Heritage, Canberra.

Moore JL 1981, 'Norfolk Island notes 1971 to 1980,' *Notornis*, vol. 28, pp. 50–56.

Morris AK, McGill AR, Holmes G 1981, *Handlist of Birds in New South Wales*, NSW Field Ornithologists Club, Sydney.

Muir A, Quin D, Dominelli S 1999, *Habitat Requirements of Black-eared Miners in South Australia,* Unpubl. report to the Black-eared Miner Recovery Team.

Murphy D 1994, *Capture, Radiotracking and Habitat Utilisation of the Western Bristlebird: Report on a Feasibility Study*, Western Australian Department of Conservation and Land Management, Perth.

Nelson JB, Powell D 1986, 'The breeding ecology of Abbott's Booby *Sula abbotti', Emu*, vol. 86, pp. 33–46.

Nelson JB 1975, 'The breeding biology of Frigatebirds: a comparative view', *Living Bird*, vol. 14, pp. 113–155.

Newbey BJ 2002, *Western Ground Parrot nest search at Waychinicup September and October 2001: a pilot project*, unpublished report.

Newbey BJ 2003, *Western Ground Parrot in the Waychinicup/Manypeaks area: distribution, numbers and breeding 2002–2003*, unpublished report to Birds Australia Western Australia Inc.

Oliver DL, Ley AJ, Williams B 1998, 'Breeding success and nest site selection of the Regent Honeyeater *Xanthomyza phrygia', Emu*, vol. 98, pp. 65–69.

Olsen P 1996, 'Re-establishment of an endangered subspecies: the Norfolk Island Boobook Owl *Ninox novaeseelandiae undulata', Bird Conservation International*, vol. 6, pp. 63-80.

Olsen P 2002, *Draft Abbott's Booby Recovery Plan (Papasula abbotti),* Department of Environment and Heritage, Canberra.

Parker SA 1984, 'Remarks on some results of John Gould's visit to South Australia in 1839', South Australian Ornithologist, vol. 29, pp. 109–112.

Parsons FE, McGilp JN 1935, 'The two red-throated whistlers', *Emu*, vol. 35, pp. 113–126.

Pepper JW 1993, 'A new food source for the Glossy Black-Cockatoo', *South Australian Ornithologist*, vol. 31, pp. 144–145.

Pepper JW 1997, 'A survey if the South Australian Glossy Black-Cockatoo (*Calyptorhynchus lathami halmaturinus*) and its habitat', *Wildlife Research*, vol. 24, pp. 209–223.

Pepper JW 2000, 'Foraging ecology of the South Australian Glossy Black-Cockatoo (*Calyptorhynchus lathami halmaturinus*)', *Austral Ecology*, vol. 25, pp. 16–24.

Pickett M 2000, *The Mount Lofty Ranges Southern Emu-wren Stipiturus malachurus intermedius recovery program: banding and monitoring 1994–1999,* Conservation Council of South Australia Inc. Adelaide.

Possingham HP 1993, 'Southern Emu-wrens in the Koppio Hills and near Edillilie, Eyre Peninsula', *South Australian Ornithologist*, vol. 31, pp. 143.

Pruett-Jones S, Tarvin KA 2001, 'Aspects of the ecology and behaviour of the White-winged Fairy-wrens of Barrow Island', *Emu*, vol. 101, pp. 73–78.

Recher HF, Davis WE 2000, 'A contribution to the natural history of the Slender-billed Thornbill Acanthiza iredalei in Western Australia', *Australian Bird Watcher*, vol. 18, pp. 297–305.

Reid JRW 2000, *Survey of the Buff-banded Rail (Gallirallus philippensis andrewsi) in Pulu Keeling National Park, Cocos Islands, Indian Ocean.*

Robinson D, Woinarski JCZ 1992, 'A review of records of the Northern Shrike-tit *Falcunculus frontatus whitei* in north western Australia', *South Australian Ornithologist*, vol. 31, pp. 111–117.

Robinson D. 1988, *Ecology and management of the Scarlet Robin, White-breasted White-eye and Long-billed White-eye on Norfolk Island.*

Robinson D 1997, *An evaluation of the status of the Norfolk Island Robin following rat-control and weed-control works in the Norfolk Island National Park.*

Robinson FN 1975, 'Discovery of the Western Whipbird at Hopetoun', *Western Australian Naturalist*, vol. 13, pp. 66–67.

Rogers D 1995, 'A mystery with history: the Buff-breasted Button-quail', *Wingspan*, vol. 5, pp. 26–31.

Rowley I 1988, *The Purple-crowned Fairy-wren—an RAOU Conservation Statement.*

Rowley I, Russell E 1993, 'The Purple-crowned Fairy-wren *Malurus coronatus*. 2. Breeding biology, social organisation, demography and management', *Emu*, vol. 93, pp. 235–250.

Rowley I, Russell E 1997, *Fairy-wrens and Grasswrens*, Oxford University Press, Oxford, UK.

RPAGP(2001, *Recovery Plan for Albatrosses and Giant-Petrels*, Environment Australia, Canberra.

Sadleir RMFS, Taylor RH, Taylor GA 1986, 'Breeding of Antarctic Terns (*Sterna vittata bethunei*)', *Notornis*, vol. 33, pp. 264–265.

Sagar PN 1978, 'The breeding of Antarctic Terns at the Snares Islands, New Zealand', *Notornis*, vol. 25, pp. 59–70.

SAOA (SA Ornithological Association) 1991, *Endangered birds in South Australia,* submission to the advisory committee on threatened species in South Australia for Nature Conservation Society of South Australia Inc. South Australian Ornithological Association, Adelaide.

Saunders DA 1974a, 'The Occurrence of the White-tailed Black Cockatoo, *Calyptorhynchus baudinii*, in *Pinus* plantations in Western Australia', *Australian Wildlife Research*, vol. 1, pp. 45–54.

Saunders DA 1974b, 'Subspeciation in the White-tailed Black Cockatoo, *Calyptorhynchus baudinii*, in Western Australia', *Australian Wildlife Research*, vol. 1, pp. 55–69.

Saunders DA 1977, 'The effect of agricultural clearing on the breeding success of the White-tailed Black Cockatoo', *Emu*, vol. 77, pp. 180–184.

Saunders DA 1979a, 'Distribution and Taxonomy of the White-tailed and Yellow-tailed Black-Cockatoos *Calyptorhynchus* spp.', *Emu*, vol. 79, pp. 215–227.

Saunders DA 1979b, 'The availability of the hollows for use as nest sites by White-tailed Black Cockatoo', *Australian Wildlife Research*, vol. 6, pp. 205–216.

Saunders DA 1980, 'Food and movements of the short-billed form of the White-tailed Black Cockatoo', *Australian Wildlife Research*, vol. 7, pp. 257–269.

Saunders DA, Ingram JA 1995, *Birds of southwestern Australia*, Surrey Beatty & Sons, Chipping Norton, NSW.

Saunders DA, Rowley I, Smith GT 1985, *The effects of clearing for agriculture on the distribution of Cockatoos in the southwest of Western Australia*, Surrey Beatty, Sydney.

Schodde R 1976, *A Survey of the Fauna of the Lower McArthur River Region, Northern Territory*, CSIRO Division of Wildlife Research for Mimets Development Pty Ltd.

Schodde R 1982, *The Fairy-wrens: A Monograph of the Maluridae*, Lansdowne Editions, Melbourne.

Schodde R, Christides L 1987, 'Genetic differentiation and subspeciation in the Grey Grasswren *Amytornis barbauts* (Maluridae)', *Emu*, vol. 87, pp. 188-192.

Schodde R, Mason IJ 1997, *Aves (Columbidae to Coraciidae). Zoological catalogue of Australia. Vol. 37.2,* CSIRO Publishing, Melbourne.

Schodde R, Mason IJ 1999, *The Directory of Australian Birds: Passerines*, CSIRO, Melbourne.

Schodde R, Fullagar P, Hermes N 1983, 'A review of Norfolk Island birds: past and present', *Australian National Parks and Wildlife Service Special Publication 8*.

Schrader NW 1980, 'A review of the distribution of the Superb Parrot in New South Wales', *Australian Birds*, vol. 14, pp. 45–50.

Sedgwick EH 1978, 'A population study of the Barrow Island avifauna', *Western Australian Naturalist*, vol. 14(4), pp. 85–108.

Sedgwick EH 1988, 'The status of bird species in the rural town of Harvey, Western Australia', *Australian Bird Watcher*, vol. 12, pp. 222–232.

Serventy DL, Serventy VN, Warham J 1971, *The Handbook of Australian Seabirds*, Reed, Sydney.

Serventy VN 1943, 'Notes on nesting birds of the Abrolhos Islands', *Emu*, vol. 42, pp. 235–241.

Sharrock RE 1981, 'Birds of the city of Wagga Wagga, New South Wales', *Australian Bird Watcher*, vol. 9, pp. 110–123.

Shaughnessy PD, Haberley B 1994, 'Surveys of Cape Barren Geese *Cereopsis novaehollandiae* in Western Australia, 1987–1992', *Corella*, vol. 18, pp. 8–13.

Slater P 1959, 'Breeding periods of birds in the Kimberley Division, Western Australia', *Western Australian Naturalist*, vol. 7, pp. 35–41.

Sluiter IRK, O'Neill GC 1996, 'An additional record of the Red-lored Whistler from the northern Murray Mallee', *South Australian Ornithologist*, vol. 32, pp. 110–111.

Smedley JH 1904, 'Finches in northern Queensland', *Emu*, vol. 4, pp. 68–69.

Smith GC, Aridis J, Lees N 1998, 'Radio-tracking revealed home-ranges of Black-breasted Button-quail *Turnix melanogaster* in remnant vine scrub between Hoop Pine plantation and agriculture', *Emu*, vol. 98, pp. 171–177.

Smith GT 1985a, *Fire effects on populations of the Noisy Scrub-bird (Atrichornis clamosus), Western Bristlebird (Dasyornis longirostris) and Western Whipbird (Psophodes nigrogularis)*, WA Institute of Technology, Perth.

Smith GT 1985b, 'Population and habitat selection of the Noisy Scrub-bird, *Atrichornis clamosus', Australian Wildlife Research*, vol. 12, pp. 479–485.

Smith GT 1987, 'Observations on the biology of the Western Bristle-bird *Dasyornis longirostris', Emu,* vol. 87, pp. 111–118.

Smith GT 1991. 'Ecology of the Western Whipbird *Psophodes nigrogularis* in Western Australia', *Emu*, vol. 91, pp. 145–157.

Smith GT 1996, 'Habitat use and management for the Noisy Scrub-bird *Atrichornis clamosus', Bird Conservation International*, vol. 6, pp. 33–48.

Smith GT, Robinson FN 1976, 'The Noisy Scrub-bird: an interim report', *Emu,* vol. 76, pp. 37–42.

Smith GT, Moore LA 1977, 'An extension of the range of the Western Bristlebird', *Western Australian Naturalist*, vol. 14, pp. 28.

Smith GT, Moore LA 1991, 'Foods of Corellas *Cacatua pastinator* in Western Australia', *Emu*, vol. 91, pp. 87–92.

Smith GT, Moore LA 1992, 'Patterns of movements in the Western Long-billed Corella *Cacatua pastinator* in the south-west of Western Australia', *Emu*, vol. 92, pp. 19–27.

Smith GT, Forrester RI 1981, 'The status of the Noisy Scrub-bird *Atrichornis clamosus', Biological Conservation*, vol. 19, pp. 239–254.

Smithers CN, Disney H.J. de S 1969, 'The distribution of terrestrial and freshwater birds on Norfolk Island', *Australian Zoologist*, vol. 15, pp. 127–140.

Smyth AK, Young J 1996, 'Observations on the endangered Black-breasted Button-quail *Turnix melanogaster* breeding in the wild', *Emu*, vol. 96, pp. 202–207.

Smyth AK, Noble D, Wiley C 2001, 'Black-breasted Button-quail in open eucalypt forest in south-eastern Queensland', *Australian Bird Watcher*, vol. 19, pp. 45–47.

Spear LB, Howell SNG, Ainley DG 1992, 'Notes on the at-sea identification of some Pacific gadfly petrels (genus: *Pterodroma*)', *Colonial Waterbirds*, vol. 15, pp. 202–218.

Squire JE 1990, 'Some southern records and other observations of the Buff-breasted Button-quail *Turnix olivii*', *Australian Bird Watcher*, vol. 13, pp. 149–152.

Stahl JC, Bartle JA, Cheshire NG, Petyt C, Sagar PM 1998, 'Distribution and movements of Buller's albatross (*Diomedea bulleri*) in Australasian seas', *New Zealand Journal of Zoology*, vol. 25, pp. 109–137.

Stahl JC, Sagar PM 2000, 'Foraging strategies and migration of southern Buller's albatrosses *Diomedea b. bulleri* breeding on the Solander Is, New Zealand', *Journal of The Royal Society of New Zealand*, vol. 30, pp. 319–334.

Starks J 1987, *The status and distribution of the Black-eared Miner (Manorina melanotis) in Victoria*, Arthur Rylah Institute Technical Report Series 49.

Starks J, Brown PB, Loyn R, Menkhorst P 1992, 'Twelve Years of Winter Counts of the Orange-bellied Parrot *Neophema chrysogaster*', *Australian Bird Watcher*, vol. 14, pp. 305–312.

Stephenson L 1991, *The Orange-bellied Parrot Recovery Plan: Management Phase*, Department of Parks, Wildlife and Heritage, Hobart.

Stokes T, Corben C 1985, 'A survey of pelagic birds in the western Coral Sea and Great Barrier Reef', *Corella*, vol. 9, pp. 25–29.

Stokes T 1984, *An Indicative Appraisal of the Effects of Proposed Clearing and Mining on Terrace-nesting Seabirds of Christmas Island, Indian Ocean*, ANPWS, Christmas Island.

Stokes T, Hinchey M 1990, 'Which small Noddies breed at Ashmore Reef in Eastern Indian Ocean?', *Emu*, vol. 90, pp. 269–271.

Storr GM 1973, *List of Queensland birds*, Special Publication of the Western Australian Museum 5.

Storr GM 1977, 'Birds of the Northern Territory', *Western Australian Museum Special Publication,* vol. 7, pp. 1–130.

Storr GM 1980, 'Birds of the Kimberley Division, Western Australia', *Western Australian Museum Special Publication*, vol. 11, pp. 1–117.

Storr GM 1984a, 'Birds of the Pilbara Region, Western Australia', *Records of the Western Australian Museum, Suppl.*, vol. 16.

Storr GM 1984b, 'Revised list of Queensland birds', *Records of the Western Australian Museum, Suppl.*, vol. 19, pp. 1–189.

Storr GM 1985a, 'Birds of the Gascoyne Region, Western Australia', *Records of the Western Australian Museum, Suppl.,* vol. 21, pp. 1–66.

Storr GM 1985b, 'Birds of the mid-eastern interior of Western Australia', *Records of the Western Australian Museum, Suppl.*, vol. 22, pp. 1–45.

Storr GM 1986, 'Birds of the south-eastern interior of Western Australia', *Records of the Western Australian Museum, Suppl.,* vol. 26, pp. 1–60.

Storr GM 1987, 'Birds of the Eucla Division of Western Australia', *Records of the Western Australian Museum, Suppl.* Vol, 27, pp. 1–81.

Storr GM, Johnstone RE, Griffin P 1986, 'Birds of the Houtman Abrolhos, Western Australia', *Records of the Western Australian Museum Suppl.*, vol. 24, pp. 1–42.

Strahan R (Ed.). 1996, *Finches, Bowerbirds and other Passerines of Australia*, Angus and Robertson, Sydney.

Surman CA, Wooller RD 1995, 'The breeding biology of the Lesser Noddy on Pelsaert Island, Western Australia', *Emu*, vol. 95, pp. 47–53.

Taylor M, COG (Canberra Ornithologists Group) 1992, *Birds of the Australian Capital Territory, An Atlas*, Canberra Ornithologists Group Inc. and National Capital Planning Authority, Canberra.

Terauds A, Gales R, Alderman R 2005, 'Trends in numbers and survival of Black-browed (*Thalassarche melanophrys*) and Grey-headed (*T. chrysostoma*) Albatrosses breeding on Macquarie Island', *Emu*, vol. 105(2), pp. 159-167.

Thomas DG 1974, 'The Scrubtit *Acanthornis magnus*: status and ecology', *Tasmanian Naturalist*, vol. 38, pp. 1–8.

Tidemann SC, Woinarski JCZ 1994, 'Moult characteristics and breeding seasons of Gouldian *Erythrura gouldiae*, Masked *Poephila personata* and Long-tailed Finches *P. acuticauda* in savannah woodland in the Northern Territory', *Emu*, vol. 94, pp. 46–52.

Tidemann SC, Lawson C, Elvish R, Boyden J, Elvish J 1999, 'Breeding biology of the Gouldian Finch *Erythrura gouldiae*, an endangered finch of northern Australia', *Emu*, vol. 99, pp. 191–199.

Todd MK 2002, 'Nest-site and breeding-season data for the Crimson Finch *Neochmia phaeton* in Australia', *Australian Bird Watcher*, vol. 19, pp. 161–171.

TSU (Threatened Species Unit) 1998, *Listing Statement: Forty-spotted Pardalote Pardalotus quadragintus,* Tasmanian Parks and Wildlife Service, Hobart.

Veitch CR, Harper G 1998, 'Breeding season of Kermadec Petrels (*Pterodroma neglecta neglecta*) at Meyer Islands, Kermadec Group, New Zealand', *Notornis*, vol. 45, pp. 67–69.

Wall LE 1982, 'Historical notes on the Forty-spotted Pardalote', *Australian Bird Watcher*, vol. 9, pp. 165–168.

Warham J 1996, *The Behaviour, Population Biology and Physiology of the Petrels,* Academic Press, London.

WCTP 2007, *Buff-breasted Buttonquail Conservation Project Pilot Season Report August 2007*, Wildlife Conservancy of Tropical Queensland, Australia.

Webster HO 1966, 'The Western Whipbird at Two Peoples Bay', *Western Australian Naturalist,* vol. 10, pp. 25–28.

Webster R, Ahern L 1992, *Management for the conservation of the Superb Parrot (Polytelis swainsonii) in New South Wales and Victoria*, Report to New South Wales National Parks & Wildlife Service & Victorian Department of Conservation & Natural Resources.

Webster R, Menkhorst P 1992, 'The Regernt Honeyeater (*Xanthomyza phrygia*): population status and ecology in Victoria and New South Wales', *Arthur Rylah Institute Technical Report 126.*

Webster R 1988, 'The Superb Parrot: a survey of the breeding distribution and habitat requirements', *Australian National Parks and Wildlife Service Report Series 12.*

Webster R 1991, *The Biology and Management of the Regent Parrot (Polytelis anthopeplus) in New South Wales*, NSW National Parks & Wildlife Service, Sydney.

Wells BA, Wells AG 1974, 'Report on a visit to Dirk Hartog Island, August–September 1973, with some observations on the flora and fauna', *Western Australian Naturalist*, vol. 13(1), pp. 19–23.

White HL 1914, 'Descriptions of new Australian bird's eggs', *Emu*, vol. 14, pp. 57–59.

White HL 1922, 'Description of nest and eggs of *Turnix olivii* (Robinson)', *Emu*, vol. 22, pp. 99–116.

Whitlock FL 1918, 'Notes on north-western birds', *Emu,* vol. 17, pp. 166–179.

Whitlock FL 1919, 'Notes on birds breeding in Dampier Archipelago, NW coast of Australia', *Emu,* vol. 18, pp. 240–253.

Whitlock FL 1921, 'Notes on Dirk Hartog Island and Peron Peninsula, Shark Bay, Western Australia', *Emu*, vol. 20, pp. 168–186.

Whitlock FL 1924, 'Journey to central Australia in search of the Night Parrot', *Emu,* vol. 23, pp. 248–281.

Whittell HM 1936, 'The bristlebirds of Western Australia', *Emu*, vol. 35, pp. 197–201.

Whittell HM 1939, ‘Recent records of the Western Whipbird’, *Emu*, vol. 39, pp. 129–131.

Whittell HM 1942, ‘A review of the work of John Gilbert in Western Australia’, *Emu*, vol. 41, pp. 289–305.

Wilson FE 1912, ‘Oologists in the Mallee’, *Emu*, vol. 12, pp. 30–39.

Woinarski JCZ 1987, ‘Notes on the status and ecology of the Red-lored Whistler *Pachycephala rufogularis’, Emu*, vol. 87, pp. 224–231.

Woinarski JCZ, Bulman CM 1985, ‘Ecology and breeding biology of the Forty-spotted Pardalote and other pardalotes on North Bruny Island’, *Emu*, vol. 85, pp. 106–120.

Woinarski JCZ, Rounsevell DE 1983, ‘Comparative ecology of pardalotes, including the Forty-Spotted Pardalote, *Pardalotus quadragintus* (Aves: Pardalotidae) in south-eastern Tasmania’, *Australian Wildlife Research*, vol. 10, pp. 351–361.

Woinarski JCZ, Tidemann SC 1991, ‘The bird fauna of a deciduous woodland in the wet-dry tropics of northern Australia’, *Wildlife Research*, vol. 18, pp. 479–500.

Woinarski JCZ, Tidemann SC 1992, ‘Survivorship and some population parameters for the endangered Gouldian Finch *Erythrura gouldiae* and two other finch species at two sites in tropical Northern Australia’, *Emu*, vol. 92, pp. 33–38.

Woinarski JCZ, Eckert HJ, Menkhorst PW 1988, ‘A review of the distribution, habitat and conservation status of the Western Whipbird *Psophodes nigrogularis leucogaster* in the Murray Mallee’, *South Australian Ornithologist*, vol. 30, pp. 146–153.

Wooller RD, Calver MC 1981, ‘Diet of three insectivorous birds on Barrow Island, WA’, *Emu*, vol. 81, pp. 48–50.

Yorkston HG, Green PT 1997, ‘The breeding distribution and status of Abbott’s Booby (Sulidae: *Papasula abbotti*) on Christmas Island, Indian Ocean’, *Biological Conservation*, vol. 79, pp. 293–301.

Zann R 1976, ‘Distribution, status and breeding of Black-throated Finches *Poephila cincta* in northern Queensland’, Emu, vol. 76, pp. 201–206.

GENERAL REFERENCES (EXCLUDING REFERENCES FOR SPECIES ACCOUNTS)

Abbott I, Mellican A, Craig MD, Williams M, Liddelow G, Wheeler I 2003, 'Short-term logging and burning impacts on species richness, abundance and community structure of birds in open eucalypt forest in Western Australia', *Wildlife Research*, vol. 30, pp. 321–329.

Anganuzzi AA, Buckland ST 1993, 'Post-stratification as a bias reduction technique', *Journal of Wildlife Management*, vol. 57, pp. 827–834.

Arnold GW 1984, 'Comparison of numbers and species of birds in Wandoo woodland obtained by two census methods', in *Methods of Censusing Birds in Australia*, Ed. SJJF Davies. RAOU, Melbourne, and Department
of Conservation and Environment, Perth.

Baker-Gabb D, Steele WK 1999, 'The Relative Abundance, Distribution and Seasonal Movements of Australian Falconiformes, 1986–90', *Birds Australia Report 6.*

Barrett G, Silcocks A, Barry S, Cunningham R, Poulter R 2003, *The New Atlas of Australian Birds*, RAOU, Melbourne.

Bibby CJ, Burgess ND, Hill DA 1992, *Bird Census Techniques*, Academic Press, New York.

BIOMASS 1982, 'Recording observations of seabirds at sea', *BIOMASS Handbook 14.*

Blakers M, Davies SJJF, Reilly PN 1984, *The Atlas of Australian Birds*, Melbourne University Press, Melbourne.

Braithwaite LW, Maher M, Briggs SV, Parker BS 1986, 'An aerial survey of three game species of waterfowl (family Anatidae) populations in eastern Australia', *Wildlife Research*, vol. 13, pp. 213–224.

Briggs KT, Tyler WB, Lewis DB 1985, 'Comparison of ship and aerial surveys of birds at sea', *Journal of Wildlife Management*, vol. 49, pp. 405–411.

Colwell MA, Cooper RJ 1993, 'Estimates of coastal shorebird abundance: the importance of multiple counts', *Journal of Field Ornithology*, vol. 64, pp. 293–301.

Craig MD, Roberts JD 2001, 'Evaluation of the impact of time of day, weather, vegetation density and bird movements on outcomes of area searches for birds in eucalypt forests of south-western Australia', *Wildlife Research*, vol. 28, pp. 33–39.

Cresswell M 1996, *Kakapo recovery plan 1996–2005. Threatened Species Recovery Plan No. 21,* Department of Conservation, Wellington.

Cunningham RB, Lindenmayer DB, Nix HA 1999, 'Quantifying observer heterogeneity in bird counts', *Australian Journal of Ecology*, vol. 24, pp. 270–277.

Davies SJJF 1972, 'Results of 40 hours of continuous watch at five waterpoints in an Australian desert', *Emu*, vol. 72, pp. 8–12.

Debus SJS 1995, 'Surveys of large forest owls in northern New South Wales: methodology, calling behaviour and owl responses', *Corella*, vol. 19, pp. 38–50.

Department of Environment and Heritage 2004, *Provision of data for National Flora and Fauna Survey Standards. Tender Specification Brief 62/2002*.

Dettmers R, Buehler DA, Bartlett JG, Klaus NA 1999, 'Influence of point count length and repeated visits on habitat model performance', *Journal of Wildlife Management*, vol. 63, pp. 815–823.

Diefenbach DR, Brauning DW, Mattice JA 2003, 'Variability in grassland bird counts related to observer differences and species detection rates', *Auk*, vol. 120, pp. 1168–1179.

Drapeau P, Leduc A, McNeil R 1999, 'Refining the use of point counts at the scale of individual points in studies of bird-habitat relationships', *Journal of Avian Biology*, vol. 30, pp. 367–382.

Er KBH, Robinson AP, Tidemann CR 1995, 'Importance of sampling duration and strip width in use of the fixed-width strip transect method for estimation of bird abundance and species diversity', *Corella*, vol. 19, pp. 109–114.

Er KBH, Innes JL, Kozak A 2003, 'Effects of census duration on estimates of winter bird abundance and species richness along line transects in coastal coniferous forest fragments', *Journal Field Ornithology*, vol. 74, pp. 119–124.

Evans SM, Bougher AR 1987, 'The Abundance of Estrildid Finches at Waterholes in the Kimberley (WA)', *Emu*, vol. 87, pp. 124–127.

Field SA, Tyre AJ, Possingham HP 2002, 'Estimating bird species richness: how should repeat surveys be organized in time?', *Austral Ecology*, vol. 27, pp. 624–629.

Garnett S, Crowley G 2000, *The Action Plan for Australian Birds*, Environment Australia, Canberra.

Gibbs JP, Melvin SW 1993, 'Call-response surveys for monitoring breeding waterbirds', *Journal of Wildlife Management*, vol. 57, pp. 27–34.

Griffioen P, Clarke MF 2002, 'Large-scale bird movements evident in eastern Australian Atlas data', *Emu*, vol. 102, pp. 99–125.

Halse S, Pearson G 2003, 'A comparison of ground and aerial counts of waterfowl in Western Australia: getting the numbers of species and individuals right', Program and Abstracts of the Australasian Ornithological Conference, Canberra, p. 46.

Harden RH, Muir RG, Milledge DR 1986, 'An evaluation of the strip transect method for censusing bird populations in forests', *Australian Wildlife Research*, vol. 13, pp. 203–11.

Henry R 1903, *The Habits of Flightless Birds of New Zealand: With Notes on Other Flightless New Zealand Birds*, Government Printer, Wellington.

Herzog SK, Kessler M, Cahill TM 2002, 'Estimating species richness of tropical bird communities from rapid assessment data', *Auk,* vol. 119, pp. 749–769.

Hewish MJ, Loyn RH 1989, 'Popularity and effectiveness of four survey methods for monitoring populations of Australian land birds', *RAOU Report No. 55.*

Howes J, Bakewell D 1989, *Shorebird Studies Manual*, Asian Wetland Bureau Publication 55.

Hyrenbach KD 2001, 'Albatross response to survey vessels: implications for studies of the distribution, abundance, and prey consumption of seabird populations', *Marine Ecology-Progress Series*, vol. 212, pp. 283–295.

Karr JR 1981, 'Surveying birds with mist nets', *Studies in Avian Biology*, vol. 6, pp. 62–67.

Kavanagh RP, Peake P 1993, 'Survey procedures for nocturnal forest birds: an evaluation of the variability in census results due to temporal factors, weather and technique', in *Australian Raptor Studies*, Ed. P Olsen, Australasian Raptor Association, RAOU, Melbourne.

Keast A 1984, 'Assessment of community composition and species richness in contrasting habitats', in *Methods of Censusing Birds in Australia*, Ed. SJJF Davies. RAOU, Melbourne, and Department of Conservation and Environment, Perth.

Kingsford RT, Bedward M, Porter JL 1994, *Waterbirds and wetlands in northwestern New South Wales. NSW NPWS Occasional Paper 19*, New South Wales National Parks and Wildlife Service, Hurstville.

Komdeur J, Bertelsen J, Cracknell G 1992, *Manual for Aeroplane and ship surveys of waterfowl and seabirds. IWRB Special Publication 19*, Slimbridge.

Lane BA 1987, *Shorebirds in Australia*, Nelson Publishing, Melbourne.

Loyn RH 1986, 'The 20 minute search—a simple method for counting forest birds', *Corella,* vol. 10, pp. 58–60

Loyn RH, Lane BA, Chandler C, Carr GW 1986, 'Ecology of Orange-bellied Parrots *Neophema chrysogaster* at their main remnant wintering site', *Emu*, vol. 86, pp. 195–206.

Loyn RH, McNabb EG, Volodina L, Willig R 2001, 'Modelling landscape distributions of large forest owls as applied to managing forests in north-east Victoria, Australia', *Biological Conservation*, vol. 97, pp. 361–376.

Mac Nally R, Watson DM 1997, 'Distinguishing areas and habitat heterogeneity effects on species richness: birds in Victorian Buloke remnants', *Australian Journal of Ecology*, vol. 22, pp. 227–233.

Mac Nally R, Ellis M, Barrett G 2004, 'Avian biodiversity monitoring in Australian rangelands', *Austral Ecology*, vol. 29, pp. 93–99.

Mac Nally R, Horrocks G 2002, 'Proportionate spatial sampling and equal-time sampling of mobile animals: a dilemma for inferring areal dependence', *Austral Ecology*, vol. 27, pp. 405–415.

McClure E 1984, *Bird Banding*, Boxwood Press, California.

Magrath MJLM, Olsen P, Weston MA, Antos M 2004, *Draft National Survey Standards for Birds: Literature Review*, Birds Australia report to DEH.

Marchant S, Higgins P 1990, *The Handbook of Australian, New Zealand and Antarctic Birds. Volume 1. Ratites to Ducks,* Oxford University Press, Melbourne.

Marchant S, Higgins P 1993, *The Handbook of Australian, New Zealand and Antarctic Birds. Volume 2. Raptors to Lapwings*. Oxford University Press, Melbourne.

NSW DEC 2004, *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities' (Working draft),* Department of Environment and Conservation, New South Wales.

Nichols JD, Hines JE, Sauer JR, Fallon FW, Fallon JE, Heglund PJ 2000, 'A double-observer approach for estimating detection probability and abundance from point counts', *Auk*, vol. 117, pp. 393–408.

O'Conner RJ, Hicks RK 1980, 'The influence of weather conditions on the detection of birds during Common Birds Census fieldwork', *Bird Study*, vol. 27, pp. 137–151.

Olsen P 1995, *Australian Birds of Prey*, University of New South Wales Press, Sydney.

Olsen PD, Olsen J 1978, 'Alleviating the impact of human disturbance on the breeding peregrine falcon. I. Ornithologists', *Corella*, vol. 2, pp. 1-7.

Olsen P, Weston MA, Cunningham R, Silcocks A 2003, *State of Australia's Birds 2003*, Birds Australia, Melbourne.

Pagen RW, Thompson FR, Burhans DE 2002, 'A comparison of point-count and mist-net detections of songbirds by habitat and time-of-season', *Journal of Field Ornithology*, vol. 73, pp. 53–59.

Pyke GH, Recher HF 1984, 'Censusing Australian birds: a summary of procedures and a scheme for standardisation of data presentation and storage', in *Methods of Censusing Birds in Australia*, Ed. SJJF Davies. RAOU, Melbourne, and Department of Conservation and Environment, Perth, WA.

Pyke GH, Recher HF 1985, 'Estimated forest bird densities by variable distance point counts', *Australian Wildlife Research*, vol. 12, pp. 307–319.

Ralph CJ, Scott JM 1981, *Estimating numbers of terrestrial birds. Studies in Avian Biology No. 6,* Cooper Ornithological Society.

Recher HF 1988, 'Counting terrestrial birds: use and application of census procedures in Australia', *Australian Journal of Zoology Review*, vol. 1, pp. 25–45.

Reid JRW, Jaensch, RP 2004, 'Aerial waterbird survey results', in *ARIDFLO Scientific Report: Environmental Flow Requirements of Arid Zone Rivers with Particular Reference to the Lake Eyre Drainage Basin*, Eds. JF Costelloe, PJ Hudson, JC Pritchard, JT Puckridge, JRW Reid. Final Report to South Australian Department of Water, Land and Biodiversity Conservation and Commonwealth Department of Environment and Heritage. School of Earth and Environmental Sciences, University of Adelaide, Adelaide.

Reid T, Hindell MA, Eades DW, Newman M 2002, *Seabird Atlas of South-eastern Australian Waters. Birds Australia Monograph 4*, Birds Australia, Melbourne.

Resources Inventory Committee 1997, *Standardised Inventory Methodologies for Components of British Columbia's Biodiversity: Shorebirds*, Resources Inventory Branch, Ministry of Environment, Lands and Parks, British Columbia.

Resources Inventory Committee 1998a, *Resource Inventory Fundamentals, Components of British Columbia's Biodiversity No. 1,* Resources Inventory Branch, Ministry of Environment, Lands and Parks, British Columbia.

Resources Inventory Committee 1998b, *Inventory Methods for Marsh Birds: Bitterns and Rails*. Standards for Components of British Columbia's Biodiversity No. 7, Resources Inventory Branch, Ministry of Environment, Lands and Parks, British Columbia.

Resources Inventory Committee 1999*, Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot and Sandhill Cranes,* Standards for Components of British Columbia's Biodiversity No. 18, Resources Inventory Branch, Ministry of Environment, Lands and Parks, British Columbia.

Resources Inventory Committee 2001, *Inventory Methods for Raptors*, Standards for Components of British Columbia's Biodiversity No. 11, Resources Inventory Branch, Ministry of Environment, Lands and Parks, British Columbia.

Robertson PA, Liley D 1998, 'Assessment of sites: measurement of species richness and diversity', in *Expedition Field Techniques: Bird Surveys*, Eds. C Bibby, M Jones, S Marsden. Royal Geographical Society and BirdLife International, London.

Rosenstock SS, Anderson DR, Giesen KM, Leukering T, Carter MF 2002, 'Landbird counting techniques: current practices and an alternative', *Auk*, vol. 119, pp. 46–53.

Rowley I, Russell E 1997, *Fairy wrens and grass wrens*, Oxford University Press, New York.

Royle JA, Nichols JD 2003, 'Estimating abundance from repeated presence-absence data or point counts', *Ecology*, vol. 84, pp. 777–790.

Saffer VM 2002, 'Community involvement in the assessment of the health of selected remnants in south-western Australia', *Western Australian Naturalist*, vol. 23, pp. 237

Sauer JR, Peterjohn BG, Link WA 1994, 'Observer Differences in the North-American Breeding Bird Survey', *Auk*, vol. 111, pp. 50–62.

Slater PJ 1994, 'Factors affecting the efficiency of the area search method of censusing birds in open forests and woodlands', *Emu,* vol. 94, pp. 9–16.

Starks J, Brown P, Loyn R, Menkhorst P 1992, 'Twelve years of winter counts of the Orange-bellied Parrot', *Australian Bird Watcher*, vol. 14, pp. 305–312.

Starks J, Holdsworth M 2004, *Draft Orange-bellied Parrot Recovery Plan*, DPIEW, Hobart.

Swift Parrot Recovery Team 2001, *Swift Parrot Recovery Plan*, DPIEW, Hobart.

Tasker ML, Jones PH, Dixon T, Blake BF 1984, 'Counting Seabirds at Sea from Ships—a Review of Methods Employed and a Suggestion for a Standardized Approach', *Auk*, vol. 101, pp. 567–577.

Threatened Bird Network (TBN) 2002, *Malleefowl Training Manual*, Birds Australia, Melbourne.

Watson DM 2004, 'Comparative evaluation of new approaches to survey birds', *Wildlife Research*, vol. 31, pp. 1–11.

Westcott DA 1999, 'Counting cassowaries: what does cassowary sign reveal about their abundance?', *Wildlife Research*, vol. 26, pp. 61–67.

Zimmerling JR, Ankney CD 2000, 'A technique that increases detectability of passerine species during point counts', *Journal of Field Ornithology*, vol. 71, pp. 638–649.

APPENDIX 1: BIRD TAXA LISTED AS THREATENED AT JUNE 2009

Table A1: Australian bird taxa that are currently (June 2009) listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

Abbott's booby	*Papasula abbotti*	Endangered
Amsterdam albatross	*Diomedea amsterdamensis*	Endangered
Antarctic tern (Indian Ocean)	*Sterna vittata vittata*	Vulnerable
Antarctic tern (New Zealand)	*Sterna vittata bethunei*	Endangered
Antipodean albatross	*Diomedea antipodensis* = *Diomedea antipodensis antipodensis*	Vulnerable
Australian lesser noddy	*Anous tenuirostris melanops*	Vulnerable
Australian painted snipe	*Rostratula australis*	Vulnerable
Baudin's black cockatoo, long-billed black cockatoo	*Calyptorhynchus baudinii*	Vulnerable
Black-breasted button quail	*Turnix melanogaster*	Vulnerable
Black-browed albatross	*Thalassarche melanophris*	Vulnerable
Black-eared miner	*Manorina melanotis*	Endangered
Black-throated finch (southern)	*Poephila cincta cincta*	Endangered
Blue petrel	*Halobaena caerulea*	Vulnerable
Brown thornbill (King Island)	*Acanthiza pusilla archibaldi*	Endangered
Buff-banded rail (Cocos (Keeling) Islands)	*Gallirallus philippensis andrewsi*	Endangered
Buff-breasted button quail	*Turnix olivii*	Endangered
Buller's albatross	*Thalassarche bulleri*	Vulnerable
Campbell albatross	*Thalassarche impavida*	Vulnerable
Cape Barren goose (south-western), Recherche Cape Barren goose	*Cereopsis novaehollandiae grisea*	Vulnerable
Carnaby's black cockatoo, short-billed black cockatoo	*Calyptorhynchus latirostris*	Endangered
Chatham albatross	*Thalassarche eremita*	Endangered
Chestnut-rumped heathwren (Mt Lofty Ranges)	*Hylacola pyrrhopygia parkeri*	Endangered
Christmas Island frigatebird, Andrew's frigatebird	*Fregata andrewsi*	Vulnerable

Christmas Island goshawk	*Accipiter fasciatus natalis*	Endangered
Christmas Island hawk owl	*Ninox natalis*	Vulnerable
Coxen's fig parrot	*Cyclopsitta diophthalma coxeni*	Endangered
Crested shrike tit (northern), northern shrike tit	*Falcunculus frontatus whitei*	Vulnerable
Crimson finch (white-bellied)	*Neochmia phaeton evangelinae*	Vulnerable
Eastern bristlebird	*Dasyornis brachypterus*	Endangered
Emerald dove (Christmas Island)	*Chalcophaps indica natalis*	Endangered
Fairy prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable
Forty-spotted pardalote	*Pardalotus quadragintus*	Endangered
Gibson's albatross	*Diomedea gibsoni = Diomedea antipodensis gibsoni*	Vulnerable
Glossy black cockatoo (South Australian), glossy black Cockatoo (Kangaroo Island)	*Calyptorhynchus lathami halmaturinus*	Endangered
Golden whistler (Norfolk Island)	*Pachycephala pectoralis xanthoprocta*	Vulnerable
Golden-shouldered parrot	*Psephotus chrysopterygius*	Endangered
Gouldian finch	*Erythrura gouldiae*	Endangered
Gould's petrel	*Pterodroma leucoptera leucoptera*	Endangered
Grey grasswren (Bulloo)	*Amytornis barbatus barbatus*	Vulnerable
Grey-headed albatross	*Thalassarche chrysostoma*	Vulnerable
Helmeted honeyeater	*Lichenostomus melanops cassidix*	Endangered
Herald petrel	*Pterodroma heraldica*	Critically endangered
Hooded robin (Tiwi Islands)	*Melanodryas cucullata melvillensis*	Endangered
Imperial shag (Heard Island)	*Leucocarbo atriceps nivalis*	Vulnerable
Indian yellow-nosed albatross	*Thalassarche carteri*	Vulnerable
Island thrush (Christmas Island)	*Turdus poliocephalus erythropleurus*	Endangered
Kermadec petrel (western)	*Pterodroma neglecta neglecta*	Vulnerable
Lord Howe Island currawong, pied currawong (Lord Howe Island)	*Strepera graculina crissalis*	Vulnerable
Lord Howe woodhen	*Gallirallus sylvestris*	Vulnerable
Macquarie shag	*Phalacrocorax albiventer purpurascens*	Vulnerable
Mallee emu wren	*Stipiturus malleeVulnerable*	
Malleefowl	*Leipoa ocellata*	Vulnerable
Masked owl (northern)	*Tyto novaehollandiae kimberli*	Vulnerable
Masked owl (Tiwi Islands)	*Tyto novaehollandiae melvillensis*	Endangered

Muir's corella (southern), Western long-billed corella (southern)	*Cacatua pastinator pastinator*	Vulnerable
Night parrot	*Pezoporus occidentalis*	Endangered
Noisy scrub bird	*Atrichornis clamosus*	Vulnerable
Norfolk Island boobook owl, southern boobook (Norfolk Island)	*Ninox novaeseelandiae undulata*	Endangered
Norfolk Island green parrot	*Cyanoramphus cookii*	Endangered
Northern giant petrel	*Macronectes halli*	Vulnerable
Northern royal albatross	*Diomedea sanfordi*	Endangered
Orange-bellied parrot	*Neophema chrysogaster*	Critically endangered
Pacific albatross	*Thalassarche nov. sp. = Thalassarche bulleri platei*	Vulnerable
Painted button quail (Houtman Abrolhos)	*Turnix varia scintillans*	Vulnerable
Partridge pigeon (eastern)	*Geophaps smithii smithii*	Vulnerable
Partridge pigeon (western)	*Geophaps smithii blaauwi*	Vulnerable
Plains wanderer	*Pedionomus torquatus*	Vulnerable
Princess parrot, Alexandra's parrot	*Polytelis alexandrae*	Vulnerable
Purple-crowned fairy wren (western)	*Malurus coronatus coronatus*	Vulnerable
Red goshawk	*Erythrotriorchis radiatus*	Vulnerable
Red-lored whistler	*Pachycephala rufogularis*	Vulnerable
Red-tailed black cockatoo (south-eastern)	*Calyptorhynchus banksii graptogyne*	Endangered
Regent honeyeater	*Xanthomyza phrygia*	Endangered
Regent parrot (eastern)	*Polytelis anthopeplus monarchoides*	Vulnerable
Round Island petrel	*Pterodroma arminjoniana*	Critically endangered
Salvin's albatross	*Thalassarche salvini*	Vulnerable
Scarlet robin (Norfolk Island)	*Petroica multicolor multicolor*	Vulnerable
Scrubtit (King Island)	*Acanthornis magnus greenianus*	Critically endangered
Shy albatross	*Thalassarche cauta*	Vulnerable
Slender-billed thornbill (western)	*Acanthiza iredalei iredalei*	Vulnerable
Soft-plumaged petrel	*Pterodroma mollis*	Vulnerable
Sooty albatross	*Phoebetria fusca*	Vulnerable
Southern cassowary (Australian)	*Casuarius casuarius johnsonii*	Endangered
Southern emu wren (Eyre Peninsula)	*Stipiturus malachurus parimeda*	Vulnerable

Southern emu wren (Fleurieu Peninsula), Mount Lofty southern emu wren	*Stipiturus malachurus intermedius*	Endangered
Southern giant petrel	*Macronectes giganteus*	Endangered
Southern royal albatross	*Diomedea epomophora*	Vulnerable
Spotted quail thrush (Mt Lofty Ranges)	*Cinclosoma punctatum anachoreta*	Critically endangered
Squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable
Star finch (eastern), star finch (southern)	*Neochmia ruficauda ruficauda*	Endangered
Superb parrot	*Polytelis swainsonii*	Vulnerable
Swift parrot	*Lathamus discolor*	Endangered
Thick-billed grasswren (eastern)	*Amytornis textilis modestus*	Vulnerable
Thick-billed grasswren (Gawler Ranges)	*Amytornis textilis myall*	Vulnerable
Tristan albatross	*Diomedea dabbenena*	Endangered
Wandering albatross	*Diomedea exulans*	Vulnerable
Wedge-tailed eagle (Tasmanian)	*Aquila audax fleayi*	Endangered
Western bristlebird	*Dasyornis longirostris*	Vulnerable
Western ground parrot	*Pezoporus wallicus flaviventris*	Endangered
Western whipbird (eastern)	*Psophodes nigrogularis leucogaster*	Vulnerable
Western whipbird (western heath)	*Psophodes nigrogularis nigrogularis*	Endangered
Western whipbird (western mallee)	*Psophodes nigrogularis oberon*	Vulnerable
White-bellied storm petrel (Tasman Sea), white-bellied storm petrel (Australasian)	*Fregetta grallaria grallaria*	Vulnerable
White-capped albatross	*Thalassarche steadi*	Vulnerable
White-winged fairy wren (Barrow Island), Barrow Island black-and-white fairy wren	*Malurus leucopterus edouardi*	Vulnerable
White-winged fairy wren (Dirk Hartog Island), Dirk Hartog black-and-white fairy wren	*Malurus leucopterus leucopterus*	Vulnerable
Yellow chat (Alligator Rivers)	*Epthianura crocea tunneyi*	Endangered
Yellow chat (Dawson)	*Epthianura crocea macgregori*	Critically endangered

APPENDIX 2: METHOD SELECTION GUIDE FOR BIRD GROUPS

The tables provided in this appendix outline the recommended survey techniques for groups of birds (for example, seabirds). Species in each group have broadly similar biology and ecology, allowing for general recommendations.

The EPBC Act list of threatened taxa is a dynamic list. It is thus likely that birds will be added to the list after the publication of these guidelines. The recommendations contained in this appendix should be applied to newly listed bird taxa, unless specific aspects of their biology or habitat render this impractical.

A2.1 Ratites and megapodes

Ratites and megapodes are large, conspicuous terrestrial birds. Currently, one ratite (southern cassowary) and one megapode (malleefowl) are listed as threatened under the EPBC Act.

Table A2.1 Recommended survey methods for ratites and megapodes.

Sub-group	Recommended techniques	Comments
Ratites	Area searches in appropriate habitat in and around the study area for sightings and signs including dung, tracks and feathers.	For emus in extensive areas, vehicle or aerial transects suitable over open country.
Megapodes	Area searches in suitable habitat in and around the study area for active nest mounds, tracks and sightings.	For malleefowl, aerial surveys for the detection of mounds in extensive areas of suitable habitat (see species account).

A2.2 Seabirds

Seabirds are a diverse group that have a common dependency on the marine environment for most of their food requirements (Marchant & Higgins 1990; Reid et al. 2002). Most members of the group are large, diurnal, conspicuous and easily detected whether at sea or on land. However, identification to species level can be difficult. Most breed in colonies, usually on offshore or oceanic islands. Methods of detection are similar for most seabirds but differ depending on whether they are at sea or on land. Seabirds that occur in Australian waters include penguins, albatrosses, petrels, prions, shearwaters, gannets, boobies, cormorants, frigatebirds, tropicbirds, skuas, gulls, terns and noddies. There are currently 35 seabird taxa listed as threatened under the EPBC Act.

Table A2.2 Recommended survey methods for seabirds.

Environment	Recommended techniques
At sea	Ship-board transect surveys, observing in all directions from the ship.
	Aerial transect surveys for detection in expansive areas.
	Observation from onshore vantage points using a telescope, particularly when there are strong onshore winds.
On land	Area searches of suitable habitat in and around the study area for nesting colonies and roosting sites. Searches for signs indicative of recent nesting activity (for example, nests, egg shells, dead young). Spotlight searches may be suitable for some nocturnally active species.
	Observation from vantage points for birds arriving at or leaving nesting colonies.
	Aerial searches over suitable nesting and roosting habitat.

A2.3 Birds of prey

Birds of prey vary widely in their lifestyle and detectability (Olsen 1995). Some diurnal raptors are highly conspicuous because of their soaring flight, highly visible perch sites and/or large nests in open habitat (Bibby et al. 1992; Resources Inventory Committee 2001). Other diurnal raptors are much less conspicuous and have concealed nest sites and secretive hunting strategies. Additionally, there is a range of nocturnal or crepuscular taxa that are visually cryptic and usually detected by their vocalisations. Birds of prey may be detected directly by sight, call, and indirectly by a range of signs (Olsen 1995). Useful signs left by raptors include nests, prey remains, pellets, whitewash excreta and moulted feathers (see Resources Inventory Committee 2001). Currently, seven birds of prey are listed as threatened under the EPBC Act.

Table A2.3 Recommended survey methods for raptors.

Sub-group	Recommended techniques
Conspicuous diurnal eagles osprey kites harriers falcons kestrel	Observation from vantage points to detect soaring species over suitable habitat. Detection by sightings. Area searches on foot in suitable habitat in and around the study area. Detection by sightings, calls and signs of occupancy. Transect surveys by vehicle within extensive study areas looking for flying or perched birds and nests. Transect surveys by boat along suitable coastal or riverine habitat for detection of birds and nests. Aerial surveys in extensive areas for detecting birds and nests of larger species.
Inconspicuous diurnal hawks sparrowhawk goshawks	Intensive area searches on foot in and around the study area, involving detection by sight, call and signs of occupancy, especially nests. Broadcast surveys from selected stations in suitable habitat. Most effective before and during the breeding season. Detection by solicited calls and sightings. Stations should usually be at least 1 km apart.
Nocturnal owls frogmouths nightjars	Broadcast surveys in conjunction with spotlight searches from selected stations in suitable habitat. Most effective before and during the breeding season. Detection by solicited calls and sightings. Stations should usually be at least 1km apart. Area searches or transect spotlight surveys in suitable habitat in and around the study area, especially soon after dusk and before dawn. Detection of unsolicited calls and sightings. Usually less effective than active broadcasting of calls but less intrusive.

A2.4 Shorebirds

Most shorebirds usually reside in a narrow band of suitable habitat along coastlines or the margins of rivers, lakes and wetlands. A few exceptions inhabit semi-arid regions. Generally, coastal species forage in the intertidal zone when tidal flats or rocky reefs are exposed during the receding tide, although nearby grasslands may also be used at high tide (Lane 1987). When surveying in the intertidal zone, the period about two hours before or after high tide is usually suitable, although the optimal stage may vary among species (Colwell & Cooper 1993). During these periods only a limited intertidal area is exposed and the foraging birds are concentrated into areas closer to the shore (Resources Inventory Committee 1997). Surveys at lower stages of the tide will reveal the locations of foraging shorebirds. Potential roosting or inshore foraging areas should be surveyed at high tide. Currently, two taxa of shorebirds are listed as threatened under the EPBC Act.

Table A2.4 Recommended survey methods for shorebirds.

Sub-group	Recommended techniques
Conspicuous oystercatchers stilts and avocet some sandpipers knots pratincoles some plovers	Observation using telescope from vantage points overlooking suitable foraging or roosting habitat at appropriate periods of the tidal cycle. Transect surveys by boat around offshore islands, lake shores, coastlines and rivers. Aerial surveys of foraging habitat in large or remote study areas at the appropriate period of the tidal cycle.
Inconspicuous some plovers dotterels some sandpipers snipe painted snipe plains wanderer	Observation using telescope from vantage points overlooking suitable foraging or roosting habitat at the appropriate period of the tidal cycle. Diurnal area search in appropriate habitat in and around the study area, including flushing surveys in particular for snipe and painted snipe. Nocturnal area or transect spotlight surveys in suitable habitat either on foot or from a slow-moving vehicle for the plains wanderer.

A2.5 Wetland birds

Wetland birds vary in their conspicuousness depending on lifestyle and time of the year. Generally, species that frequent open water will be conspicuous and easily detected throughout the day. Others that inhabit dense vegetation in wetlands and on the margins of water-bodies will often be difficult to sight, and detection will usually rely on call recognition or flushing. In general, calls will be most frequent in the early morning but are also strongly dependent on time of year. Currently, three wetland species are listed as threatened under the EPBC Act.

Table A2.5 Recommended survey methods for wetland birds.

Sub-group	Recommended techniques
Inconspicuous rails crakes	Broadcast surveys in suitable habitat for solicited call responses and sightings. Broadcast stations may be established at wetland edges to avoid damage to wetland vegetation. Stations should usually be at least 250m apart.
bitterns	Observation of targeted foraging habitat within wetlands in the early morning or early evening. Detection by sightings and unsolicited calls.
	Area searches in suitable habitat for sightings, nests, indicative footprints and feathers.

A2.6 Quail and allies

The quail and allies are inconspicuous, secretive, ground-dwelling birds found in a wide variety of terrestrial habitats. Currently, three taxa are listed as threatened under the EPBC Act.

Table A2.6 Recommended survey methods for quails and allies.

Sub-group	Recommended techniques
Quail Button quail	Diurnal area searches and transect-point surveys in suitable habitat to reveal flushing birds, calls or signs of presence such as droppings or distinctive depressions (platelets) created while foraging.
	Flushing surveys using a line of walkers or a rope dragged through suitable grasslands.
	Pointer dogs may be useful to detect birds, especially outside the breeding season when calling is infrequent, though unlikely to be of wide application.

A2.7 Parrots and pigeons

The parrots and pigeons are medium-sized, diurnally active birds found in a wide variety of terrestrial habitats. They vary from being cryptic and elusive to highly conspicuous. Some have conspicuous, far-ranging calls. Currently, 15 parrots and four pigeons are listed as threatened under the EPBC Act.

Table A2.7 Recommended survey methods for parrots and pigeons.

Sub-group	Recommended techniques
Conspicuous most cockatoos corellas rosellas some lorikeets cockatiel budgerigar some pigeons	Area searches or transects in suitable habitat in and around the study area. Detection by sightings, calls or foraging signs. Transects by vehicle in suitable open, expansive habitat. Detection by sighting. Aerial surveys for distinctive species in extensive and remote areas. Detection by sighting. Targeted searches around waterholes in arid areas, because most granivores need to drink daily.
Inconspicuous some parrots some lorikeets pigeons doves bronzewings	Target searches for features where birds may aggregate (for example, waterholes, fruiting trees). Organise watches of these features, especially in the early morning or late afternoon. Detection by call, sighting and indicative signs. Area searches or transect-point surveys on foot in suitable habitat in and around the study area. Detection by sighting, call or indicative signs. Flushing surveys in heathlands. Detection by flushing individuals.

A2.8 Passerines

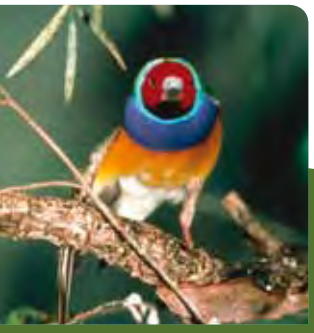
The passerines are a large, diverse group of predominantly diurnal birds. Systematic or random sampling procedures are suitable for detection of many of the more common passerines. However, targeted approaches will be more efficient for uncommon or rare, cryptic species or those that are highly aggregated in distribution. Generally, surveys should be undertaken in the first three to four hours after sunrise when most passerines are vocally and behaviourally more active than later in the day (Bibby et al. 1992; Resources Inventory Committee 1999). Currently, 37 passerine taxa are listed as threatened under the EPBC Act.

Table A2.8 Recommended survey methods for passerines.

Sub-group	Recommended techniques
Conspicuous ravens swallows woodswallows kingfishers most honeyeaters finches babblers bowerbirds	Diurnal area searches or transect-point surveys in areas of favoured habitat in and around the study area. Detection mostly by sighting and calls, though ravens, swallows and bowerbirds may be detected by nests or bowers. Diurnal transect surveys along watercourses (kingfishers and swallows) or roads (other groups). For species with very low abundance of individuals or aggregations (for example, some finches), targeted searches for required habitat features such as waterholes. Organise watches of these features, especially in the early morning or late afternoon. Detection by call, sighting and indicative signs.
Inconspicuous cuckoos fairy-wrens emu-wrens grasswrens warblers bristlebirds pittas thrushes robins whistlers thornbills treecreepers pardalotes	Diurnal area searches or transect-point surveys in areas of favoured habitat in and around the study area. Detection mostly by sighting and calls. Early morning broadcast surveys for secretive species (for example, bristlebirds) within favoured habitat. Detect solicited calls and sightings. Usually most effective before and during the breeding season. Mist-netting in dense habitat for selected secretive species (for example grasswrens).

FRONT COVER IMAGES (l-r):
Birds at dawn in the Diamantina National Park (Nick Rains), Field biologist using playback survey method (Dean Ingwersen), Purple crowned fairy wren (Nick Rains), Regent parrot (Nick Rains), Juvenile wandering albatross (Mike Whittle), Regent honeyeater (Graeme Chapman)

BACK COVER IMAGES (l-r):
Gouldian finch (P. L. Dostine), Mallee emu wren (Ashley Herrod), Adult mallee fowl (Joe Benshemesh), Princess parrot (Steve G Wilson), Wedge-tailed eagle (Steve G Wilson), Birds at dawn in the Diamantina National Park (Nick Rains)



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