

ENDANGERED BLACK COCKATOOS IN WESTERN AUSTRALIA

Proceedings of a symposium about their
biology, status, threats and efforts to
restore their habitat and populations,
26 November 2010

Kim Beazley Lecture Theatre
Murdoch University

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WHAT IS THE URBAN BUSHLAND COUNCIL?

The Urban Bushland Council is a voluntary, non-government organisation that is an association of more than 60 community conservation groups concerned about urban bushland. It is the peak community organisation for urban bushland conservation and protection in WA.

HOW THE URBAN BUSHLAND COUNCIL FORMED

In response to continuing threats to urban bushland, including Hepburn Heights, over 40 groups represented at a workshop organised by the Conservation Council on 7th November 1992 unanimously called for the establishment of a coalition of community groups to work to protect urban bushland.

The workshop called for:

- ❖ Greater public awareness of natural heritage,
- ❖ Community participation in decision-making and in caring for urban bushland,
- ❖ A government policy to recognise and protect urban bushland.

The Urban Bushland Council was formally launched in Kings Park on 21st March 1993.

THE ROLES OF THE URBAN BUSHLAND COUNCIL

- ❖ **Local action and networking** through providing a forum to support local community groups by encouraging local action and networking and by providing access to ideas, information and expertise concerning bushland.
- ❖ **Policy development** through debate, developing and promoting policy for the protection and management of urban bushland.
- ❖ **Lobbying** by providing an avenue for influence by letter writing, submissions, delegations and media contact in seeking legislative change for bushland protection.
- ❖ **Raising public awareness** of the values and problems facing urban bushland.

CURRENT ACTIVITIES

- ❖ **Bush Forever:** The Bush Forever Amendment to the Metropolitan Region Scheme passed through Parliament in 2010, giving legal definition to all Bush Forever sites. The focus is now on getting adequate resources for management to maintain conservation values.
- ❖ **Local bushland and Perth Biodiversity Project (PBP):** We call for the retention and recurrent funding of the PBP. We encourage all Councils to implement the 'Local Government Biodiversity Planning Guidelines' (2004) and to manage their local bushland in conjunction with Friends groups to retain values.
- ❖ **Climate change:** Falling ground water levels are threatening bushland ecosystems. The UBC is calling for strategic management of ground water levels to protect sensitive areas and the fostering of a water conservation ethic in the community and within industry.
- ❖ **Perth Urban Bushland Fungi project:** This collaborative project, based at the WA Conservation Centre, is supported by the UBC – go to website: www.fungiperth.org.au
- ❖ **Other campaigns:** Numerous campaigns by Friends groups to save local and regional bushland are supported by the UBC including the www.cockatoosneedyou.org.au campaign lobbying for protection of endangered black cockatoos.

PREFACE

There is considerable community concern about the decline in populations of Black Cockatoos and the continuing loss of their habitat due to clearing of native vegetation in the Perth region and the south west of Western Australia. This decline is continuing despite the listing of the three species of cockatoos – Carnaby's, Baudin's and the Forest Red-tailed Black – as endangered, and despite the existence of the State Government's Recovery Plans, as well as land clearing regulations underpinned by a set of principles, one of which states 'Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia'.

The Urban Bushland Council organised the Endangered Black Cockatoo Symposium held on 26th November 2010 at Murdoch University as part of its celebration of the 2010 International Year of Biodiversity. Speakers discussed the biology, natural history and threatened status of the birds. Others outlined efforts underway to conserve them, through protection of habitat, provision of artificial nest hollows, revegetation and genetic studies. Several of the presentations provided data from monitoring and citizen science.

The Urban Bushland Council organised the symposium with assistance of generous funding by Lotterywest. This enabled production of these proceedings and employment of Amrit Kendrick to organise the symposium in her hearty friendly manner and for the wide publicity which attracted so many participants from all sectors of the community. Amrit worked enthusiastically with a steering group chaired by Council President Mary Gray alongside Kim Sarti and Christine Richardson. The Council's Treasurer Christine Allbeury competently controlled finances. We acknowledge the energy, skill and knowledge of this group in bringing the symposium to fruition.

We would like to thank Murdoch University for generously donating the Kim Beazley Lecture Theatre as the venue for the whole day. Sound recordings were made and all the film footage and PowerPoint slides were projected clearly for the audience. Thank you to community members Mary Gray, David Wake, Mike Norman and Rob Greenwood for chairing the sessions. A very special thankyou is due to Associate Professor John Bailey, Dean of Environmental Science at Murdoch University, who in the closing session presented a poignant summary of the day and a call to action. His succinct and passionate presentation was a highlight of the day, capturing and reflecting the hearts and minds of the audience.

The Urban Bushland Council acknowledges all the participants for their interest in black cockatoo conservation. A lively audience of more than 150 people, including two carers with two live black cockatoos, Chasey and Harmony, from the Kaarakin Black Cockatoo Rehabilitation Centre attended. Amrit as organiser enlisted the enthusiastic participation of 12 presenters. The day was filled with inspiring, informative and engaging content. Appreciation goes to all the presenters for the quality of their talks, their openness to questions and their passionate recommendations for action.

On the day there were many community volunteers who helped in many ways: Christine Allbeury played a mammoth task in managing registrations and attendance records including many 'on the day'; Kim Sarti, Margaret Owen, and Rob Greenwood organised displays in the foyer; Mary Gray and Kim Sarti devised and distributed feedback forms; Margaret Owen, Christine Allbeury and Beth Schultz collected forms and labels. All are commended as friendly hosts.

At the end of the day, recommendations were taken on board by the participants. This is reflected in their Feedback Sheets where people stated the following actions were needed for black cockatoo conservation: Stop land clearing especially on the Swan Coastal Plain and protect habitat; end native forest logging; toughen legislation, regulations and policy to prevent loss of habitat; protect stag and veteran trees; educate the public about black cockatoos; grow cockatoo food in home gardens and landscaping; install nest boxes; control feral bees, corellas and galah populations; and lobby to protect cockatoos and their habitat.



PROGRAMME: BLACK COCKATOO SYMPOSIUM

26th November 2010

Kim Beazley Lecture Theatre, Murdoch University

Session 1: Science of the Cockatoos and Government Action Chair: Mary Gray		
8:45 – 9:00	Mary Gray	Welcome to the Symposium
9:00 – 9:05	Representative for Minister for the Environment	Government Recognition of Cockatoos and their Habitat
9:05 – 9:55	Ron Johnstone WA Museum	Cockatoos Calling: the biology and ecology
9:55 – 10:25	Geoff Barrett DEC	Recovery Planning and the Great Cocky Count
10:25 – 10:45	Morning Tea served near Lecture Theatre	
Session 2: Community Action for Cockatoos Chair: David Wake		
10:45 – 11:05	Dave Mitchell DEC	Native Vegetation and Habitat Mapping
11:05 – 11:35	Kristina Huelin UWA	Citizen Science for Tracking Cockatoos
11:35 – 12:05	Margaret Owen Urban Bushland Council	Counting Cockatoos in the Western Suburbs
12:05 – 1:00	Lunch: Served across Bush Court at Café downstairs Club Murdoch	
Session 3: Expanding our Understanding Chair: Mike Norman		
1:00 – 1:45	Leighton de Barros Sea Dog Films	Filming Cockatoo Natural History: On a Wing and a Prayer
1:45 – 2:15	Cheryl Gole Birds Australia	The Birds Australia Carnaby's Cockatoo Recovery Project: ten years of a community based approach to conservation, 2000–2010
2:15 – 2:45	Vicki Stokes ALCOA	Mining Rehabilitation and Cockatoo Feeding
2:45 – 3:15	Nicole White Murdoch University	Population genetics and other findings on Black Cockatoos
3:15 – 3:35	Afternoon Tea	
Session 4: Restoring Habitat Chair: Rob Greenwood		
3:35 – 4:00	Francis Smit Serpentine-Jarrahdale Landcare	Trialling Habitat substitutions with Cockatubes
4:00 – 4:30	Caroline Minton Murdoch University	Managing a campus for habitat
4:30 – 4:45	John Bailey Dean of Environmental Science, Murdoch University	Summary of the day and call to action
4:45	Symposium closes; audience can mingle around exhibits and foyer until 5:15	Exhibits

OFFICIAL OPENING OF BLACK COCKATOO SYMPOSIUM

HON LIZ BEHJAT MLC, MEMBER FOR NORTH METROPOLITAN REGION

Thank you for the invitation to be here on behalf of Environment Minister Donna Faragher, who unfortunately is unable to join us today, to speak about the black cockatoos.

There is much work going on to protect black cockatoos, and this work is coming from a wide range of groups, from the State Government to non-government environmental organisations, universities, community groups and volunteer-run rehabilitation facilities.

As you would be aware, it is estimated the total population of Carnaby's is now around 40,000, which is considerably less than half of what it is estimated to have been 50 years ago, and the range of these birds is only two-thirds of what it once was.

In the past year the Government has launched a number of initiatives targeting crucial issues affecting Carnaby's cockatoos.

Natural Resource Management Program funded projects include:

- Establishing a partnership between the Department of Environment and Conservation and the Department of Planning to develop a Geographic Information System tool that will assist conservation and land-use planning;
- Surveying potential breeding sites to learn more about which nesting sites are active and therefore most valuable;
- Investigating the use of artificial nesting boxes and assessing the effectiveness of different construction materials; and
- Developing a database of plant species recommended for planting and retention in residential developments and along corridors such as roadsides as a feeding, roosting and nesting resource for Carnaby's black cockatoos.

There are of course other initiatives, such as the Great Cocky Count, which was most recently undertaken in April this year, that aim to increase our understanding of this fascinating bird and I would like to acknowledge the work being done by organisations such as Birds Australia, which facilitated the count in conjunction with DEC.

Cooperation is essential if we are to succeed in ensuring the long-term survival of black cockatoos in WA.

As many of you would be aware, the cocky count is all about people counting the number of birds at roost sites, and the results of the surveys are helping us determine population trends.

The Environment Minister also recently launched the Plants for Carnaby's search tool, which enables thousands of individuals to take action on their own and contribute to something that has a broad impact.

For example, the combined efforts of hundreds of gardeners in Perth planting even just one tree or shrub that provides food for Carnaby's will be significant.

Unfortunately, although home gardeners and councils have been greening our cities and towns for years, many of the plants are not Carnaby's friendly - in fact these often support problem species such as the introduced Rainbow Lorikeet.

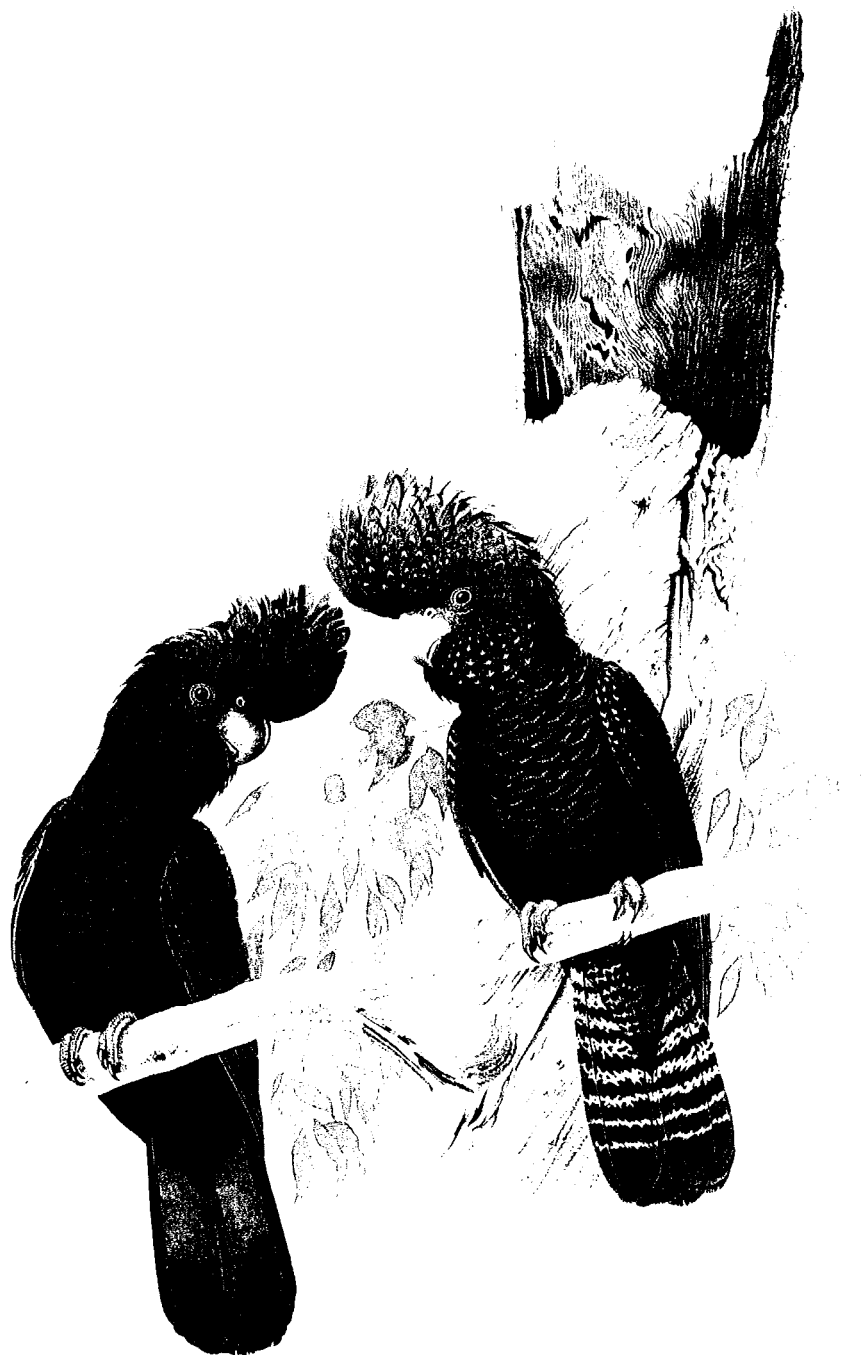
As well as compiling lists of suitable species for both small and large scale planting, the search tool can also be used to provide lists of key species to be retained. This will help land owners and managers assess the value of potential habitat and guide their decisions.

Can I conclude by saying that there is need to continue to further understand how this species' habitat needs are to be met in the future.

The only way we can do this is by having detailed and accurate information that everyone - conservationists, planners, developers and the general community - can rely on and be guided by.

And that is one of the reasons we are all here today - to exchange ideas and information, and to pave the way for the conservation and protection of our iconic black cockatoos.

Thank you.



A pair of Forest Red-tailed Black Cockatoos (male left and female right) at a nest hollow in Bungendore Park. The Forest Red-tailed Black Cockatoo is a sociable species often gathering in noisy flocks to feed and roost in Marri trees.

Illustration by Rob Fleming, reproduced with permission of Bungendore Park Management Committee.

COCKATOOS CALLING

R.E. Johnstone, T. Kirkby and K. Sarti, Western Australian Museum

Introduction

Over the past nine years researchers at the Western Australian Museum with support from the Water Corporation, Western Power, the Tourist Commission and a number of State and Local Government departments, community groups, volunteers and the general public have carried out important research into the breeding biology of Baudin's Cockatoo *Calyptorhynchus baudinii*, Carnaby's Cockatoo *Calyptorhynchus latirostris* and the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*. All of these cockatoos are endemic to the south-west corner of Western Australia and all have declined greatly over the past 50 years. The current conservation status of Baudin's Cockatoo and Carnaby's Cockatoo is listed as Endangered and the Forest Red-tailed Black Cockatoo is listed as Vulnerable.

The future survival of these cockatoos is of great concern. The impacts of climate change, alterations in the landscape, changing forest structure and the expansion of some native and exotic species that are competing with cockatoos are all having an adverse affect on cockatoo populations. Declining rainfall, for example, has already altered the foraging behaviour, distribution and, in some areas, migration patterns of cockatoos and will no doubt also influence breeding success.

On the Swan Coastal Plain about 90% of the original vegetation has been replaced by cities, towns, farms, vineyards, orchards and industrial areas. In many areas the small patches of remnant bushland remaining are not in pristine condition. Furthermore, the entire structure of the adjacent Jarrah-Marri forest has been altered in the past 60–100 years.

Our work on all three species of cockatoo has encompassed a range of conservation issues. These include the identification of threats, help with the establishment of

recovery and management plans, the identification of critical habitat and an improved understanding of their breeding biology, movements and changes in distribution and status.

It is often extremely difficult to differentiate between the two species of white-tailed black cockatoo, especially in southern forests where both species regularly occur and sometimes feed close together. Bill size and shape and their slightly different calls are the only reliable means of identification. Location and habitat can be very misleading. For example, while it would be reasonable for you to assume that if you were in the northern or eastern wheatbelt or on most of the Swan Coastal Plain (north of Mandurah), that the white-tail you are looking at is a Carnaby's Cockatoo and you would be almost 100% correct.

However, if today you were in southern forests throughout the south-west corner e.g. at Jarrahdale, Collie, Bridgetown, Nannup, Lake Muir, Denmark or Albany or on the southern Swan Coastal Plain (Bunbury to Busselton) and you assume that the white-tail you are looking at is a Baudin's Cockatoo, then you would in around 80% of cases be wrong. Judging from our recent preliminary field work throughout the south-west corner, the relative abundance of Carnaby's Cockatoo is much greater than that of Baudin's Cockatoo with the former outnumbering the latter by at least 5:1.

Key objectives of Cockatoo project

Key objectives of the WA Museum's cockatoo conservation activities are to:

1. Research the breeding biology, current distribution and ecological status of all three species and the threats to their survival.
2. Document areas of critical habitat (breeding, roosting and feeding sites); also species ranges and changes in

populations due to impacts of land clearing, nest competitors, fire and climate change.

3. Conduct targeted surveys for breeding, feeding and roosting sites in important sections of the south-west including northern Darling Range, Swan Coastal Plain, Whicher Range, Albany-Walpole region and Leeuwin-Naturaliste Ridge.
4. Provide information on habitat enhancement through habitat planting to help protect and restore native vegetation and terrestrial ecosystems and help with the design, installation and protocols for the installation of artificial nest boxes.
5. Increase public awareness of conservation issues related to black cockatoos and the importance of maintaining existing nest hollows especially veteran and stag trees and feeding habitats.
6. Assess the impact of introduced and invasive species including feral European honey bees, and Galahs and Corellas on cockatoo nest hollows and the development of effective eradication and control methods

Field program

Field activities of the WA Museum's cockatoo project include the following:

1. Aspects of the breeding biology program have involved:
 - Documenting and monitoring nests with details of nest trees including hollow size, height and aspect of hollow, circumference of nest tree at breast height, distance apart of nests and details of local vegetation. This provides a profile of a preferred nest site. Nest tree characteristics may also help provide a protocol for identifying primary habitat trees (trees of >50 cm diameter) that may be potential nest trees.
 - Documenting clutch size, incubation period, fledging period, breeding behaviour and movements.

- Locating nests during the breeding season and trees with nests marked, measured, photographed and located on map using GPS. Nest trees are also scored using the Kim Whitford senescence scale and hollow characteristics taken including entrance size, depth, facing-direction and floor space.

2. Mapping critical habitats:

- Mapping the recent expansion of Carnaby's Cockatoo westwards as a breeding bird into the Darling Range and on to the Swan Coastal Plain.
- Monitoring important roost sites for all three species of black cockatoos especially Baudin's Cockatoo and Forest Red-tailed Black Cockatoo in the northern Jarrah forests and Swan Coastal Plain.
- Mapping the changing foraging ecology of Forest Red-tailed Black Cockatoo west on to the Swan Coastal Plain and east into the Wheatbelt.
- Monitoring the impacts of fire *e.g.* Mount Cooke, Bungendore Park, Pickering Brook and Bindoon.

3. Recent surveys have highlighted the importance of:

- Breeding sites in the Lake Clifton region for Carnaby's Cockatoo.
- The Wungong Catchment, Whicher Range and Leeuwin-Naturaliste Ridge for all three species of black cockatoo.
- Banksia woodland in the East Wanneroo area and in other sections of the Swan Coastal Plain.
- Wandoo woodlands in the Bindoon region (the largest known breeding population of Carnaby's Cockatoo in the south-west).
- Traditional roost sites for Baudin's Cockatoo in the northern Jarrah-Marri forest.
- Nest hollow competition by all three species in the Jarrah-Marri and Karri

forests and in Tuart forests on the Swan Coastal Plain.

- Competition for food resources by, for example, Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo on parts of the Swan Coastal Plain.

Data generated from these surveys is being used by DEWHA, DEC, DOP, Department of Defence and Water Corporation.

4. Developing techniques and providing advice on habitat enhancement including:
 - Food plants used by black cockatoos for revegetation programs including sections of the Great Northern Highway and Forrest Highway.
 - Repair of sub-standard and damaged hollows e.g. replacing collapsed floors and fixing sidewalls for weather protection and to prevent predation.
 - Construction of prototypes and testing both timber and PVC nest boxes for black cockatoos and providing protocols for their installation.
 - Advice to government departments and private landholders on the importance of retaining veteran and stag trees especially in urban and agricultural areas and developing guidelines for selecting suitable trees for retention in the landscape for obligate hollow-nesting birds.
 - Develop a food library, photographic library and audio library (including regional dialects) for all three species.
 - Conduct early trials on eradication techniques for feral European honeybees. This has since been followed up by DEC and Water Corporation.
 - Map the expansion of some super abundant native species e.g. Galah, Rainbow Lorikeet and corellas into the south-west. These species compete for nest hollows and food with cockatoos.

Cockatoo Care – a public program

The aims of the Cockatoo Care program include:

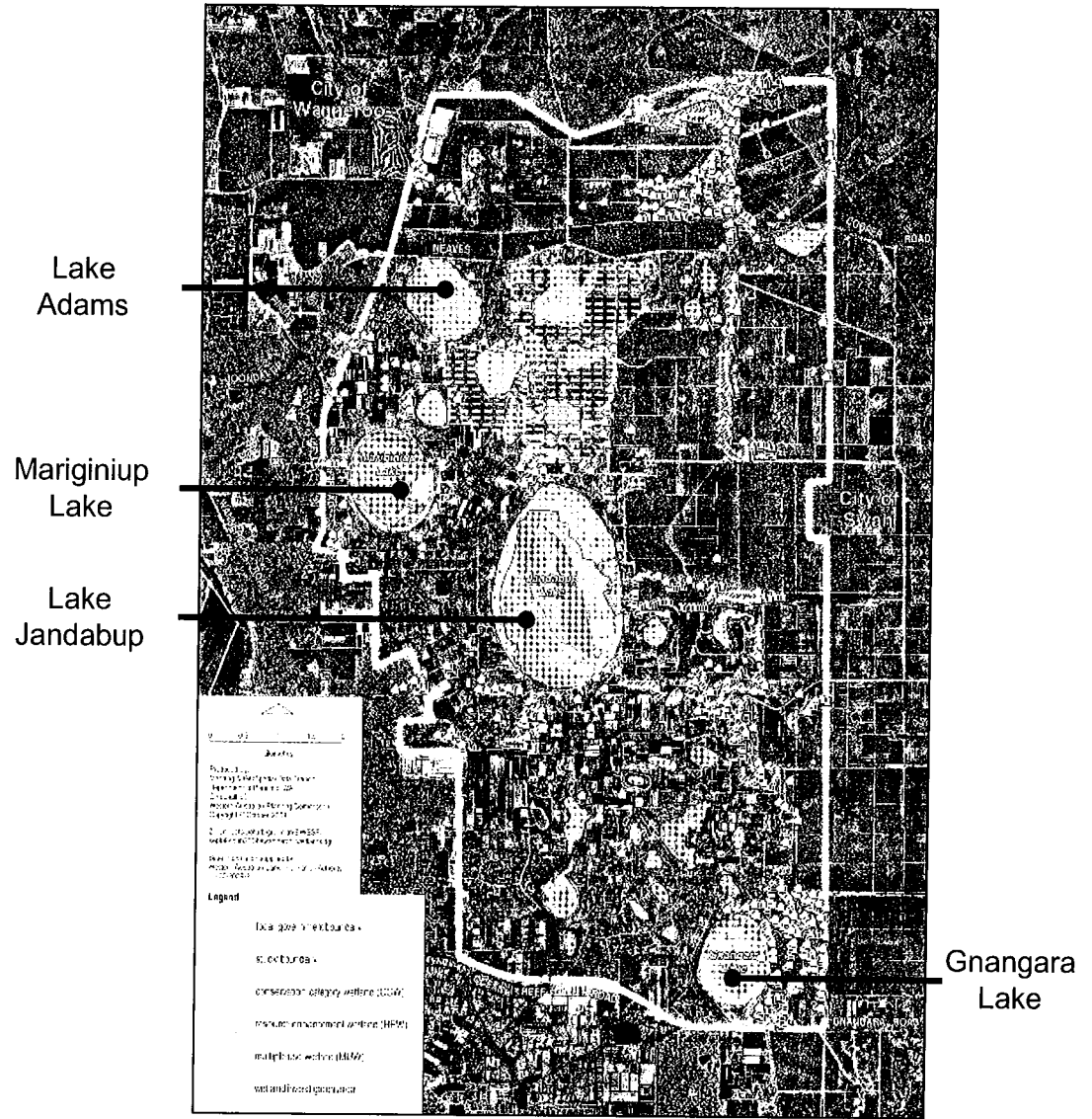
- Knowledge generation via research into the distribution, ecology and breeding biology of each species and the threats to their survival. This includes monitoring of feeding and breeding, of roosting sites and of migration and movements.
- Assessment of critical habitat for government agencies.
- Assessment of impact of feral honey bees on hollow-nesting birds in South-West forests and development of effective control measures.
- Community education, information dissemination and involvement through citizen science.
- Installation and monitoring of artificial nest boxes

Outcomes and achievements over the past seven years

The major achievements of the cockatoo project include:

1. The conservation status of Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo has been upgraded by both State and Federal Government agencies and recovery teams have been established by the Department of Environment and Conservation (DEC).
2. A policy on feral European honeybees initiated and trials on eradication methods are being carried out.
3. Data generated from the program used by State and Federal Government agencies especially information on distribution, status, movements and important habitats to enable the conservation of critical areas.
4. High levels of public engagement through web visits, over 15,000 observation records received from the public and a partnership with the Bibbulmun Track Foundation (On the Trail of the Red-tail).

Targeted surveys of cockatoo foraging habitat, East Wanneroo

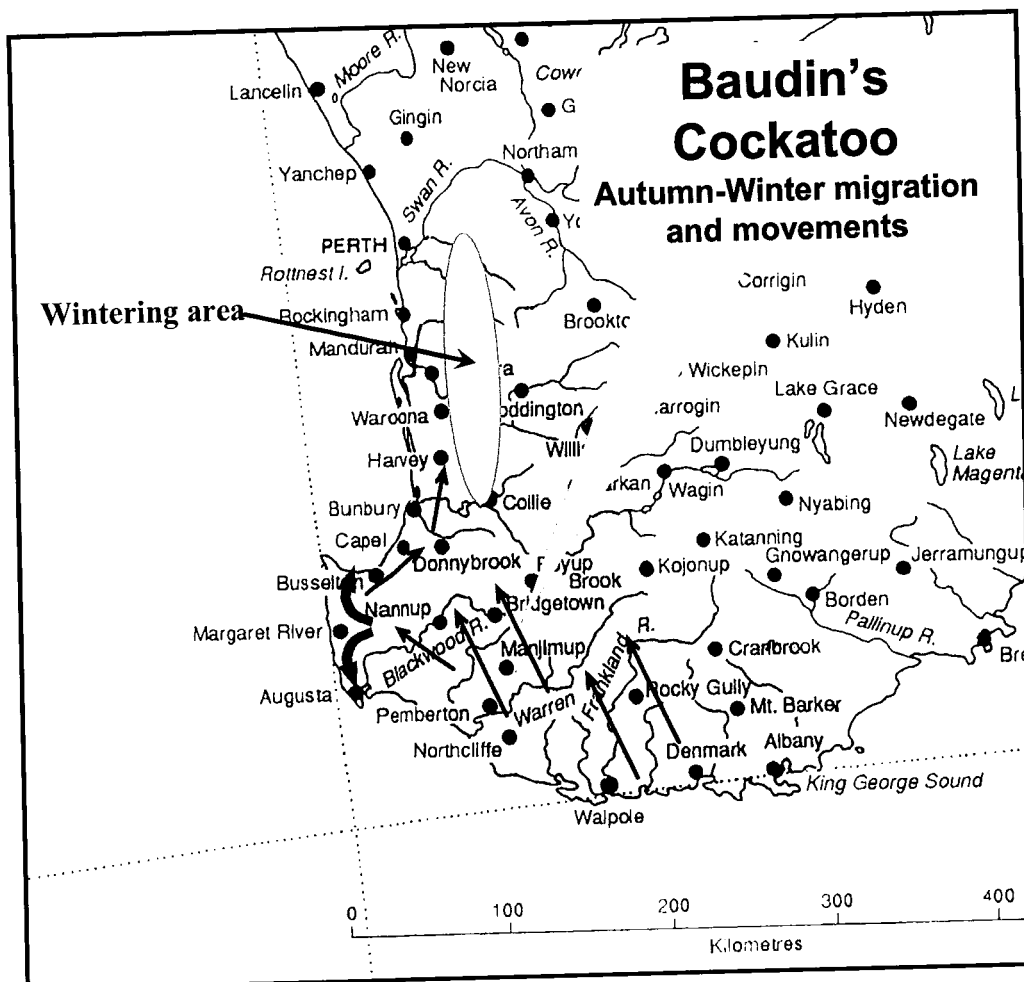
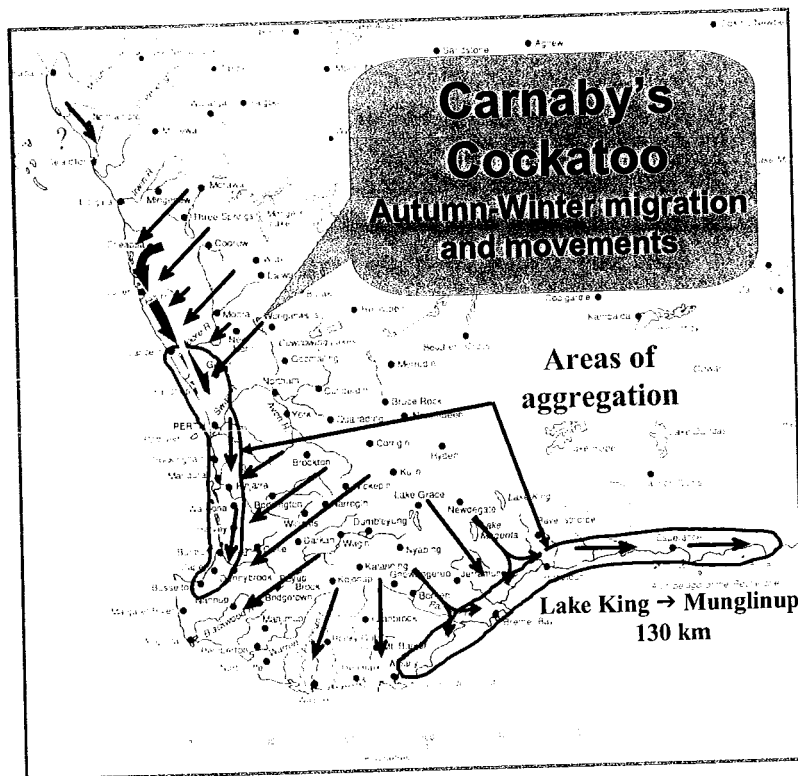


Tail marked and
band recoveries

Badgingarra → Jurien 56 km

Cataby → 3 sites: Gngangara,
Wanneroo & Cottesloe 160 km

Manmanning → Gingin 138 km



5. Identification of the importance of roosts and developed techniques for counting birds at roosts to gain information on abundance and demography. These techniques are now used by other individuals and groups such as Birds Australia.
6. Ten scientific papers published (with others in preparation) including those on the food of the Forest Red-tailed Black Cockatoo; the conservation status of parrots and cockatoos in Western Australia; identification challenges and changes in distribution and status; papers on veteran and stag trees; on the impact of feral European honey bees; and on the distribution, status, social organisation, movements and conservation of Baudin's Cockatoo in south-west Western Australia.
7. Reports prepared for DEWHA on white-tailed black cockatoos on the Southern Swan Coastal Plain and on the Northern Swan Coastal Plain to help develop a strategic regional plan for those regions.
8. Over 50 presentations have been given to natural history groups (including the Smithsonian Institution in 2004), and papers presented at 4 symposiums.
9. Excellent public promotion including newspaper and magazine articles, radio interviews, television stories (eg ABC 'Catalyst' program); Museum educational programs; series of information sheets, flyers, endangered species display cases, travelling display panels; art exhibition 'Cockatoos by Conolan'; joint initiative of Tourist Commission and Friends of Bibbulmun Track 'On the Trail of the Red-tailed Black Cockatoo'; provided information and images to Perth Zoo for their cockatoo display; and enormous public response to www.cockatoocare.com.au website.
10. Development of artificial nest hollows and protocols for their use and installation.

Conservation issues and threats

The major threats to conservation of black cockatoos are:

1. Destruction of forests and woodland habitat resulting in the loss of food and hollow-bearing trees. Clearing on the Swan Coastal Plain and in the Wheatbelt where the rate and scale of clearing is unequalled on the planet.
2. Competition for breeding hollows by super-abundant native species (Galahs & corellas), some ducks and possums.
3. Impact of feral European honey bees taking over nest hollows.
4. Large numbers of mainly Baudin's Cockatoo shot by orchardists.
5. Poaching of eggs and chicks for the aviary trade.
6. Changes in fire regimes.
7. Impacts of climate change, and
8. Vehicle strikes.

Recommendations

Our recommendations for the protection and recovery of the three species of black cockatoos are:

1. Targeted surveys, similar to those carried out recently in the Wungong Catchment and East Wanneroo, to identify and confirm areas of critical habitat which includes breeding, feeding and roosting sites particularly on the Swan Coastal Plain.
2. Land use planning and on-going management of public and private lands should aim to maintain a mosaic of vegetation classes, especially those with Banksia and Tuart on the Swan Coastal Plain.
3. Broad scale surveys throughout the south-west region to determine the current distribution and status and significance of cockatoo migration and movements.
4. Study food resources used by all three black cockatoos on the Swan Coastal

Plain and adjacent Darling Scarp to identify significant areas and changes in foraging ecology.

5. Monitor nest hollows already located and determine timing and success of nesting events.
6. Document nest tree information. Nest tree characteristics may help provide a protocol for identifying primary habitat trees that may be potential nest trees.
7. Use of some offset funding for control of feral species.
8. Land use planning should focus on opportunities to retain or enhance ecological corridors, linking major reserves and patches of remnant vegetation.
9. Use of existing cleared areas should be maximised to suit requirements for future urban development.
10. Opportunities to revegetate degraded areas should be exploited.

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RECOVERY PLAN ACTIONS – COMMUNITY MONITORING OF CARNABY'S COCKATOOS

Geoff Barrett, David Mitchell and Peter Mawson, Department of Environment and Conservation

All three species of Black Cockatoo are 'Specially Protected Fauna' under the *Wildlife Conservation Act* 1950 (i.e. 'threatened'). Carnaby's and Baudin's cockatoos are also listed as Endangered, and the Forest Red-tailed Black Cockatoo as Vulnerable under the Commonwealth EPBC Act 1999. Baudin's Cockatoo is declared a pest species under the Agriculture and Related Resources Protection Act 1976.

Comparing Birds Australia atlas Carnaby's Cockatoo (CBC) records, pre and post 2003, the area of occupancy has declined by around 50%. And in the northern part of its range, there has been a 45% decline in reporting rate.

The common objective for both the Carnaby's Cockatoo recovery team and the Forest Black Cockatoo recovery team (Red-tails and Baudin's) is

'To stop any further decline in the breeding populations and to ensure their persistence throughout their respective ranges in the south-west of Western Australia'.

In association with the World Wide Fund for Nature, Birds Australia and DEC, the Carnaby's Cockatoo recovery team initiated the 2009 Carnaby's Cockatoo Forum, which identified a number of recovery actions and produced a Strategic Framework. This framework, which informed the revision of the recovery plan for the species, listed specific actions under habitat management, policy and legislation, monitoring, community and research.

Recent (2009) WA State NRM funded cockatoo projects

1. Mapping and assessment of habitat on the Swan Coastal Plain
2. Mapping and assessment of habitat in the Wheatbelt (a joint project between Land for Wildlife, Greening Australia and Birds Australia)
3. On-ground action – assistance for Wheatbelt habitat conservation and a Pilot Revegetation Project (Department of Planning)

4. Planting guidelines – Plants for Carnaby's Search Tool
(<http://www.dec.wa.gov.au/content/view/5983/2006/>)
5. Artificial Nest Hollow study (joint project between DEC and the WA Museum)

Other projects

1. Quantifying food value of different areas of habitat (DEC).
2. Quantifying and defining characteristics of Carnaby's Cockatoo roosting and breeding habitat. Counts of overnight roost sites of Carnaby's Cockatoo have been used recently to estimate the population. Many locations of overnight roosts are known, but there is a lack of understanding of the characteristics of the roosts or the reasons Carnaby's Cockatoo roosts in those locations. Megan Stalker at Edith Cowan University (ECU) is collecting this data to better inform and provide a tool for decision makers who are bringing species conservation to urban planning.
3. Banksia population – DNA, pollination and seed productivity studies of remnants (DEC, Kings Park)
4. Genetic and population studies of Carnaby's Cockatoo (See Murdoch University Nicole White's paper in these Proceedings)
5. CBC movements using radio transmitters and audio recordings (Birds Australia and DEC)

Prior to European settlement, 90% of the Swan Coastal Plain was likely to be Carnaby's Cockatoo feeding habitat (1.4 million ha from Jurien Bay to Busselton) and 40% of this remains today (approximately 500,000 ha). On the Swan Coastal Plain (SCP) 50% of the likely feeding habitat occurs in DEC conservation estate (approximately 30,000 ha). Across most of the Wheatbelt 90% of the native vegetation has been cleared. Carnaby's Cockatoos have been recorded breeding near Lake Clifton on the Swan Coastal Plain, suggesting that the breeding activity may be shifting west, with

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birds staying to breed on the Swan Coastal Plain rather than returning to the Wheatbelt.

Main findings from Great Cocky Count 2010

1. 350 volunteers surveyed 189 sites and increased the number of known roosts from 70 to 130
2. The count of 6,623 birds across these 130 roosts supports the estimate of 8,000 to 10,000 birds in the Greater Perth region
3. There was no difference in the number of birds in 2006 compared with 2010. There was, however, a trend towards fewer birds per roost and a decline in the total number of birds
4. Pine removal appears to result in a loss of roosting birds. For example: Roost R1 went from 2,489 to 0 birds in 2010 and Roost DEC14 went from 574 to 346 birds, representing a 30% decline.

For a copy of the Great Cocky Count Report, see:

<http://www.dec.wa.gov.au/content/blogcategory/774/2308/>

What can we do to help our Black Cockatoos?

1. Recognise that biodiversity is important. This includes large, old trees with nest hollows, feeding habitat and roosting habitat.
2. There are opportunities for public engagement in the Land Use Planning and

Environmental Impact Assessment process. However, we must get involved in the early stages of the process.

3. There are opportunities for involvement in on-ground management and research *e.g.* fencing work, planting trees, fire management and the control of European honey bees and other feral pests.
4. Where possible, plant native trees and shrubs that encourage Cockatoos (www.dec.wa.gov.au/plantsforcarnabys)
5. Have a bird bath in your garden.
6. Look out for Cockatoo friendly fruit.
7. Find out what universities and organisations such as Birds Australia, the World Wide Fund for Nature and EarthWatch Australia are up to. Support these organisations and get involved in their projects.
8. Record sightings of Black Cockatoos:
 - Atlas of Living Australia:
<http://www.ala.org.au>
 - ClimateWatch:
<http://www.climatewatch.org.au/>
 - Cockatoo Care:
<http://www.museum.wa.gov.au/cockatoocare/>
9. Become involved in the Great Cocky Count 2011
10. Contact Geoff Barrett, DEC,
geoff.barrett@dec.wa.gov.au



▲ Carnaby's Cockatoos, Bindoon

RECOVERY OF CARNABY'S COCKATOO

David Mitchell, Department of Environment and Conservation

Carnaby's Cockatoo is one of three threatened black cockatoos in WA. Its population has declined by 50%, its range has contracted by 30% and the species has disappeared from more than a third of its breeding range. The species is still in decline.

Carnaby's Cockatoo is listed under the *WA Wildlife Conservation Act (1950)* and also listed as endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC).

What will it take to recover Carnaby's Cockatoo?

Recovery of Carnaby's Cockatoo requires actions covering its entire range as it is a migratory breeder. It is a very mobile species and uses large areas of habitat.

The historical conservation or recovery approach for Carnaby's Cockatoo and other threatened species has tended to focus on the "on-ground" management of populations and habitat, as well as the research and monitoring required to support this. Some guidance is provided within recovery plans for planning and environmental assessment, but in many ways protection through statutory planning and environmental assessment processes has been a separate exercise.

Recently there has been an increase or shift of effort to decision-making processes around land use. Decision making is an important part of conserving the species. Statutory land use planning and environmental impact assessment needs to reflect the need for conserving Carnaby's Cockatoo habitat.

In breeding areas recovery focus needs to be on ensuring sufficient nest hollows and nearby feeding habitat. Nest hollows must be retained, and if removed or damaged, need to be replaced. Numbers of nest hollows, and new trees to provide future hollows, need to be increased to allow for more breeding. Sufficient feeding habitat near nest hollows need to be assured. Habitat and food plants

usable by breeding birds also needs to be retained, replaced and increased.

We need to note the evidence of changing locations for breeding activity. Observations need to be recorded in jarrah forest and the Swan Coastal Plain of breeding locations not noted previously. It is likely that breeding in these areas is increasing, and if so, our planning and habitat management needs to include this.

In areas where the Carnaby's Cockatoo has not traditionally carried out breeding activities (non-breeding areas), recovery attention needs to be focused on protection of banksia, pine and tuart. The banksias and pines provide food and roosting areas. The tuarts are potential breeding sites as well as roost sites.

Banksia woodlands cleared for development and fragmented by development are a major component of the habitat loss for Carnaby's Cockatoo. There is also continuing decline in condition, and subsequent "food value" for cockatoos, of many banksia woodland remnants because of *Phytophthora cinnamomi* dieback and weed infestation, as well as frequent fire impacts.

Pine trees and the pine plantations are an important food source for Carnaby's Cockatoo. The 20,000 hectares of pine plantation in the Gngangara, Pinjar and Yanchep plantations are to be harvested and not replaced so to increase recharge into the Gngangara groundwater mound for public water supply. In response to the risk from the European house borer (EHB) many of the pines in the infected areas are to be removed. All of these losses of pine will impact Carnaby's Cockatoo roost and feeding sites.

Statutory protection for Carnaby's Cockatoo

The State legislative basis for threatened species is the *Wildlife Conservation Act (1950)*. This legislation is sixty years old and does not include many of the elements of more recent biodiversity conservation policy that is used in policy or legislation in other jurisdictions.

DEC can make decisions on land use when a development is referred to Native Vegetation Clearing regulations under the *Environmental Protection Act (1986)*.

In most other planning and environmental impact assessment (EIA) processes DEC can only provide advice. DEC's advice to planning decision makers and to the EPA is part of a larger process and DEC does not make the decisions.

This advice considers each specific situation, including the values and assets at that site and any previous and future decision processes. The advice is given in the context of existing planning policies and Environmental Protection Act guidance, which in general seeks decision makers to consider and protect significant assets. Decision makers should take due consideration of DEC advice, but there is no legal requirement or capacity for DEC to direct or require any outcome.

Significant impacts on listed cockatoo species also require referral to the Commonwealth Government for assessment under the Commonwealth *Environment Protection Biodiversity Conservation Act* (EPBC Act). This process is within the Commonwealth jurisdiction and DEC (and other State agencies) has no formal role or responsibility in this. However the Commonwealth Department of Sustainability, Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) does seek advice from DEC.

Outcomes of decisions made by other agencies affect DEC management. Conservation and recovery actions for threatened species are negated, or made more difficult if the species becomes more threatened as a result of their habitat being lost or reduced.

DEC often finds itself responsible for assisting or delivering mitigation or "offsets" actions. This can include the identification of offset land to purchase and then providing ongoing management of the purchased offset. DEC can also be expected to facilitate rehabilitation (including topsoil transfer) to DEC managed lands, and ongoing liaison with proponents for delivery of conditions.

Decision making and Carnaby's Cockatoo

There is existing policy and guidance under planning and environmental protection processes for example State Planning Policy and Guidance from the EPA.

There is a hierarchy of decision making, from rezoning under the Metropolitan Region Scheme (MRS) to structure planning to subdivision. At each stage there is opportunity for comment by agencies and community.

MRS zone ⇒ structure plan ⇒ subdivision

Government as a whole in partnership with the community should aim to deal with significant clearing and habitat loss issues early, for example at rezoning not at subdivision. When the resolution of biodiversity issues is deferred to later stages of planning it simply enforces the expectations of development.

Similarly if the State addresses its own biodiversity issues adequately, then it would meet the requirements under the EPBC Act and so reduce the need for separate or additional EPBC Act assessment.

Habitat on Swan Coastal Plain

As part of State NRM funding, DEC has undertaken a joint project with the Department of Planning (DOP) to improve the mapping of Carnaby's Cockatoo habitat in Perth and Peel and surrounding areas.

The current mapping, which has been conducted, has been produced by intersecting the best available vegetation mapping with remnant vegetation. This mapping is useful to identify where Carnaby's Cockatoo should be considered in Environmental Impact Assessment (EIA), and also assists in planning for recovery priorities and actions. As data becomes available through studies currently underway, more detail about habitat and Carnaby's Cockatoo use of the habitat can be added.

For example we need field assessment and further analysis to refine and confirm how much of what is mapped as food habitat actually is feeding habitat. We also know there are differences in food energy value (and so "value" to Carnaby's Cockatoo) across the landscape (for example between banksia woodland on Spearwood dunes compared with

banksia woodland on Bassendean dunes). Once we better understand how the feeding habitat is actually used, looking at the spatial and temporal use of habitat, it may be possible to improve the mapping of habitat.

The project will also map other values, such as night roosts and breeding sites. There is an expectation that breeding and roost sites should be protected as an important part of the landscape.

When completed the map products from the joint DEC/DOP project will be made available, for example through the agencies' web sites. It is hoped that the Carnaby's Cockatoo food habitat mapping will be available on DEC's NatureMap web site.

Maps of 'feed habitat' on Swan Coastal Plain and Jarrah Forest Interim Biogeographic Regionalisation for Australia (IBRA).

Maps of feed habitat have been produced and can be used. However some caution is required with interpretation and the mapping is most useful when used together with site-based information.

At the small scale there are both areas of habitat that are not mapped (as they were not mapped as remnant vegetation), as well as areas mapped as habitat that upon closer inspection will be found to not be feeding habitat, or even not be there any more.

As noted above, the actual value to Carnaby's Cockatoo of the food resource can be different between different vegetation types, for example between banksia woodland on Spearwood dunes compared with banksia woodland on Bassendean dunes. In particular the food value provided in the jarrah forest areas is very different from that provided on the Swan Coastal Plain and we have tried to make this very clear by the choice of colouring on the map.

In addition the quality of the feeding habitat in any patch is dependent on other factors, such as the time since fire and presence of weeds or *Phytophthora cinnamomi* dieback.

Therefore conclusions can be overly simplistic when looking at the map and the habitat shown on it. However, even with these

precautions the following general conclusions can be drawn.

- 40% of pre-European feed habitat on the whole of the Swan Coastal Plain IBRA remains.
- In the Metropolitan Perth and Peel regions this falls to only 24% of pre-European feed habitat remaining (89,000ha).
- In the Metropolitan Perth and Peel regions:
 - 34% of remaining feed habitat is in DEC managed lands.
 - 50% of remaining feed habitat is in Bush Forever sites.
 - 30% of remaining feed habitat is in rural zoned lands.

Reference to Figure 1

In the area surrounding this workshop venue (Murdoch University Campus) there are "areas requiring assessment as Carnaby's Cockatoo feed habitat" and roost locations. The "Carnaby's Cockatoo feed habitat" areas include some that are no longer present, or are proposed for clearing. Conversely there are other areas that haven't been included in mapping that are likely to provide resources for Carnaby's. In addition, some land uses, such as special rural sub-divisions fragment the feed habitat and increase the risk of habitat decline by additional clearing and the introduction of weeds and *Phytophthora cinnamomi*.

Another important point is that Carnaby's Cockatoo is not the only significant value in the Southwest.

The southwest of Western Australia is a biodiversity hotspot that supports many other threatened species and biodiversity values. Of these Carnaby's Cockatoo is fairly unique, including its migratory and very mobile use of a very large landscape, but also that it can be actually seen and experienced by most people in the greater Perth region.

In contrast most other threatened species are less mobile and are restricted to more specific habitat. Other threatened species have smaller ranges and areas of occupancy. And many have poorly known habitat and ecology. We should be careful in applying the sorts of conservation approaches used for Carnaby's Cockatoo to other threatened species.

Endangered Black Cockatoos in Western Australia

The habitat that Carnaby's Cockatoo use are also home to many other species of plant and animal, and so protecting the Carnaby's Cockatoo habitat provides protection and services to a range of other species, including of populations of other threatened species

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WAPC State Planning Policy 2 Environment and Natural Resources on web at:
<http://www.planning.wa.gov.au/Plans+and+policies/Publications/134.aspx>

EPA Guidance Statement 33 - Environmental Guidance for Planning and Development on web at:
http://www.epa.wa.gov.au/Policies_guidelines/EAGs/guidance/Pages/2717_GuidanceStatement33-EnvironmentalGuidancefor.aspx?pageID=28&url=Polices_guidelines/EAGs/guidance

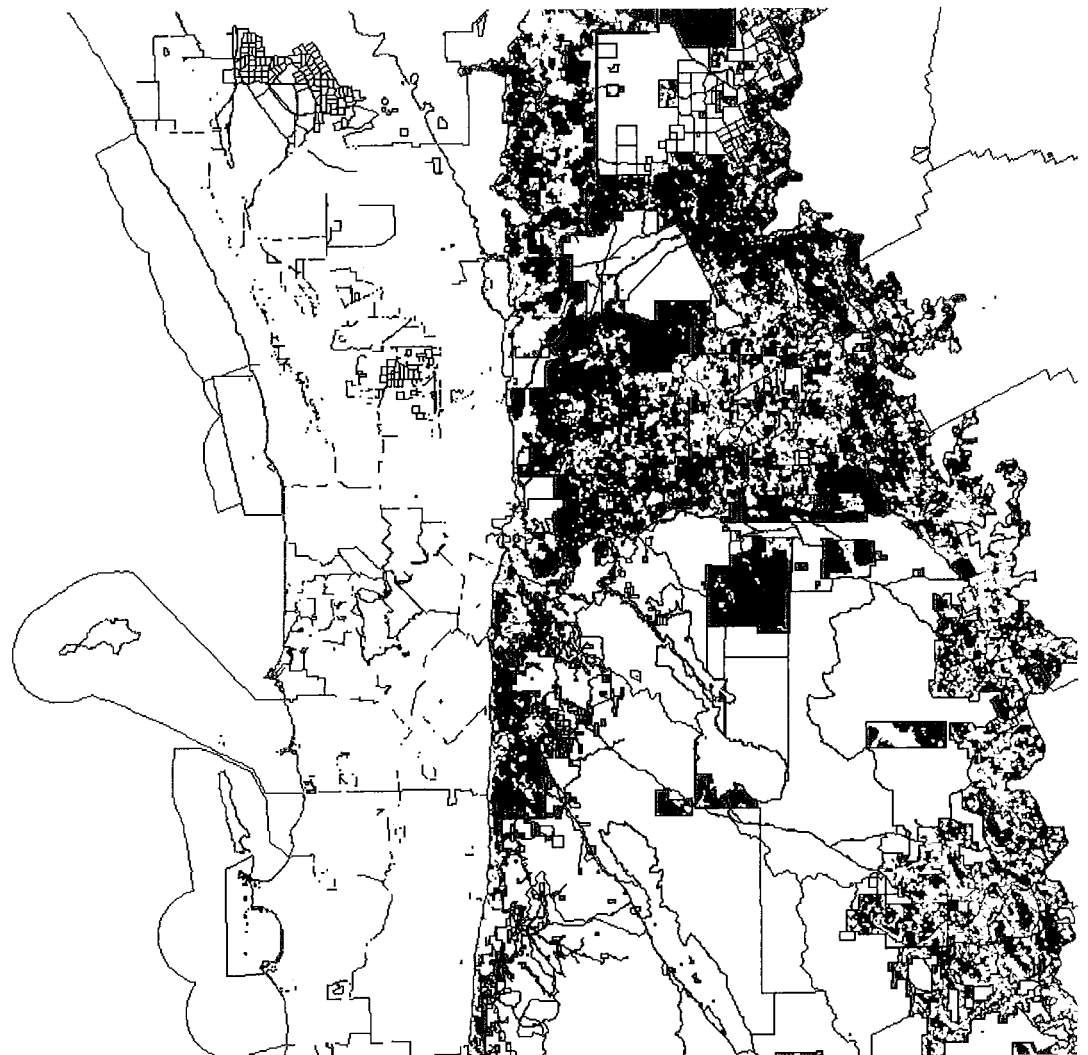
Recovery plan for Carnaby's Black Cockatoo on web at:
http://www.dec.wa.gov.au/pdf/plants_animals/threatened_species/frps/Carnaby_WA_Rec_Plan_2003.pdf

Plants for Carnaby's Search Tool
<http://www.dec.wa.gov.au/content/view/5983/2006/>

Great cocky count report
<http://www.dec.wa.gov.au/content/category/43/854/1991/>

NOTE that DEC will be updating its website to include information on Carnaby's Cockatoo on one page and so make finding information easier. In the mean time search for "Carnaby's black cockatoo"

Figure 1 – a snap shot of "areas requiring assessment as Carnaby's Cockatoo feed habitat" (light and dark) overlain with DEC managed lands, Bush Forever sites.



CARNABY TRACKER: A CITIZEN SCIENCE PROJECT

Kristina Huelin, The University of Western Australia

The Carnaby Tracker project was developed to test whether volunteer observations or 'citizen science' could be used to estimate the movements of Carnaby's Cockatoo within the Perth Metropolitan Area.

It was developed by the UWA Schools of Animal Biology and Computer Science and was active during 2010 from April 19th to September 12th (initially September 1st 2010), after which the project was transferred and added to the Birds Australia Carnaby's Black-Cockatoo Recovery Project.

Observations could be submitted from April 19 to September 12, and observations of Carnaby's Cockatoo during this time period were encouraged. Only these observations were considered for analysis of participant activity, though all submissions made were kept to be directed to the new website.

For the sake of this project, the Perth Metro area was broadly defined as the area bordered by the suburbs of Joondalup, Midland, Armadale and Rockingham.

Volunteers were recruited primarily through the media with at least five newspaper articles, two radio interviews and countless other small articles from environmental and conservation groups.

Participants were not required to actively find *Calyptrorhynchus latirostris*; they only needed to record their observations regardless of whether they were opportunistic or not.

There were no formal training sessions as information regarding the project, black cockatoos and how to make submissions were readily available on the website.

The Carnaby Tracker website, developed by UWA Computer Science student Abdullah Alsubaie, was the home for the project. It provided the online form allowing registered participants to submit their Carnaby's Cockatoo observations into a database.

The website also contained information regarding the project, a guide to the

observation form, a news feed updated at least biweekly, daily observations, general information to discriminate between southwest black cockatoos and a gallery of Carnaby's Cockatoo voice recordings and photos provided by participants.

At the end of the project, an online survey available during 9th-17th September was distributed to registered members via email, aimed to obtain feedback regarding the project, website and, levels and reasons of participation.

A total of 586 citizens registered as Carnaby Tracker participants, and at least 3490 observations of Carnaby's Cockatoo during the project time period were submitted.

There was a trend in the average number of sightings per week and the average number of participants making observations, with a peak in sightings occurring in early May, followed by a gradual decline.

A significantly greater number of observations were contributed on weekends compared to weekdays, but not between the number of contributors on weekends and weekdays. The number of observations of *C. latirostris* during the day peaked between 5:00 and 6:00 pm, and 7:00 to 8:00 am while participant numbers peaked at around 8:00 am.

As there was no clear trend in daily movement patterns, the volunteer activity was assessed for an indication of coverage over time. Of our registered participants, only 69% made submissions of white-tailed black cockatoos and the average number of observations per user was 8.6, with five participants contributing 24% of all observations.

The end of project survey, completed by 30% of our participants, indicated a few key problems.

Some participants had compatibility problems regarding visuals, logging into accounts and the online form, particularly the Google map, though the majority of participants found the website user friendly.

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Another issue included participants forgetting to submit observations or that birds occurring frequently in a given area that volunteers found it exhausting to submit all observations.

The limited number of observations during midday and weekdays limits the probability of Carnaby's Cockatoo being tracked daily using volunteers.

The main and obvious solutions to this would be to either increase the number of active participants or restrict the time frame of the project. Increased participation could have been accomplished through further campaigning, increasing efforts in retaining interest and allowing other options by which volunteers can make observations as well as observations recording no birds. On the other hand, restricting the time frame for tracking Carnaby's Cockatoo may avoid volunteer fatigue.

This project was enjoyed by many of its participants, and it provided a chance for a community to uncover more about a well-loved visitor to the Perth suburbs. Daily movements are unlikely to be tracked via this method due to limited volunteer availability throughout the day. However, it may be used to determine monthly or weekly movements of Carnaby's Cockatoos within Perth, as many participants made note of birds that visited their gardens around the same time each year. The sharing of community knowledge into one collective database may help uncover how Carnaby's Cockatoo use urban areas and direct interaction between interested parties may further encourage an active interest in black cockatoos.

Acknowledgements go out to all the Carnaby Trackers who helped to make this project happen! Thankyou everyone!

Email: huelik01@student.uwa.edu.au



▲ Ron Johnstone checking a nest hollow in a Marri tree

FURTHER COUNTS OF CARNABY'S COCKATOO AT TWO OVERNIGHT ROOSTING SITES IN METROPOLITAN PERTH

P.F. Berry, Western Australian Museum and M. Owen

Introduction

Counts of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) at two overnight roosting sites centred on Hollywood Hospital and Perry Lakes in the Western suburbs of Perth have been previously published (Berry 2008 and Berry and Owen 2009). The counts at Hollywood were made between April 2006 and August 2009 (41 consecutive months) and at Perry Lakes from February 2008 to August 2009 (19 consecutive months).

Here we present the results of a continuation of these counts from September 2009 to October 2010 – 14 additional months, bringing the total data set for the Hollywood site to 55 consecutive months and for the Perry Lakes site to 33 consecutive months.

Results

The clear trend of mean and maximum seasonal abundance recorded in 2006, 2006/07, 2007/08, 2008/09 was repeated at the Hollywood roost site in 2009/2010 and 2010/11 (Table 1, Figures 1 and 2). After a rapid progressive increase starting in December, mean monthly numbers peaked in March or April (222, 291, 197, 262 and 212) followed by a rapid decline with lowest numbers of birds recorded from August to October (Figure 1).

Maximum numbers of birds were recorded at the Hollywood site in January/February (331), March (676), April (479, 500) and May (450), (Figure 2). In August 2009 there was an increase in birds that roosted at the Hollywood site. These persisted until October 2010.

Monthly counts made at the roosting site near Perry Lakes again showed an increase in numbers with a corresponding decline at the Hollywood site. This indicates that a progressively increasing proportion of the local cockatoo population roosts at the Perry Lakes site in autumn and winter (Table 1, Figures 3 and 4).

The mean numbers counted at both roosting sites combined confirm that a population of around 250–300 birds is present in the western suburbs for at least four months of the year (March to June) and over around 150 birds for at least 7 months (January to July)

However, between March and June maxima ranged between about 400 and 500 birds. (Table 1, Figure 5 and Figure 6).

Discussion

The records over all years counted to date confirm the clear seasonal trend of abundance of Carnaby's Cockatoo in the Western Suburbs and that the Hollywood roosting site is occupied earlier in the season than the one at Perry Lakes. The only departure from this trend of seasonal abundance was in August 2009 when there was an apparent influx of about 180 birds that persisted until October 2009.

The constancy in the total numbers of birds present each year confirms our view (Berry and Owen, 2009) that there is a correlation between numbers of birds present and food resources available to support them in the Western Suburbs.

References

Berry, P.F. (2008). Counts of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and records of flock composition at an overnight roosting site in metropolitan Perth. *Western Australian Naturalist* **26**: 1–11.

Berry, P.F. and Owen, M. (2009). Additional counts and records of flock composition of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) at two overnight roosting sites in metropolitan Perth. *Western Australian Naturalist* **27**: 27–38.

PF Berry, Honorary Associate, Western Australian Museum, padberry@bigpond.net.au
M Owen, goffmarg@bigpond.net.au

Endangered Black Cockatoos in Western Australia

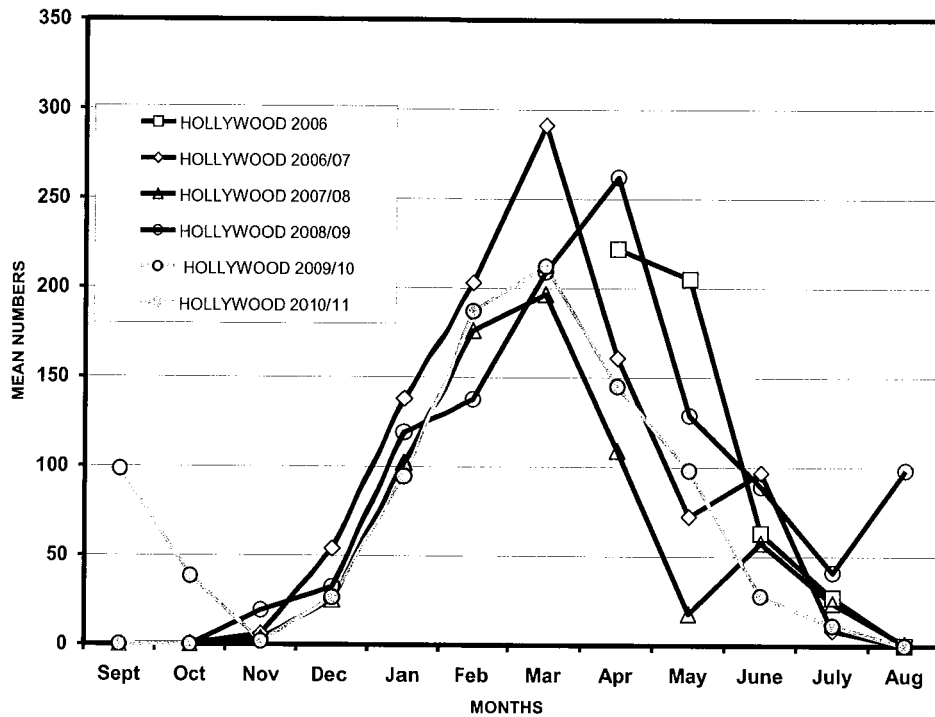


Figure 1. Mean numbers of Carnaby's Cockatoo at the Hollywood roost site over 55 consecutive months.

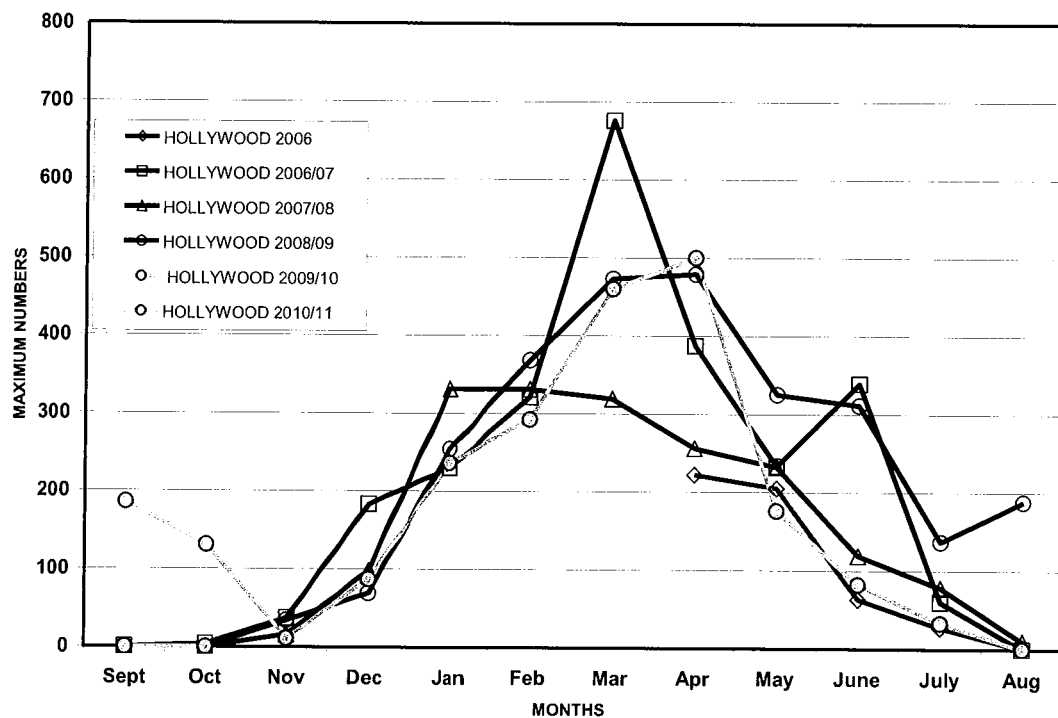


Figure 2. Maximum numbers of Carnaby's Cockatoo at the Hollywood roost site over 55 consecutive months.

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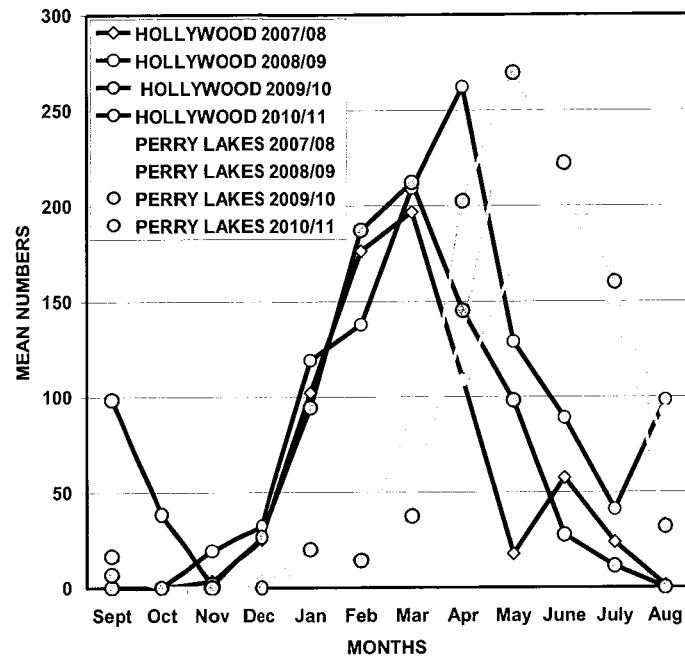


Figure 3. Mean numbers of Carnaby's Cockatoo at overnight roosting sites at Hollywood (September 2007-October 2010) and Perry Lakes (February 2008-October 2010).

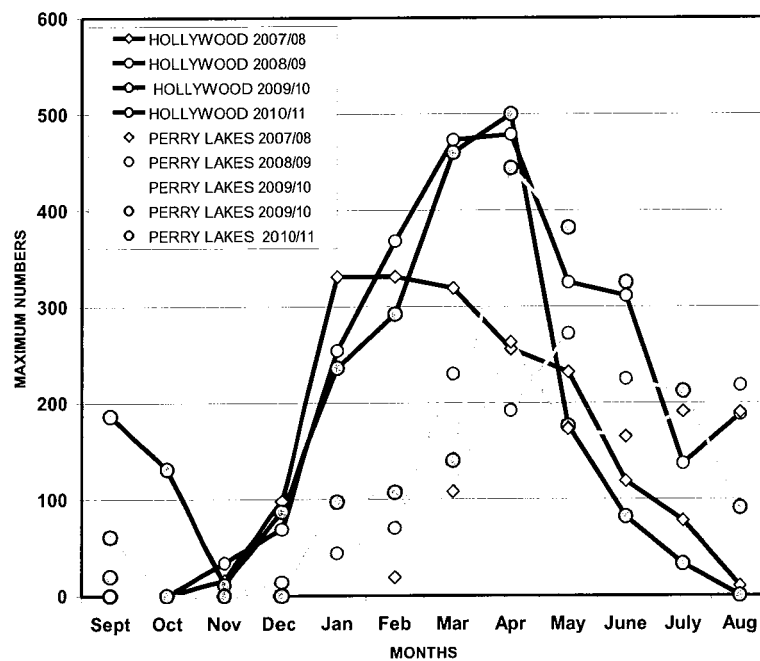


Figure 4. Maximum numbers of Carnaby's Cockatoo at overnight roosting sites at Hollywood (September 2007-October 2010) and Perry Lakes (February 2008-October 2010).

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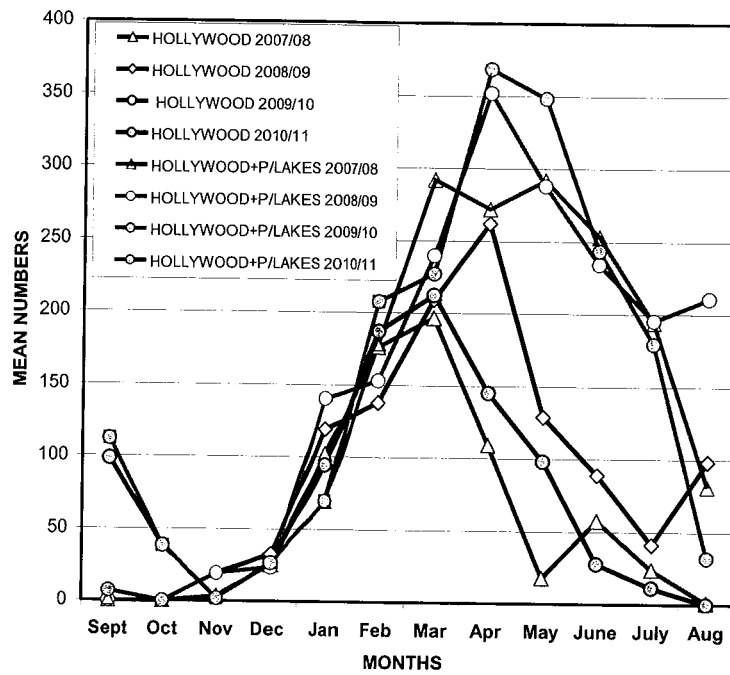


Figure 5. Mean numbers of Carnaby's Cockatoo at Hollywood and Hollywood plus Perry Lakes combined in 2007/08, 2008/09 2009/10 and 2010/11.

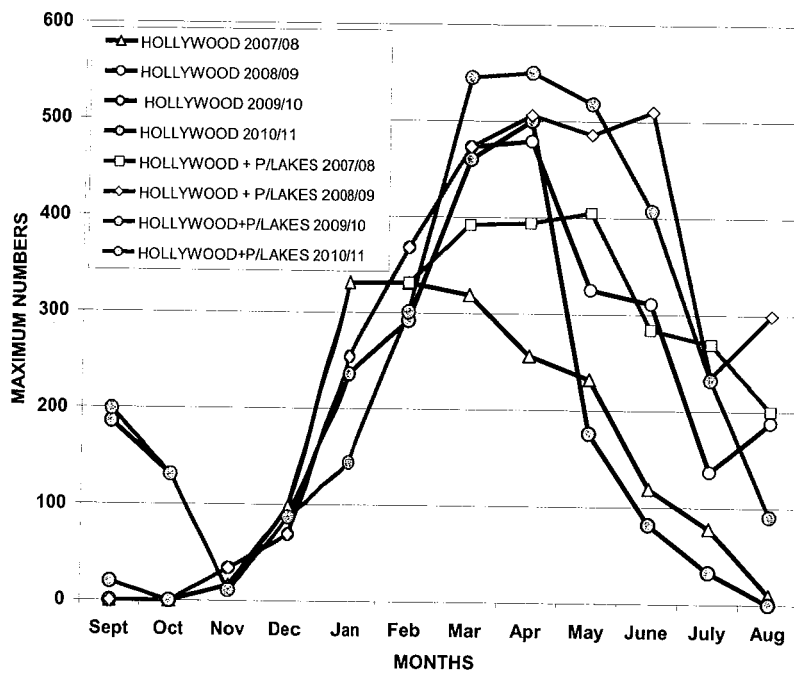


Figure 6. Maximum numbers of Carnaby's Cockatoo at Hollywood and at Hollywood plus Perry Lakes combined in 2007/08, 2008/09 2009/10 and 2010/11.

OBSERVATIONS FROM THE PERRY LAKES ROOSTING SITE

Margaret Owen



Paddy Berry and Margaret Owen each monitor one of two main roosting sites for Carnaby's Cockatoos in the Western suburbs.

The two sites are –

1. The Hollywood Hospital car park, monitored by Paddy Berry almost nightly for 27 years. Before roosting there for the night, the Carnaby's Cockatoos often drink from the sprinkler-filled urns at Karrakatta Cemetery.
2. The intersection of Underwood Avenue and Brockway Road, Shenton Park, monitored by Margaret Owen. Brockway Road runs north-south and is named Brockway Road from the intersection and to the south and Brookdale Street from the intersection and to the north. This roosting site is referred to in the Department of the Environment and Conservation and Birds Australia accounts and counts as the 'Perry Lakes' site but it is not directly at the Perry Lakes area. The site is 150 metres south-east of East Lake, Perry Lakes. The combination of a water source, adequate extent of tall trees, and nearby food sources make this site a good place for Carnaby's Cockatoos who use the site each

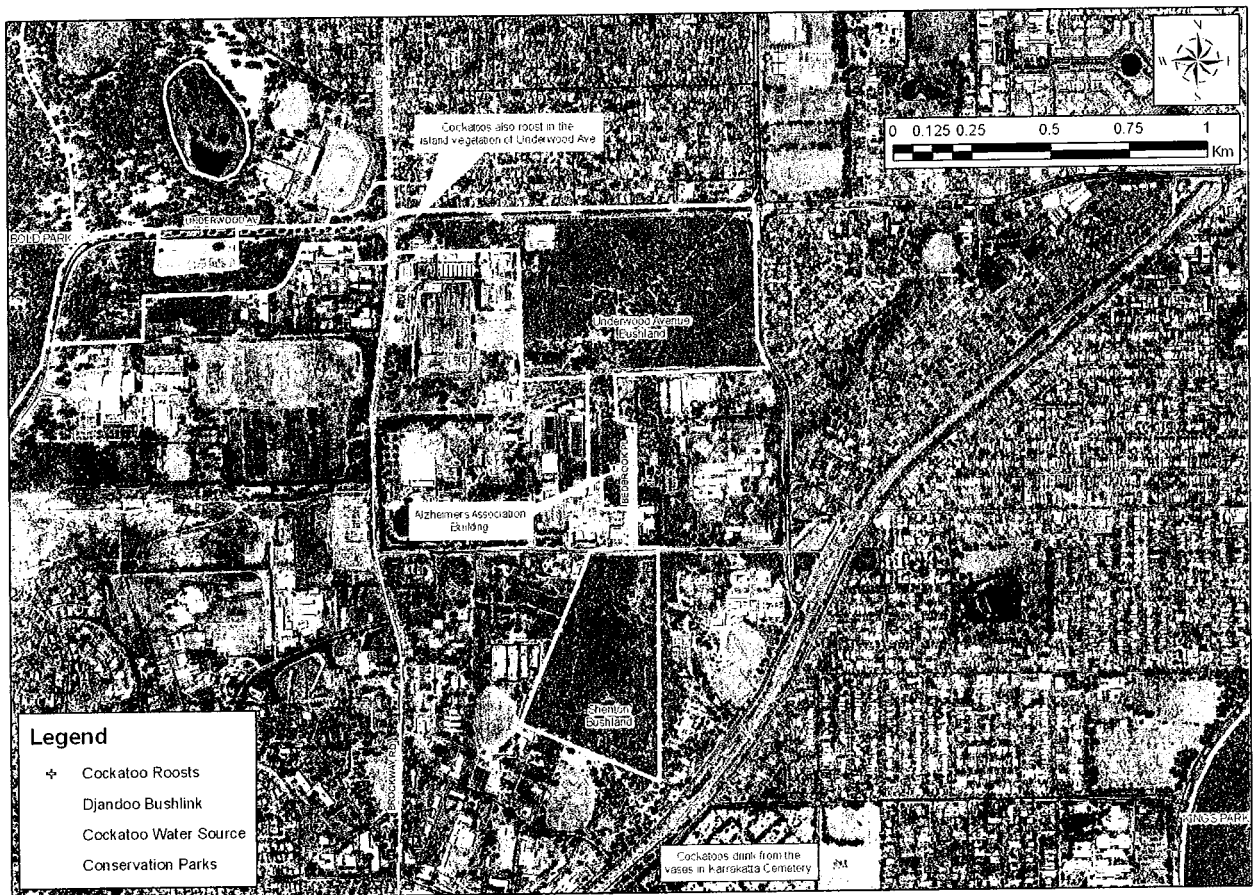
year. Food is obtained from bushland lying to the east, (Underwood Avenue Bushland), bushland to the west (Bold Park) and bushland to the south-east (Shenton Bushland and through to Kings Park) with smaller areas also very valuable. Remnant bushland and trees connect these bushland areas although some of the links are reduced and/or threatened by clearing for development. The link to Underwood Avenue Bushland from the roosting site is through Banksia and Jarrah trees within the UWA Field Station number 1, and through vegetation down the island of Underwood Avenue. The vegetation on the far side of Underwood Avenue (the north side) is also very important. Included in these areas are *Acacia saligna*, *Callistemon* species and Banksia species (*B. prionotes*, *B. attenuata*, *B. menziesii*, *B. ashbyi* and other banksias), *Caesia* (*Eucalyptus caesia*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*). Food is also available from garden plantings and street trees in the suburbs.

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Paddy Berry's paper describes the behaviour of the cockatoos and flock composition of cockatoos using these two roosting sites each year over eight or nine months of the year, from January to September.

Margaret Owen's paper notes some observations of Carnaby's Cockatoos at the lake

area of Perry Lakes and records some of the counts taken as the cockatoos fly to the roosting site. Also noted are the directions taken when cockatoos roosting at the Perry Lakes site leave the site in the mornings.



Location map of the Perry Lakes roosting site and bushland areas

Although this is part of Greenways 19, bushland along Bedbrook Place, (the road between Shenton Bushland and Underwood Avenue Bushland), is threatened. Bushland on the west side of Bedbrook Place is privately owned and one lot is zoned 'light industrial.' Probably rezoning will be sought for other lots along Bedbrook Place. Bushland to the east of Bedbrook Place is part of the Royal Perth Hospital. Bushland at AK Reserve, where Underwood Avenue turns south has been destroyed for basketball, rugby and athletics facilities although a narrow connecting strip remains.

Cockatoos drinking

From January 2010, cockatoos started arriving on the Swan Coastal Plain and the western suburbs group started moving into the area and using the Perry Lakes roosting site. Although using this roosting site, the cockatoos did not start going to the lakes area of Perry Lakes to drink until April. Rather, they were flying straight into the roosting site trees in the evenings, usually from the north. The date of the first Great Cocky Count, 7th April, was the first time for 2010 that the cockatoos flew into Perry Lakes to drink. Numbers of cockatoos had built up over the few days prior to 7th April.

Endangered Black Cockatoos in Western Australia

Cockatoos must have been drinking elsewhere, for example at bird-baths, and with the increase in numbers it would have been easier to drink from the lake.

The table shows how numbers increased at the Perry Lakes roosting site up to 7th April 2010:

28 Mar 10	10	
29 Mar 10	74	
30 Mar 10	0	112 flew in but then they flew to the south, presumably to Paddy's roosting site
31 Mar 10	0	20 came in to the site but then flew off to the south, presumably to Paddy's roosting site
2 Apr 10	40-50	Cockatoos flew in from the SSE rather than the usual - from the north
3 Apr 10	79	again from the SSE
5 Apr 10	258	mainly from the north
6 Apr 10	274	
7 Apr 10	237	First night of flying in to Perry Lakes to drink

Due to ground works (bulldozing) for the Perry Lakes housing development, puddles stayed on the ground and the flock of cockatoos was using those puddles for drinking in the evenings. An employee of the Georgeou Group made sure that the puddle-water at Perry Lakes was kept up and he also put green tape along the top of the Georgeou fence so that the cockatoos could avoid the barbed wire when they flew off the ground at dusk. The puddle-drinking started around 23 April. Until the end of May cockatoos chose to drink at either the East Lake of Perry Lakes, or from the puddles or from both sources of water.

Over 2010, cockatoos were also recorded drinking from puddles elsewhere, from bird-baths in suburban gardens and from the channel along the centre of the turf farm. The turf farm had been excised from Underwood Avenue Bushland.

Corellas

Introduced corellas also gather at Perry Lakes. Numbers in August 2010 were estimated to be around 600. Corellas generally kept to trees on the south side of the lake and cockatoos kept

to trees on the east side of the lake. The corellas were quite aggressive and caused some disturbance to the cockatoos by flying at them. To avoid the corellas, the cockatoos had to fly to other positions. Cockatoos were also disturbed by corellas when drinking and also when feeding and in bushland. On one morning a flock of corellas was perched in trees at the roosting corner, above where the cockatoos were perched. This behaviour was alarming as it could have indicated that corellas would threaten the roosting site but it was only observed on one occasion. The corellas may have flown to that position early in the morning, rather than having roosted there.

From the lake area to the roosting corner

After drinking and gathering in the tall mainly exotic eucalypts at the lake in the early evenings, the cockatoos started flying across from the lake to the roosting corner trees 150 metres to the south-east. The cockatoos roosted in trees on three corners of the intersection and in some of the tall trees on the island of Underwood Avenue. When numbers of cockatoos had built up, the roosting area extended along Brookdale Street and west along Underwood Avenue. Cockatoos also went to tall trees on a driveway just north of McGillivray Road. Another favoured outlying roosting site was in a group of tall trees to the north-east of the roosting corner in Kirwin Street. These trees are visible from the roosting corner and cockatoos roosting there usually flew back to the main corner trees in the mornings before taking off for the day.

Counts in the evenings started on 1st January 2010, and continued through to early September, 2010. The largest number of cockatoos was recorded at the end of April (30th April) with 444 cockatoos recorded. In May the greatest number was 382 (5th May). Paddy's paper records individual and combined counts over the roosting sites.

Endangered Black Cockatoos in Western Australia

From the end of July numbers of cockatoos declined steadily as can be seen below:

28 July 2010	145
30 July 2010	120
31 July 2010	94
2 August 2010	91
3 August 2010	65
4 August 2010	61
6 August 2010	30
7 August 2010	1

The following night, expecting one or no cockatoos, there were 60 cockatoos. Paddy suggested that these birds were probably flying through from southern suburbs on their journey inland.

The numbers of these 60 birds declined as follows with perhaps some more cockatoos flying through from the south and pausing temporarily at Perry Lakes:

9 August 2010	60
10 August 2010	51
12 August 2010	31 plus
14 August 2010	24
16 August 2010	0
18 August 2010	0
19 August 2010	13
22 August 2010	18
23 August 2010	10
24 August 2010	37
25 August 2010	27
30 August 2010	35
31 August 2010	27
1 September 2010	20
13 September 2010	5
15 September 2010	0
18 September 2010	5
19 September 2010	2
25 September 2010	0
26 September 2010	0

From 22nd August 2010, the cockatoos stayed at Perry Lakes (the lake area) and roosted there rather than flying across to the roosting corner.

Mornings

Observations in the mornings were started at the Perry Lakes roosting site from 13 March 2010 and continued to 18 August 2010.

During March and April, the roosting site was visited in the mornings 8 times for each month. In May, the roosting site was visited 17 times in the mornings, 23 times in June, 22 times in July and 15 times in August.

The main directions taken from the roosting site corners were:

1. West down Underwood Avenue and behind the new basketball stadium into remnant banksia and other trees. Cockatoos fed from banksias and perched in dead trees. The grove of Marri trees between the new athletics stadium and Challenge Stadium was often visited. Alternatively, the cockatoos crossed Underwood Avenue into Perry Lakes and on to Bold Park. On two occasions the observer was able to follow the group of cockatoos through Bold Park to City Beach Primary School in Marapana Road. To get there the cockatoos crossed the Zamia Trail in Bold Park near Reabold Hill and flew to very tall pine trees along Oceanic Drive. The attractions at the Primary School are the pine trees bearing numerous cones, peppermint trees and trees in gardens.
2. North-west across the old athletics stadium
3. North-east through Floreat feeding. Food sources were Callistemon as street trees and in gardens, hakeas and banksias in gardens, exotic trees such as Cape Lilac, Liquidambar, Tipuana and Peppermint trees. Cockatoos moved along the street where Peppermint trees were street trees, biting chunks of wood off the branches, after insects.
4. East down the vegetation in the island of Underwood Avenue or east into the UWA Field Station No 1, continuing east around the turf farm, and continuing east into Underwood Avenue Bushland. Time in the bushland was spent investigating tree hollows, feeding and perching, often seemingly enjoying the early morning sun. From the bushland, cockatoos have been observed flying south, eventually moving into Shenton Bushland, or moving out of the bushland to the east and flying east or north-east.

Endangered Black Cockatoos in Western Australia

Photographs of cockatoos using Underwood Avenue Bushland and investigating hollows were sent to the State Minister for the Environment, Youth, on 30th May, on 4th, 7th, 10th and 27th June and on the 5th and 8th July. This was all new data.

On 14th July 2010 the Minister announced State approval of the UWA proposal.

Description of a flock of Carnaby's Cockatoo on one morning in Underwood Avenue Bushland.

The morning was Sunday 25 July, 2010.

The cockatoos started calling at 6:44am and making sorties from their roosting trees. On this day they started flying off in dribs and drabs rather than en masse as they do more often. The group of over one hundred flew east into the trees on the northern side of Underwood Avenue, into the trees on the island of Underwood Avenue and into the UWA Field Station No. 1. There were three phalanxes heading east. After pausing at the Field Station, (feeding, perching and biting wood of a big dead old Jarrah tree) the cockatoos of this southern group continued east into Underwood Avenue Bushland. A group sat in a dead Tuart tree but corellas came flying at them and moved them on.

On every flight into Underwood Avenue Bushland the cockatoos fly into dead tall Tuart trees, most with hollows, and move into the hollows. They may be after insects but they certainly look as if they are considering the hollows for potential nesting places.

Some cockatoos had gone on ahead down the Underwood Avenue island vegetation but they flew back the way they had come, perching in trees on the island. Some of the cockatoos in the bushland flew out of the bushland to the same group of trees on the island so the whole group re-connected. The reconnected group flew back into the bushland. One sat on the barbed wire fence holding an Acorn Banksia (*Banksia prionotes*) cone and some flew on and sat on the corner sign "University of Western Australia Research Park."

Part of the group reached the corner of the bushland at Underwood Avenue and Selby Street at 8:01am.

From the observer at the corner, some cockatoos could be seen deeper in the bushland, just observable on the ground and in the trees and many cockatoos were all around in the verge vegetation of *Banksia sessilis*, and inside the fence on banksias and fallen logs. Some were walking on the firebreak.

At 8:15am the flock rose and flew into big trees on the eastern side of Selby Street. The activities of the day had started pretty well.



Conclusion

At a seminar in Perth on 20 August 2010, on matters of National Environmental Significance and planning using Carnaby's Cockatoo as a case study, Dr Andrew Weavers said: "The objective of the DEWHA is to support the persistence and recovery [of black cockatoos]. I am not confident that what we are doing will achieve that."

He also said that the Federal Government can say that these areas are so significant they are non-negotiable. Cockatoos are captivating and barely a person would deny that we would be much, much the poorer if within our lifetime or our children's lifetime, cockatoos disappeared from our skies and from our bushlands and gardens.

Endangered Black Cockatoos in Western Australia

This paper gives an indication of the importance of the last areas of habitat of Carnaby's Cockatoos in the western suburbs

and perhaps how tenuous is the event horizon between recovery, persistence and extinction. The take-home message for this paper lies below:

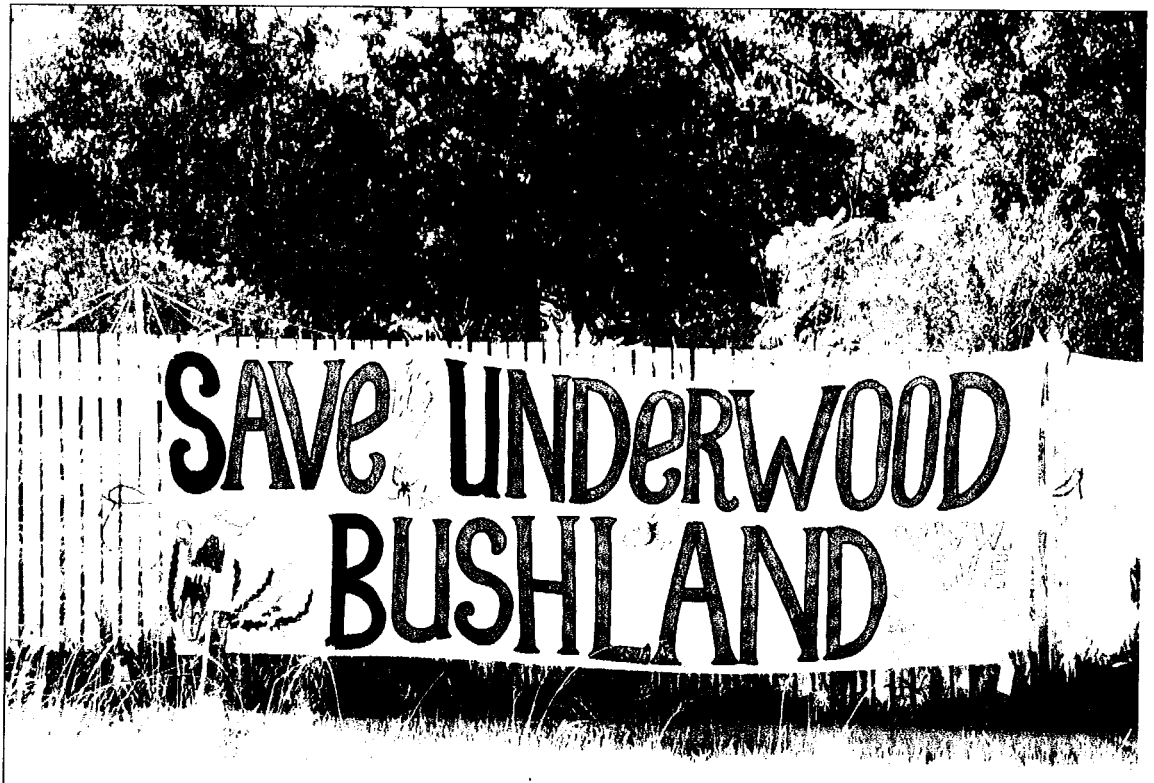


TABLE 1: CARNABY'S COCKATOO

AVERAGE COUNTS PER MONTH FROM JANUARY TO AUGUST 2010 from the two main roosting sites in the western suburbs, Hollywood Hospital carpark and at the corners of Underwood Avenue and Brockway Road, known as the Perry Lakes site. Numbers for each month recorded. The greatest number for each month is noted.

	January	February	March	April
Average numbers per month at Hollywood site	Av 86 Greatest number; 200	Av 227 Greatest number; 300	Av 223 Greatest number; 437	Av 152 Greatest number; 500
Numbers of cockatoos roosting at Hollywood site/ various dates	80,20,100,200,30, few	200,211,250,270, 274,246,264,162, 281,300,170,few, 68	55,303,221,25, 248,437,119,220, 172,353*,318,211, 141,312	500,326,80,2,73, 334,414,87,99,125 157,48,127,120,112, 110,112,22,32
	Perry Lakes	Perry Lakes	Perry Lakes	Perry Lakes
Average numbers per month roosting at Perry Lakes site	Av 18 Greatest number; 97	Av 14 Greatest number; 107	Av 44 Greatest number; 139	Av 209 Greatest number; 444
Numbers of cockatoos roosting at the Perry Lakes site/ various dates.	0,0,12,97,0,0	0,55,21,27,0,0,0, 0,6,107,15,0,0,0,0 , 0,3,	0,0,0,0,0,0,22,53, 81,108,99,149,140, 139,62+(24 March 2010, two days after the storm), 0*(three days after the storm), 15 ,3, 10, 74, 0, 0.	40,79,258,274,237, 60,23,79,118,222, 177,170,248,232, 321,278,243,444

Endangered Black Cockatoos in Western Australia

TABLE 1 continued: CARNABY'S COCKATOO

	May	June	July	August
Average numbers per month at Hollywood site	Av 88	Av 42	Av 22	Av 0
Numbers of cockatoos roosting at the Hollywood site/month	169,31,29,5,136, 169,0,145,144, 139,158,144,147, 0,0,92,101,29,113 0	7,9,82,36,7,9,29 42,35,350,0,32,6, 6, 32,32,6	26,27,20,33,32, 32,26,0,20,0,144, 0,9,0,0,0,0	0,0,0,
	Perry Lakes	Perry Lakes	Perry Lakes	Perry Lakes
	May	June	July	August
Numbers per month roosting at the Perry Lakes site	239,264,150,299, 382,340,167,330, 291,290,240,290, 220,358,303,250, 166,227,291,294, 333,245,315,248.	292,230,325,301, 220,255,155,209 237,281,280,253, 190,248,179,111, 212,237,247,115, 117,168	188,197,197,197 187,122,130,86,202, 159,212,187,121, 114,157,137,139, 145,120,94	91,65,61,30,1, 60,60,51,31,24,0,0,0,0, 13,18,10,37 (stayed at PL roosting),27(PL), 35 (PL), 27(PL), 20(PL),15 (PL),14(PL),5(PL),5 (PL),2 (PL),0,0.
Average number of cockatoos roosting at Perry Lakes site/month	Av 272 Greatest no; 382	Av 221 Greatest number; 325	Av 155 Greatest number; 197	Av 24 Greatest number; 91.

*After big hail and thunder storm came through 22 March 2010 killing 58 cockatoos in Kings Park

The greatest combined total was 540 in early April (2nd April 2010). Compare this with maximum number of 676 at Hollywood site in 2006/07. However, that was a spike above usual counts, where the maximum was closer to 500 birds.

The UWA cockatoo recording site was a great success with up to 651 observers putting records on the Google map on the site <http://cockatoo.csse.uwa.edu.au>

"This research which uses 'citizen scientists' aims to determine the daily movement

patterns of Western Australian iconic Carnaby's Black-Cockatoo within the south-west of Western Australia."

Total number of records 3,856. (31 October 2010).

The website is now managed by Birds Australia at: <http://birdsaustralia.ala.org.au/BDRS/home.htm>

With great thanks to my colleague, Paddy Berry. Margaret Owen Email: goffmarg@bigpond.net.au

ON A WING AND A PRAYER - A FILM TO BE RELEASED IN 2011

Leighton de Barros

Playful, mischievous and highly intelligent, Carnaby's Cockatoos are adored by thousands, hunted by many and saved by few. Endemic to the south-west region of Western Australia, only a small pocket of these large, gregarious birds remain and these are permanently under threat. Some are still being poached and smuggled for private collections. Many are illegally shot. Together with land clearing, loss of native food habitat and injury from man-made structures, the Carnaby's Cockatoo is plummeting towards extinction.

Species recovery is an uphill struggle, only two percent of new-born chicks make it to adulthood. The odds are against them. Hope for their future lies in the hands of the local community and one man in particular, Senior Wildlife Investigator Rick Dawson.

This year Rick is determined to protect one small family of Carnaby's Cockatoos at a 'high risk' nesting site he calls 'The Stump'. Over the last four years the parents have lost their chicks to poachers. With their species numbers more than halved over the last forty years, it is vital for the survival of their kind that the Stump pair breeds successfully this season. Rick will do whatever it takes to make it happen.

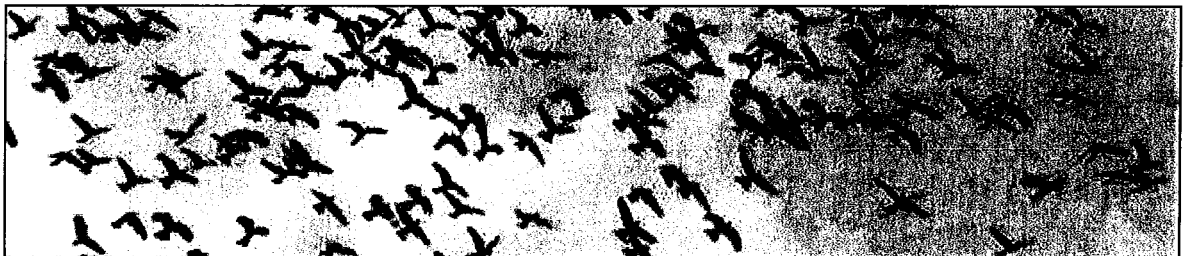
'On a Wing and a Prayer' follows the incredible life cycle of this family of striking birds as they migrate to breeding grounds in the south-west of Western Australia.

Every milestone in their struggle to survive is documented through the engaging story of The Stump family. This is a story of love, loss and sheer endurance.

The story of The Stump family showcases the cockatoo's unique natural behaviour. This is interwoven with Rick's work as he passionately shepherds the birds on their life journey. He will stop at nothing. He sets up surveillance devices to protect The Stump from poachers. But is this enough? When an anonymous informant hands over the bodies of two shot Black Cockatoos, Rick is more determined than ever. He risks going undercover to try to catch the shooter. When bullets fire the chase is on. But will Rick catch the shooter and will he have enough evidence to prosecute? Every bird is precious and when an adult Carnaby's Cockatoo is hit by a car, Rick is the first on the scene to rescue it. But after critical surgery, can the bird make it in time to join the others in the biggest release of rehabilitated cockatoos back to the wild in Australia?

With special access granted to our film-makers and photographed in stunning HD, 'On a Wing and a Prayer' will enter the extraordinary world of the Black Cockatoo, capturing a remarkable never-filmed-before journey of life and hope for one of Australia's most loved, but critically endangered birds.

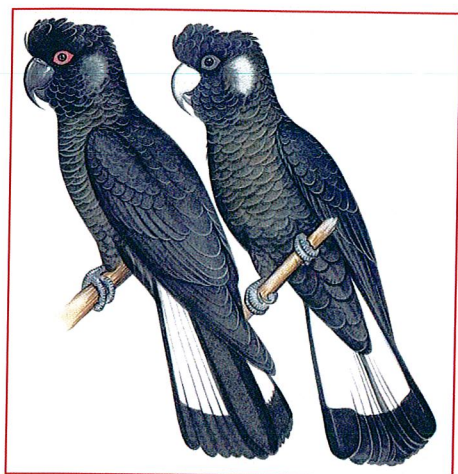
www.wingandaprayer.com.au



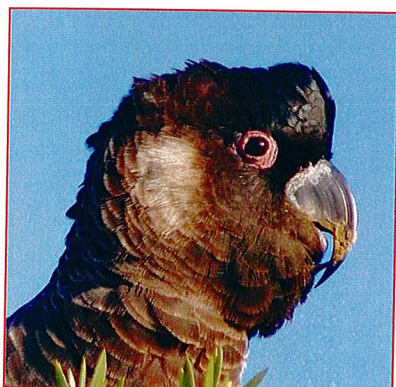
Information Sheet

Baudin's Cockatoo

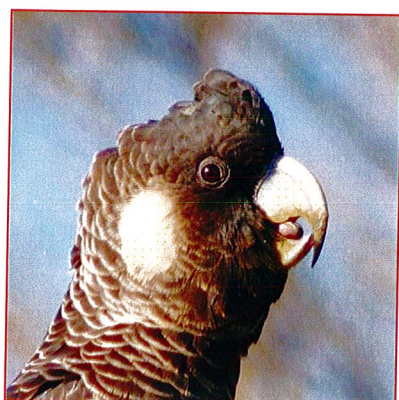
Calyptorhynchus baudinii



Male (left), Female (right)



Adult male



Adult female

Other names:

Baudin's Black Cockatoo and Long-billed Black Cockatoo. Named in honour of French explorer Nicolas Baudin (1754–1803).

Threatened Status:

"Listed Endangered: Schedule 1 – Western Australian Wildlife Conservation Act".

"Endangered: under Federal *Environmental Protection and Biodiversity Conservation Act*".

Scarce to moderately common (most numerous in deep southwest). Mainly in flocks (up to 300), occasionally larger aggregations (up to 1200) at roosts. It has declined in the last 50 years, its low rate of reproduction (0.6 chick per year) precluding it from replacing the large numbers shot by orchardists.

Description:

Length 50–60 cm. Weight 560–770 g.

Upper bill narrower and longer than Carnaby's Cockatoo.

Adult male: mostly brownish black, the feathers edged with dusky white giving a scalloped appearance; ear coverts dusky white; white band towards tip of tail, broken in middle; bill black; bare skin around eye pink.

Female: like male but differs in having the ear coverts a brighter yellowish white; bill greyish with dark tip and eye skin grey.

Call:

A short "whicher whicher" and "bunyip bunyip" flock call.

Breeding call a repeated low "arr" followed by a high-pitched whistle.

Breeding:

Nesting in hollows of Karri, Marri, Wandoo, Tuart and Bullich trees. Eggs laid in August-December; clutch 1–2 (only one young reared) and only the female incubates and broods the chick.

Life span: 25–50 years.

Distribution:

Occurs in south-western humid and subhumid zones, north to Gidgegannup, east to Clackline, Wandering, Quindanning, the Perup River, Lake Muir and King River, and west to eastern strip of Swan Coastal Plain including West Midland, Gosnells, Byford, North Dandalup, Yarloop, Wokalup and Bunbury also the Stirling and Porongurup Ranges and along the south coast to Waychinicup National Park. It is endemic to Western Australia.

Habitat and food:

Southern eucalypt forests of mainly Jarrah, Marri and Karri. Feeds on seeds of eucalypts, Banksia, Hakea and fruiting apples and pears. Also nectar, buds and flowers and strips bark from dead trees in search of beetle larvae. Forages at all levels from canopy to ground.

Ron Johnstone

Department of Terrestrial Vertebrates

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Female Baudin's Cockatoo at nest

Threats to the species:

Clearing of forest, fires, vehicle strikes, feral bees which take over nesting hollows and in the past large numbers shot by orchardists.

References:

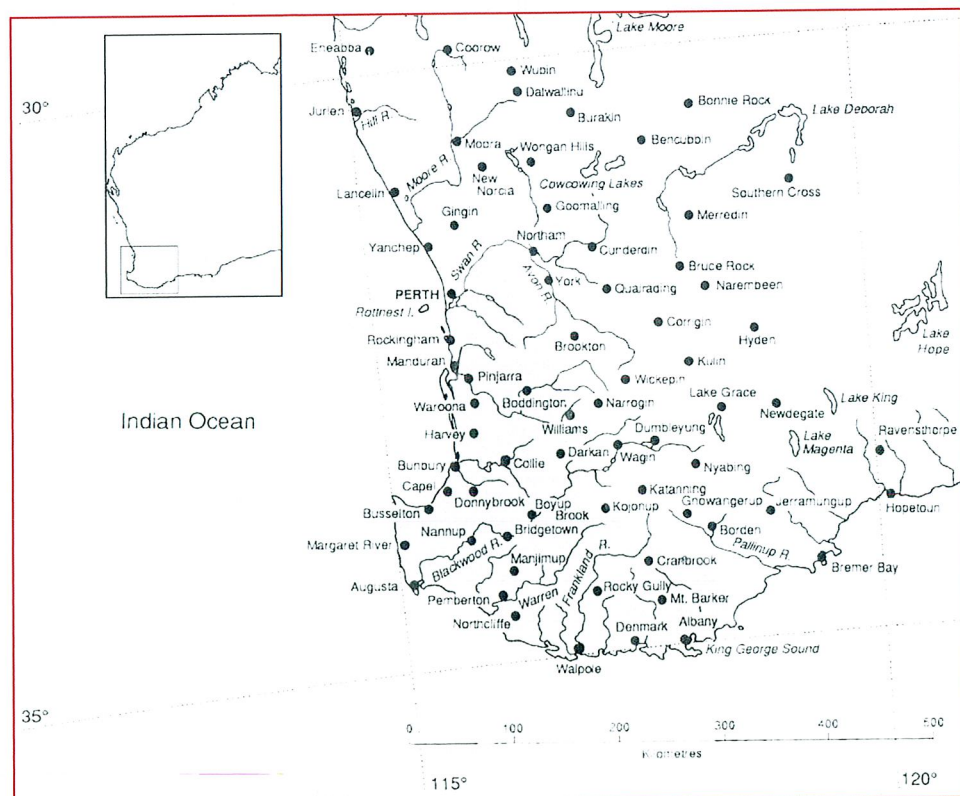
Johnstone, R.E. and Storr, G.M. (1998). *Handbook of Western Australian Birds*. Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum pp. 278–280.

Johnstone, R.E. and Kirkby, T. (2008). Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia. *Records of the Western Australian Museum* **25**: 107–118.

Images: Tony Kirkby Layout design: Kim Sarti



Marri nuts chewed by Baudin's Cockatoo



Current distribution in south-west Western Australia

Information Sheet

Carnaby's Cockatoo

Calyptorhynchus latirostris



Male (left), Female (right)



Adult male



Adult female

Other names:

Carnaby's Black Cockatoo and Short-billed Black Cockatoo. Named in honour of oologist and naturalist Ivan Carnaby (1908–1974).

Threatened Status:

"Listed Endangered: Schedule 1 – Western Australian Wildlife Conservation Act".

"Endangered: under Federal *Environmental Protection and Biodiversity Conservation Act*".

It is uncommon to common in wetter parts of range, scarce and patchily distributed in driest parts of range. Usually in pairs or small flocks, occasionally large flocks or aggregations up to 5,000 in non-breeding season especially at pine plantations. It has declined in the last 50 years due to habitat loss and destruction especially large-scale clearing in much of the wheatbelt and Banksia and Tuart woodlands on the Swan Coastal Plain.

Description:

Length 53–58 cm. Weight 500–790 g.

Upper bill broader and shorter than Baudin's Cockatoo.

Adult male: mostly brownish black, the feathers tipped with dusky white giving a scalloped appearance; ear coverts dusky white; white band towards tip of tail, broken in middle; bill black; bare skin around eye pink.

Female: like male but differs in having the ear coverts yellowish white; bill greyish white or grey with a black tip and eye skin grey.

Call:

A short "weeyou-weeyou" or "weeloo-weeloo" flock call.

Breeding:

Mainly in wheatbelt, in hollows of old smooth-barked eucalypts including Salmon Gum and Wandoo. Also Tuart, Flooded Gum and Karri as well as Bullich and Marri. Eggs laid on wood dust or chips at bottom of hollow from early July to December. Clutch 1–2 (usually only one young reared) and only the female incubates and broods the chick.

Life span: 25–50 years.

Distribution:

Occurs in south-west north to lower Murchison and east to Nabawa, Wilroy, Waddi Forest, Manmanning, Durokoppin, Lake Cronin and just east of Condingup. It is endemic to Western Australia.

Habitat and food:

Woodlands and scrubs of semiarid interior of Western Australia, in non-breeding season wandering in flocks to coastal areas, especially pine plantations and Banksia woodlands. Food includes the flowers, nectar and seeds of Banksia, Dryandra, Hakea, Eucalyptus, Corymbia, Grevillea, also seeds of Pinus, fruiting nut trees especially almonds and macadamias, the flesh and juice of apples and persimmons and insect larvae.

Ron Johnstone

Department of Terrestrial Vertebrates

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November 2010



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Female Carnaby's Cockatoo at nest

Threats to the species:

Direct causes of population decline include land clearing and fragmentation of habitat (especially in wheatbelt), the loss of hollow-bearing trees and impact of hollow competitors including Galah, corellas and feral European honey bee, also fires and vehicle strikes.

References:

Johnstone, R.E. and Storr, G.M. (1998). *Handbook of Western Australian Birds*. Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum pp. 276–280.

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Images: Tony Kirkby Layout design: Kim Sarti



Marri nuts chewed by Carnaby's Cockatoo



Current distribution in south-west Western Australia

Information Sheet

Forest Red-tailed Black Cockatoo

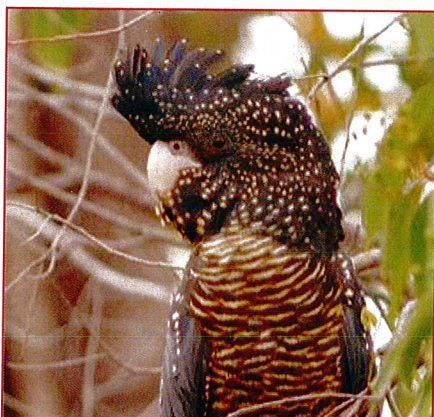
Calyptorhynchus banksii naso



Male (left), Female (centre), Juvenile (right)



Adult male



Adult female

Other names:

Red-tailed Black Cockatoo.

The south-western population *naso* (referring to its large bill) was named by John Gould in 1837. Known to the Noongar people as 'Karrak'.

Threatened Status:

"Listed Vulnerable: Schedule 1 – Western Australian Wildlife Conservation Act".

"Vulnerable: under Federal *Environmental Protection and Biodiversity Conservation Act*".

It was formerly common, but is now rare to uncommon and patchily distributed over a range which has become markedly reduced. Usually in pairs or small flocks, seldom large flocks (up to 200). It has declined due to destruction of forests and woodlands, also competition for nest hollows with native and exotic species and the impact of fire. There are three subspecies of Red-tailed Black Cockatoo in Western Australia (see map). Only the south-western population *naso* is listed as Vulnerable.

Description:

Length 53–55 cm. Weight 600–610 g.

Adult male: glossy black except for bright orange-red band towards tip of tail, bill dark grey or blackish.

Female: glossy black, the head and wing coverts spotted with pale yellow; breast and belly barred with orange-yellow; tail narrowly banded with orange-yellow (more orange) on undertail coverts; bill pale greyish white.

Juvenile and immature: similar to female except for less pale yellow spots on head, cheeks and wings, dull pale yellow bars on breast and belly, outer tail feathers brightly barred with red or orange red (little or no yellow) and bill dark grey or blackish.

Call:

Loud harsh cries "Karee", "Karrak" or "Krar-raak" also "chet" sounds and harsh nasal wheezing. Male breeding call is a repeated mechanical "waa-waa".

Breeding:

Nesting in hollows of Marri, Jarrah, Wandoo, Karri and Bullich trees. Eggs laid on wood chips at the bottom of the hollow in March–December; clutch 1 (rarely 2). Incubation period 29–31 days and only the female incubates and broods the chick. Hatchlings covered in sparse yellow down.

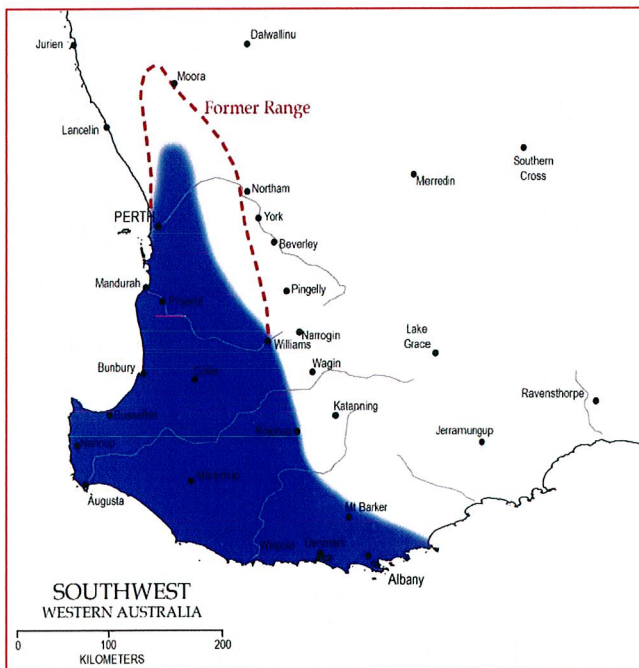
Life span: 25–50 years.



Female Forest Red-tailed Black Cockatoo at nest



Marri nuts chewed by Forest Red-tailed Black Cockatoo



Current distribution in south-west Western Australia

Distribution:

This subspecies occurs in the humid and subhumid south-west; mainly in hilly interior, north to Gingin (formerly to Dandaragan) and east to Mt Helena (formerly to Toodyay), Christmas Tree Well, near Brookton, North Bannister (formerly to Wandering), Mt Saddleback, Kojonup, Rocky Gully, upper King River and east to the Green Range. It is endemic to Western Australia.

Habitat and food:

Eucalypt forests. Feeds on seeding Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble, also some ornamental eucalypts and introduced Cape Lilac.

Threats to the species:

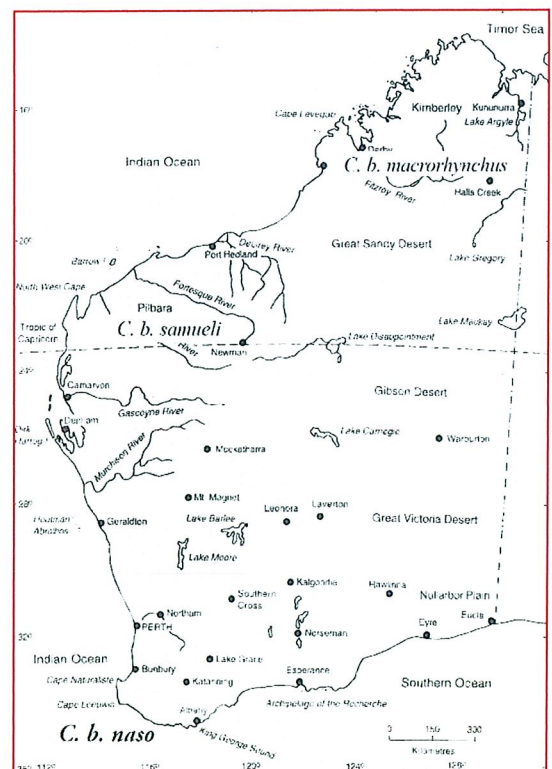
Destruction of forests, fires in spring breeding season, feral European honeybees, the expansion of Australian Shelduck and Australian Wood Duck which takes over nest hollows, also vehicle strikes.

References:

Johnstone, R.E. and Storr, G.M. (1998) *Handbook of Western Australian Birds*. Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum pp. 278–280.

Johnstone, R.E. and Kirkby, T. (1999) Food of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* in south-west Western Australia *West Aust. Nat.* **22**(3): 167–177

Images: Tony Kirkby Layout design: Kim Sarti



Distribution of three Red-tailed Black Cockatoo subspecies in south-west Western Australia



◀ Carnaby's Cockatoo chick (Nest 206)

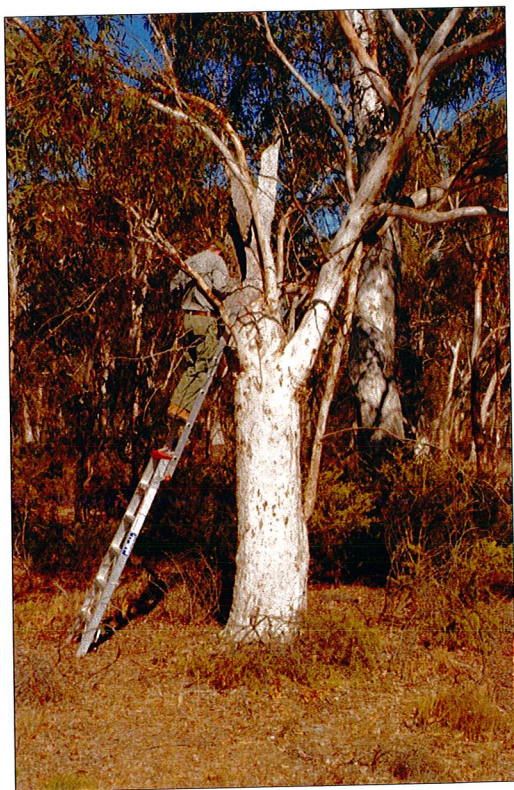


▲ Carnaby's Cockatoo chick – weighed, measured, banded etc (Nest 358)

◀ Carnaby's Cockatoo chick (Nest 063)



▲ Ron Johnstone (WA Museum) with Carnaby's Cockatoo chick (Nest 400)



▲ Some nest trees are easier to access than others! (Nest 063)



▲ Ron Johnstone undertaking field activity Marri tree (Nest 146)



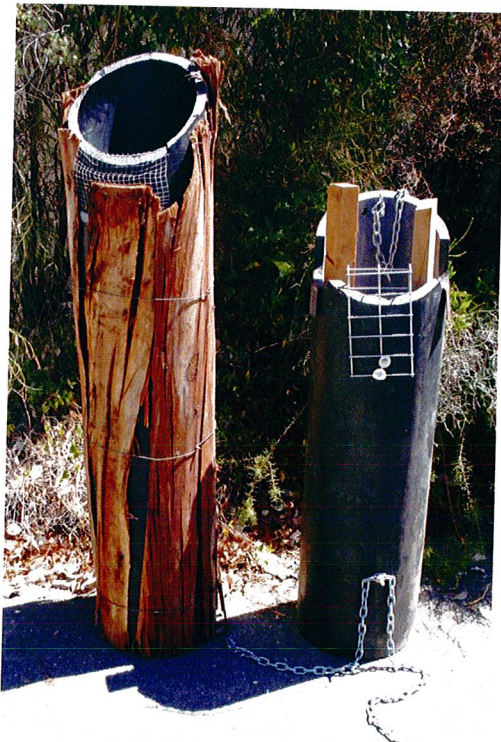
◀ Male Baudin's Cockatoo feeding on Marri



▲ Male Carnaby's Cockatoo with grub



◀ Red-tailed Black Cockatoo feeding on Cape Lilac (*Melia azedarach*)



▲ Cockatubes
(L) Early style
(R) Current style with ladder and replaceable sacrificial posts



▲ Carnaby's Cockatoo have fed on these *Banksia menziesii* cones



▲ Forest Red-tailed Black Cockatoo drinking

THE BIRDS AUSTRALIA CARNABY'S BLACK COCKATOO RECOVERY PROJECT 2000-2010: A TEN YEAR COMMUNITY-BASED APPROACH TO CONSERVATION

Raana Scott and Cheryl Gole, Birds Australia

Birds Australia has initiated and managed the Carnaby's Black-Cockatoo Recovery Project, the longest-running continuous, community-based conservation program for any cockatoo in south-west Australia.

Birds Australia is Australia's oldest conservation organisation. Formed in 1901, it is a national organisation working for the conservation and protection of Australia's birds and their habitats. The organisation runs both research and conservation projects, some of them from its national headquarters in Melbourne, some of them from within regional groups such as Birds Australia Western Australia.

The Birds Australia (BA) Carnaby's Black-Cockatoo Recovery Project began in 2000 when, with a small amount of funding from the then Lotteries Commission, it undertook extensive media work in the wheatbelt to try to establish an accurate current range for the species, and to make contact with private landholders that had the cockatoos breeding on their land. The project also aimed to identify a small number of breeding sites on private land that could be targeted for on-ground recovery work.

This was the first widespread community-focussed recovery project for Carnaby's Cockatoo. The number of stakeholders actively engaged in research and its recovery was then very small and the level of awareness of the conservation status of the species correspondingly small.

Since 2000, BA has worked continuously to protect Carnaby's Cockatoo, both to encourage and participate in research that broadens knowledge of the species, and to work closely with landholders to protect the birds on private land in the wheatbelt.

In doing so, BA has employed a very small number of project officers and utilised a large number of volunteers, many of them from outside the organisation. BA has had a close working relationship with the Department of

Environment and Conservation and has partnered with a number of conservation non-government groups and community-based organisations. Funding has been provided through private and corporate donors and a number of public federal and state funding programs.

Over the ten years of the program, BA has been an advocate for the cockatoos when clearing for urban or industrial development has threatened to remove critical habitat. In addition, it has undertaken a wide range of projects that further the aim of research and deliver activities that contribute actively to the conservation of Carnaby's Cockatoo. For details of each project, see Table 1.

The program's major activities include:

- Conservation: working with landholders to conserve critical feeding and breeding habitat in the wheatbelt by:
 - Fencing remnant vegetation,
 - Planting appropriate plant species for feeding plants and future nesting trees.
- Conservation: the nest hollow repair program to increase nest hollow availability and suitability in key breeding areas.
- Conservation: the nest competitor control program to increase nest hollow availability and suitability in key breeding areas.
- Conservation: long-term protection of critical breeding areas through brokering covenants and voluntary management agreements with private landholders.
- Conservation: community planting days.
- Community and schools education and awareness-raising program.
- Research: mapping the species range in the wheatbelt.
- Research: trialling methods to estimate the population on the Swan Coastal Plain portion of the Perth Metropolitan area.
- Research: trialling artificial nest boxes to measure uptake in various situations.

Endangered Black Cockatoos in Western Australia

- Research: trialling the growing and planting of proteaceous plant species in key areas in the wheatbelt, and gauging landholder uptake.
- Research: monitoring nesting hollow occupancy.
- Research: funds donated to BA were utilised for aviary trials to test transmitters and harnesses for satellite tracking and for regional vocal dialect studies.

In summary, over ten years, Birds Australia's Carnaby's Black Cockatoo Recovery Project has encouraged and led research broadening knowledge of the species, worked closely with landholders to protect the birds on private land in the wheatbelt and been an advocate for the cockatoos when clearing of habitat has further threatened this endangered species.

Table 1: A summary of the history of the Birds Australia Carnaby's Black-Cockatoo Recovery Project activities over the period 2000–2010.

Funded programs for Carnaby's Cockatoo	Project outcomes
2000	Raised awareness of the conservation status of the species in the WA wheatbelt; established the first non-government database of Carnaby's Cockatoo sightings; identified a set of key areas to be targeted for the species' recovery in the wheatbelt.
2000–2010	Cocky Notes newsletter distributed to interested stakeholders and members of the public.
2001–2002	Evaluated data to short-list key recovery areas in the wheatbelt; recruited, trained and organised volunteers to undertake nest searches in key areas; maintained nest records database; raised awareness in wheatbelt areas.
2002–2010	Worked with a range of stakeholders to provide support in regional areas; trained volunteers and professionals to undertake nest searches and identify critical habitat; maintained database.
2002–2003	Worked with community groups, including Men of the Trees, to plant suitable food and nesting plant species in selected wheatbelt areas; established schools education program. Coordinated nest competitor control program in wheatbelt.
2003	Organised, with DEC support, the first Carnaby's Black-Cockatoo Symposium.
2003–2004	Nesting hollow repairs program established in wheatbelt. Developed and implemented method of increasing hollow availability in key breeding sites.
2003–2004	Worked closely with landholders and rural communities to successfully manage key breeding areas for conservation.
2004–2010	Hollow repair and maintenance program continued.
2005–2006	Coordinated proteaceous plant species trial, growing and planting feed species
2004–2010	Protected, improved quality and increased extent of critical remnant vegetation in selected wheatbelt regions by fencing off remnants and planting local provenance food plant species; mapped key habitat areas; continued awareness-raising and education activities in wheatbelt. Contributed to landscape-scale conservation targets.
2005–2006	Trialled method to estimate the number of cockatoos in the Swan Coastal Plain portion of Perth Metropolitan area.
2007–2010	Artificial hollow site trials established and continued.
2008	Organised, with WWF and DEC, the second Carnaby's Black-Cockatoo Symposium.
2006 – ongoing	Extended region covered by program; prioritising larger (>20ha) patches of feeding habitat within flying distance of nesting areas; coordinating recording and collation of sightings and nesting records; engaging volunteers to implement nest competitor control at breeding sites. Contributing to landscape-scale conservation targets.

MANAGING BLACK COCKATOOS IN A PRODUCTION LANDSCAPE

Vicki Stokes, Alcoa of Australia

Alcoa of Australia has been mining bauxite in the northern jarrah forest since 1963. Approximately 600 ha of forest is mined, cleared and rehabilitated each year. The objective of Alcoa's restoration is to return a self-sustaining jarrah forest ecosystem that maintains or enhances a range of forest values including biodiversity. Managing threatened species, which includes all three species of black cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii*, Carnaby's Cockatoo *Calyptorhynchus latirostris* and the Forest Red-tailed Black Cockatoo (FRTBC) *Calyptorhynchus banksii naso*) is an important part of achieving this restoration objective.

In early 2010, Alcoa formulated a 'Threatened Species Management Plan'. The aim of the management plan is to identify threatened fauna species that occur within the mine lease; document what is known about their biology, ecology, habitat requirements and threats to local populations; identify current management actions that may benefit species; and recommend further management actions. The aim of recommended actions is to increase understanding of mining impacts on threatened species, mitigate impacts and optimise available habitat in restoration.

During 2010, several initiatives were instigated for black cockatoos. These were:

- Expert pre-mining surveys of future mine regions to locate important roost, breeding and feeding habitat of all three black cockatoo species. Survey areas will target sites of infrastructure development such as haul roads that can be re-aligned to protect habitat if required. Previous pre-mining fauna surveys only recorded the presence of birds at sites and failed to provide meaningful data on how birds utilise the landscape.
- Incorporating data from pre-mining surveys into Alcoa's GIS to be available during planning of mine infrastructure so that where practical areas of high value

roosting, nesting and feeding habitat are protected.

- Artificial nest trial at the Huntly mine. There are no historical records available on whether birds used the area for breeding prior to mining. The artificial nests will be monitored regularly for breeding activity and additional nests will be installed if birds use the nests.

For future mining regions, species-specific pre-mining surveys will provide detail on occurrence of breeding. This information will then inform restoration practice, identifying the need for artificial nests to replace nests lost due to forest clearing.

- Research on the use of restoration as foraging habitat for black cockatoos.

An Honours student project was conducted during 2010 with the aims of comparing feeding in unmined forest and several ages of restoration habitat (4-6 years, 11-13 years, and 18-20 years), and measuring the effects of thinning of older restoration on feeding behaviour.

The findings revealed highest feeding activity in unmined forest, occurring in 80% of plots by FRTBC on marri, jarrah, sheoak and *Persoonia longifolia*, and by Baudin's Cockatoo on marri only. There was no evidence of Carnaby's Cockatoo feeding in unmined forest. In 5-6 year old restoration, there was feeding in 60% of plots, all on *Hakea* species (*H. amplexicaulis*, *H. undulata*, *H. trifurcata*). While the species feeding on hakea was not determined, 80% of feeding was recent (less than 3 months old), coinciding with the presence of Baudin's Cockatoo in the area.

However, opportunistic feeding by transient Carnaby's Cockatoo should not be ruled out and needs to be confirmed through observation.

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There was little feeding in 11-13 year old restoration (only 15% of plots) and all feeding was on *Hakea* species.

In 18-20 year old restoration, feeding was recorded in 30% of plots and all feeding was on marri, with some foraging by Baudin's Cockatoo, but most foraging by FRTBC. It was concluded that restoration younger than 15 years of age contained insufficient supplies of marri fruit.

In thinned restoration, FTRBC feeding on marri was 5 times greater than in restoration plots that had not been thinned.

Further investigation is recommended of management options such as thinning that maximise growth and food production of eucalypts in restored forest. Consideration should also be given to potentially increasing the ratio of marri relative to jarrah in restoration and reducing stand densities at restoration establishment.

It was concluded that restoration, even from as young as 4 years of age, is providing food resources for black cockatoos, but provides 60% less energy per hectare than unmined forest. Thinning restoration increases the energy yield extracted by black cockatoos and may be a management option for improving feeding habitat of restored forest.

Alcoa will continue to monitor and research black cockatoo use of the northern jarrah forest within the mining lease in the long-term, to minimise impacts on habitat where possible and optimise the provision of food resources in restored forests.



▲ Comparison of bill sizes –
(L) Carnaby's Cockatoo: short, thick heavy bill
(R) Baudin's Cockatoo: long, narrow laterally-compressed bill

MOLECULAR ECOLOGY, CONSERVATION, MANAGEMENT AND PROTECTION OF BLACK-COCKATOOS IN WESTERN AUSTRALIA.

Nicole White, Peter Spencer and Michael Bunce, Murdoch University

Genetic tools are an effective, non-invasive method for gaining an understanding into a species. The study of genes provides an understanding of evolutionary history, taxonomy, population structure and migration in a species. The breeding biology and levels of genetic health can also be ascertained with genetic studies. A further application for genetic tools is the policing of illegal trade.

The Wildlife Genetics group at Murdoch University has compiled an extensive database of DNA samples from black cockatoo specimens, living and dead. The database is being analysed to answer a series of questions.

DNA markers specific for white-tailed black cockatoos have been developed with the following aims:

1. To develop an understanding into the evolutionary relationships of Australian cockatoos, *ie.* the cockatoo family tree. Features of the gene sequences can be used to determine the relative positions of the Carnaby's (*Calyptorhynchus latirostris*) and Baudin's (*C. baudinii*) black cockatoos along the evolution continuum.
2. To genetically examine the relationship between the two endangered white-tailed black cockatoo species endemic to the southwest of WA, *ie.* how closely related are they?
3. To gain an understanding of the underlying "genetic health", *ie.* are they becoming inbred or can they sustain a healthy future as a breeding population? Also, genetic studies can be used to describe their population structure and to model the movements of Carnaby's Cockatoos as habitat changes and modifications put increasing pressure on this species. The significant decline in population which this species is undergoing provides a strong imperative to do this research.
4. To measure the genetic effective population size and using historical museum specimens, prior to population

declines, compare 'present day' levels of genetic health with historical populations to establish the extent of any genetic bottlenecks and inbreeding. Genetic effective population size refers to how much genetic diversity is required to keep the population healthy.

5. To examine pair-bond and nest site fidelity. This will reveal how important actual nesting hollows are. They are formed in trees which are between 100 and 200 years old.
6. To assist wildlife enforcement agencies with the development of DNA profiling tools and databases. This knowledge is used in the prosecution of illegal wildlife activity.

As Baudin's and Carnaby's cockatoos face increasing pressures from habitat modification, climate change, invasive species and poachers, DNA profiling becomes a vital tool in understanding the biology of the species.

Understanding the biology of black cockatoos also contributes to the development of scientifically sound management responses to their population decline.

Several peer-reviewed papers detailing this research have been submitted to scientific journals and will likely be published in 2011-2012. Refer to the website for more information.

Website for Murdoch Wildlife Forensics researchers

<http://www.wildlife forensics.com.au/>

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LANDCARE SJ INC: ENGAGING THE COMMUNITY FOR BLACK COCKATOO RECOVERY.

Francis Smit

Landcare SJ is an incorporated not-for-profit community organisation managed by volunteers and staffed by part-time employees. It had been operating in the Shire of Serpentine-Jarrahdale and the North Murray districts for a few years before its incorporation in 2002, with a focus on environmental projects, in one of the fastest urban growth areas in Australia.

Landcare SJ continues working with the community in reversing land degradation, promoting best land management practices, conserving and restoring native flora and fauna habitat, and improving water quality in river, drain and wetland systems.

In developing ideas for future revenue streams after its incorporation, two enterprises were determined as having great potential – timber salvage and recycling waste polypipe from mine sites for culvert and fencing materials. Plans were made to salvage and mill timber from trees being knocked over for the increasing number of developments in the area, and BHP Billiton's Leinster mine site was identified as a supplier of pipe for recycling. The pipe supplied, however, was extremely variable in size, both in the pipe diameter and pipe wall thickness. A number of uses were trialled.

Around this time the Board and Management of Landcare SJ identified the need for a program involving a broader cross-section of the community.

At the same time, the Western Australian Museum and Water Corporation were involved in the Cockatoo Care Project. Landcare SJ linked into to this initiative, and the "cockatube" was born. The concept and design for the cockatube - an artificial cockatoo nest box, made from the larger diameter recycled pipe was created and developed by Alan Elliott, an active environmentalist, Landcare SJ volunteer and Board Member.

Initial funding was sought from Lotterywest in 2003 to build and install thirty nest boxes within the Shire. The project included engaging local school children with an educational component and poster design competition –

which was made into an interpretive sign display at Serpentine National Park. The nest boxes were constructed and installed at four local schools, in Shire reserves, on private property and on Crown land.

The cockatube design has evolved through a number of improvements, particularly aimed at their functionality and durability, as well as OH&S factors. These improvements included changes to the base, the internal ladder, sacrificial timber posts and mounting systems - see photo on page 38. Currently, we are considering a modification to further deter feral European honey bees from colonising the hollows.

Since 2003, Landcare SJ has produced approximately three hundred nest boxes for installation along the Darling Scarp, and through the wheatbelt, Great Southern, metropolitan and Peel-Harvey regions. We have supplied government agencies, individuals, environmental groups, schools, private business and corporations. Construction of the nest boxes is completed by Landcare SJ and associated community groups. We continue to aim at involving particularly our local community, but have also assisted others with materials and advice to construct nest boxes for their own projects.

Our most recent installation of thirty nest boxes within the Shire of Serpentine-Jarrahdale was made possible through funding from the WALGA South West Biodiversity Project and the Department of Environment and Conservation. These nest boxes were mostly located on private property so that residents could assist with an ongoing monitoring program. Our aim is to continue to engage the community for Black Cockatoo Recovery.

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MANAGING A UNIVERSITY CAMPUS FOR BLACK COCKATOO CONSERVATION

Caroline Minton, Murdoch University

Sustainability is a core value of Murdoch University, which is reflected in the university's commitment to biodiversity conservation. The 226 ha Murdoch campus has numerous areas of remnant vegetation and two natural wetlands that provide several habitat types, including Banksia and Eucalypt woodlands, a lake and paperbark swamp, a tuart grove, and several stands of remnant pines. These habitats support a rich assemblage of flora and fauna, including birds of prey, reptiles (including the long-necked tortoise), quenda and black cockatoos.

Biodiversity efforts at the campus have so far focused on identifying, protecting and restoring habitat for resident and visiting Carnaby's Cockatoos (an endangered species), in addition to the resident population of quenda (a Priority species). However, focus has been expanded in 2010 to include a population of Forest Red-tailed Black Cockatoos (a threatened species), which has also taken up residence at the campus.

Carnaby's Cockatoos on Campus

In 2006, development at the Murdoch campus and future intensified development of the area as a designated activity centre highlighted the need for better knowledge and protection of remaining Carnaby's Cockatoo habitat on campus. In response, autumn roost surveys and opportunistic sightings were conducted across campus over three consecutive years between 2007–2009. The results showed that a population of 30-50 Carnaby's Cockatoo is present at the campus throughout the year, whilst numbers generally swell to 200-500 in summer and early autumn¹.

Carnaby's Cockatoo roosting patterns have changed over time, however, with an increase in the number of birds roosting on campus and the duration of time that they remain (refer to Figure 1). It should be noted that surveys were conducted by volunteers, resulting in some missing data from key roost sites, and potential confusion between black cockatoos and ravens.

Carnaby's Cockatoo flocks roost predominantly in the pines and tuarts near student village, and occasionally in the white gums around the amphitheatre, childcare centre and adjacent car park and in a couple of central stands of pines. Various large stands of mature pines as well as native and introduced eucalypts throughout the campus are used for roosting sites, with use varying with the weather, time of year, and number of birds present.

Numerous feeding sites and individual food trees were noted across the campus, including the Banksia Woodland and Banksia Court, and virtually all pine trees and large marris. The numerous pine trees throughout the campus provide a critical and ready supply of food for the birds during the summer months, whilst banksias and other proteaceous plants and eucalypts such as marri in and around the campus, are an important food source at various times throughout the year.

The survey and sighting results were used to select various vegetation reserves across campus for long-term protection and management, including key roosting and feeding habitats as well as biodiversity corridors to connect various sites (i.e. for flight paths). These areas have been protected within the Murdoch University's Master Plan, and are shown in Figure 2.

On 7th April 2010 a survey of past and potential roost sites on campus was conducted as part of the Department of Environment and Conservation's 'Great Cocky Count'.

The survey results supported observations that numbers of Carnaby's Cockatoo roosting on campus had swelled significantly following destruction of off-campus roost sites in the severe storm on 22nd March 2010. Although some double-counting may have occurred, combined survey results estimate approximately 1,100 Carnaby's Cockatoo roosted on campus across 9 roost areas (refer to Table 1). These included 3 previously unconfirmed roost areas: car parks 2 and 4, and the pines East of student village.

Forest Red-tailed Black Cockatoos on Campus

Forest Red-tailed Black Cockatoos (FRTBCs) have been seen infrequently over recent years at the Murdoch campus and in surrounding suburbs within the City of Melville, in small flocks. In 2010, however, this species has been seen daily on campus in increasingly large numbers from 3 to about 30 individuals (including juveniles) between April and December. During this time there were many regular sightings of FRTBCs inspecting the nest box adjacent to the amphitheatre, and some reports of FRTBCs seen with Carnaby's Cockatoo flocks.

FRTBCs have been seen day-roosting on hot days in flocks of 3-9 in large white gums south of the Physical Sciences building and the Sports Centre. An opportunistic roost sighting on 26th November showed in excess of 60 FRTBCs roosting overnight on campus at two sites: in white gums near the Veterinary Hospital and car park 9, and in large white gums near the Mail Room. Opportunistic sightings have shown that flocks are feeding on many different trees throughout the campus. These results were confirmed by a thorough black cockatoo food survey using feeding residues, as shown below.

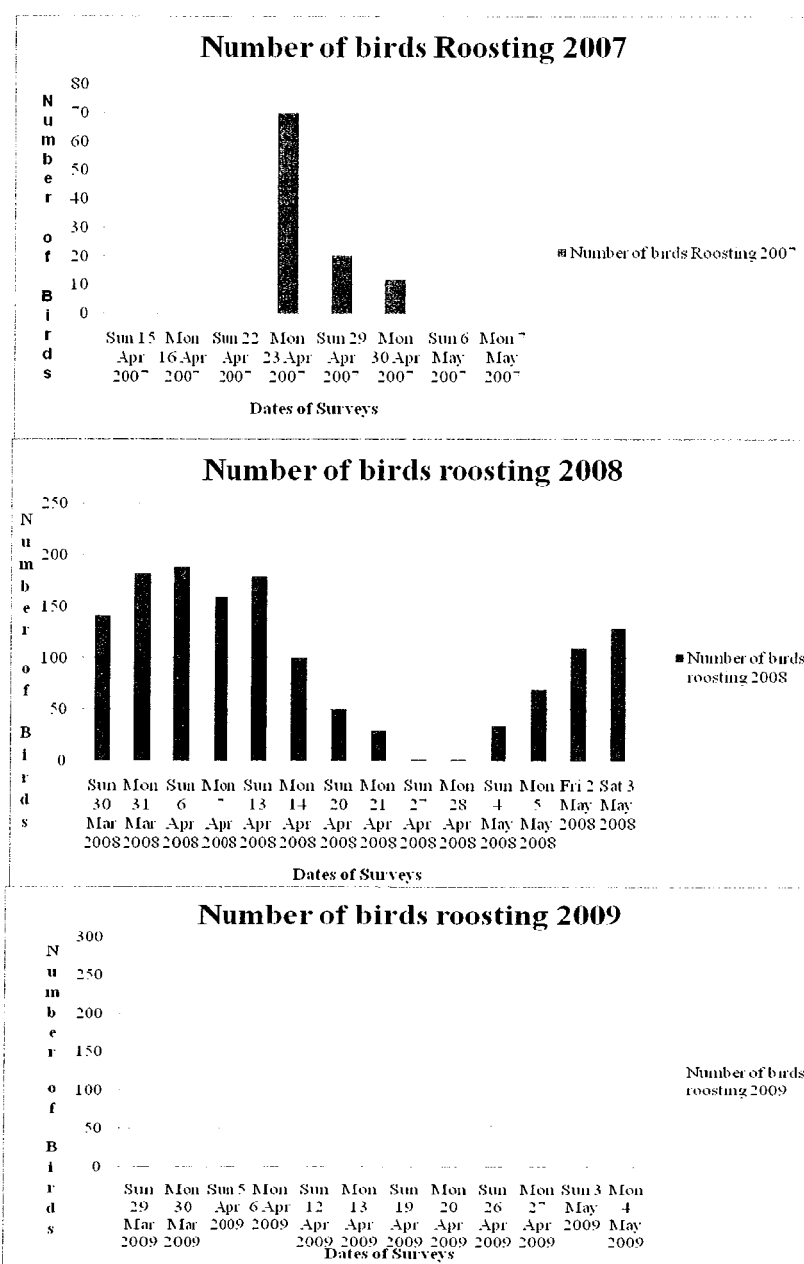


Figure 1: Carnaby's Cockatoo Roost Survey Results, 2007–2009

Endangered Black Cockatoos in Western Australia

Table 1: Great Cocky Count Roost Survey at Murdoch Campus (April 7th 2010)

Location	Main Tree type	# Roosting APR 7th	# Roosting MAY 8th	# Roosting JUN 20th	# Roosting JUL 10th	# Roosting AUG 15th
Student Village Pines	Pine	108		0		0
Tuart Grove	Marri & Tuart	355	110	17	0	
Car Park 5/Amphitheatre	Pine & Eucalypt	180			0	
Childcare Centre	Eucalypt	5	26	0	0	
Car Park 4 West	Eucalypt	68				
Car Park 4 East	Eucalypt	162	40		0	0
Car park 3	Eucalypt	0			0	0
Car Park 2 E	Eucalypt	40-55		0		
Car Park 2 W	Gum trees	60				0
St Street Verge	Eucalypt	66	0		0	0
Lower Bush Court	Pine				0	0
North of Gym	Eucalypts	0				0
Education & Humanities	White gums	1		0		
Pines E of Student Village	Pine	17		0		2
Curator's compound	White gums	0	0	0		
Woody Pear Reserve	Pine	0			0	0
Somerville Pines Reserve	Pine	0			0	0
Mailroom	White gums	0				
TOTALS		1022	176	17	0	2

NB Blank boxes indicate missing data.

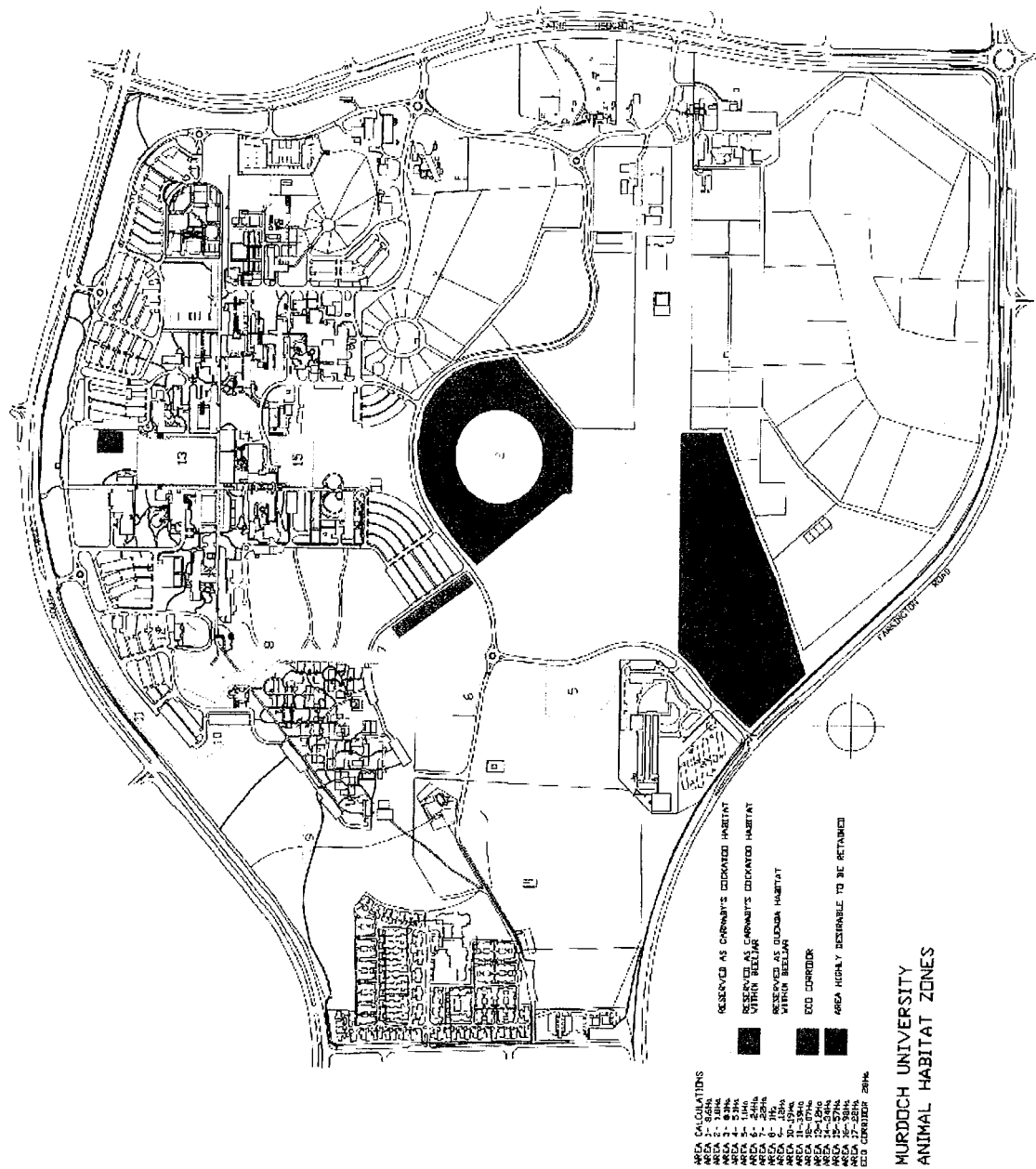


Figure 2: Habitat Conservation Reserves at Murdoch University's Murdoch Campus

Black Cockatoo Feed Survey of Campus

A survey of feeding residues from black cockatoos was conducted across campus by students in October 2010 (refer to Table 2). The results showed that Carnaby's Cockatoos are feeding on pine trees, as well as jarrah (*Eucalyptus marginata*), Rottneet Island Pine (*Callitris preissii*) and the non-native Rosewood (*Tipuana tipu*) trees. FRTBC feed residue was also found for marri (*Eucalyptus calophylla*) and jarrah, as well as Silver Princess (*Eucalyptus caesia*), Red-Capped Gum (*Eucalyptus erythrocorys*), Bushy Yate (*Eucalyptus lehmannii*) and the introduced Cape Lilac (*Melia azedarach*). These results were consistent with observational surveys of both Carnaby's and FRTBC feeding behaviour, although FRTBCs have also been seen feeding on Rosewood (*Eucalyptus grandis*) near the Chancellery building on several occasions.

Comparison of the number of sample plots per habitat type with black cockatoo feeding residues showed that Carnaby's Cockatoos were feeding extensively on pine trees across campus, with 93% of pine tree plots surveyed having been used as a food source (Table 3). The eucalypt woodland plots were also heavily used by both species, with 75% of plots utilised for food, whilst food trees throughout the built part of the campus were also well-used (54%), proving the worth of retaining *all* food trees. Only 9% of plots within the Banksia Woodland had food residues, and these were pine cones that had been dropped from elsewhere. Use of the banksia woodlands was not able to be effectively surveyed, however, as banksia residues are known to decay rapidly, and were thus considered unsuitable food residue sources. As Carnaby's Cockatoos have been seen feeding regularly in the banksia woodland, the survey results do not accurately reflect the true food value and use of this area.

Black Cockatoo Management Plan

In 2010 the Black Cockatoo Management Plan, developed previously for Carnaby's Cockatoos only, has been modified to also include management actions for FRTBCs.

The constant presence of FRTBCs at the Murdoch campus throughout 2010, the possibility that they will breed here, and their

status as a threatened species, justify incorporating their management requirements into the action plan.

Inclusion of suitable food plants in reserves and landscaping is one of a number of key management actions added for FRTBC.

The Black Cockatoo Management Plan is intended to align with, and support, the Recovery Plans for both Carnaby's and FRTBCs, as well as other conservation efforts for each species, and to ensure Murdoch University's compliance with relevant legislation.

The management plan's overall objectives are:

To protect and enhance suitable roost, food, nest and flight habitats within the South Street campus to ensure a viable population of Carnaby's Black Cockatoos remains at, and continues to migrate to, the campus.

To support the Carnaby's and Forest Red-tailed Black-Cockatoo Recovery Plans and other associated conservation and research programs.

To protect and enhance suitable roost, food, nest and flight habitats within the South Street campus to encourage the development of a viable population of Forest Red-tailed Black Cockatoos at the campus.

Ongoing identification, protection, enhancement and management of critical current and future black cockatoo habitat sites are key components of the Management Plan, including vegetation used as flight paths connecting habitat areas within and surrounding the South Street campus.

Results of the on-campus surveys, as well as research by other organisations, have been used in the plan's development.

Key management actions for black cockatoo conservation on campus include:

Habitat identification and ongoing monitoring

- Ongoing monitoring of roosting and feeding across campus.

Vegetation protection

- Multiple conservation areas reserved across the campus and incorporated into the University Master Plan for long-term black cockatoo habitat (refer to Figure 2).
- Fencing, signage and weeding of key reserves to prevent them from degradation and to raise their conservation profile.
- Careful management of European House Borer risk through pine dead wooding and pine pallet prohibition.

Habitat enhancement

- Vegetation enhancement of the tuart grove, woody pear and other key roosting areas.
- Re-vegetation of a 100m-wide wildlife corridor to connect the Banksia Woodland and Chelodina Wetland reserves, concentrating on black cockatoo food and nest-tree species.
- Habitat requirements included in Landscape Notes for Consultants, including banksias and feed trees incorporated into landscaped areas and road reserves where possible.
- 6 nest tubes installed in 2 reserves. (Suspected FRTBC nesting in one).

Awareness raising

- Inductions for staff and students include black cockatoo appreciation and protection.
- Involvement of staff, students and community in surveys and tree planting.

Table 2: Black Cockatoo Food Residue Survey at Murdoch Campus (October 2010) Food Trees Used by Carnaby's and Forest Red-tailed Black cockatoos

PLANT SPECIES	CARNABY'S	RED-TAIL
Native		
Marri	Y	Y
Jarra	Y	Y
Silver Princess		Y
Rottnest Island Pine	Y	
Red-Capped Gum		Y
Bushy Yate		Y
Exotic		
Cape Lilac		Y
Maritime Pine	Y	
Rosewood	Y	
TOTAL FOOD SOURCE	5	6

Source: K. Boxall²

Table 3: Black Cockatoo Food Residue Survey Sample Plots with Feeding Residues Per Habitat Type

Habitat Type	Proportion of Sample Plots with Feeding Residues
Pine Plantation	93%
Eucalypt Woodland	75%
Built Environment	54%
Banksia Woodland	9%*

*Banksia cones were not used as a feeding residue; therefore results are unlikely to reflect the true feeding use of these plots

Key Challenges and Future Directions

Many of the Carnaby's Cockatoo roost and feeding sites on campus are remnant pines under threat of infestation by the European House Borer (EHB), which could be clear felled as a requirement under the Agriculture and Related Resources Protection (European House Borer) Regulations if they were to become infested.

The Carnaby's and FRTBC roost sites in white gums are similarly under threat of removal, as they are Eastern States gums that pose a potential safety risk to campus occupants from dropping limbs. In addition, continued development at the Murdoch campus and future intensified development of the Eastern precinct as a designated activity centre will place added pressure on remaining habitat on campus outside reserve areas.

The on-campus food sources have become even more important for retention and protection since ≈35ha of high quality Banksia heathland was cleared in late 2008 for the future Fiona Stanley Hospital, and other nearby food sources and pine plantations continue to be cleared or threatened (e.g. for extensions to the Jandakot airport; an EHB infestation at the Piney Lakes Carnaby's roost site). The new presence of FRTBCs on campus, and the significant overlap in preferred food trees with Carnaby's Cockatoos, also places significant added pressure on remaining food sources on and near campus.

Analysis of existing on-campus vegetation, in particular within reserved areas, is required to

ensure sufficient habitat and food reserves are maintained to support the resident and migrant Carnaby's and FRTBC populations into the future. A targeted FRTBC roost survey is also required to determine exact numbers of FRTBC present on campus, whether their key habitats on campus are protected, and whether there are additional roost sites off campus that also require protection.

It is imperative that other stakeholders in the area, such as the Cities of Melville and Cockburn, the St John of God and Fiona Stanley Hospitals, and the Challenger TAFE, also implement effective black cockatoo habitat protection and enhancement measures. Murdoch University is unlikely to be able to sustain the Carnaby's and FRTBC populations in the area without added support and habitat resources within surrounding landholdings. Conservation of these endangered species is *everyone's* responsibility.

References

- 1 Neil Goldsborough, 2009 (unpublished). A Population Survey of Carnaby's Cockatoo, *Calyptorhynchus latirostris*, at Murdoch University Western Australia.
- 2 Kelly Boxall, 2010 (unpublished). Feeding Habitat Use of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on Murdoch University Campus – details and implications for management.

Caroline Minton, Environmental Program Manager



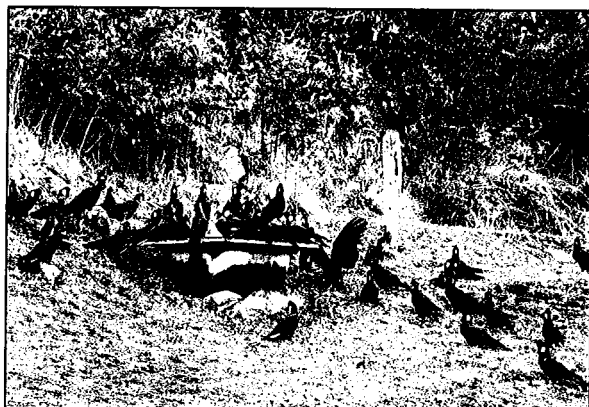
▲ Male Carnaby's Cockatoo in flight



◀ Female Baudin's Cockatoo feeding juvenile



▲ Female Baudin's Cockatoo in flight –
note long, narrow bill



◀ Importance of watering points for Baudin's
Cockatoo



▲ Male Carnaby's Cockatoo displaying
to a female

Carnaby's Cockatoo chick –
note short, wide bill ▶



▲ Female Carnaby's Cockatoo at nest in
Wandoo



SUMMARY AND CALL TO ACTION

John Bailey, Murdoch University

Rob Greenwood:

John has the unenviable task of wrapping up the whole day, so thanks John.

John Bailey:

And it is indeed an unenviable task after such a range of excellent papers for the whole of today.

I'd like to start with an anecdote that I need to update. The anecdote that I have often started these sorts of sessions with is when I arrived in Australia in 1970 I was stunned by three things. I was stunned by the fact that houses were all short, they only had one storey, so they were non-grown up houses. The streets were way too wide and there were parrots in the trees. The parrots in the trees were specifically Ringnecks at the time and I was stunned for many years that you could walk out of your front door and see a parrot. Three years ago the Forest Red-tails arrived in my street. There were only two, two weeks ago there were about fifty. That's much more stunning than a Ringneck. And over those thirty or forty years I've certainly got to love this country way more than that tiny place in the northern hemisphere called England. I've definitely got the job of not just summarising the papers but it says... "call for action". Which will be a little bit challenging and I will probably attempt to be a little bit provocative, because that's the way I do things.

Let's start by thinking about what Ron [Johnstone] and Geoff [Barrett] said this morning and then Vicki [Stokes] a little bit later on and the message I take from their presentations is that while we are gathering a fairly good understanding about the needs of black cockatoos we've got a long way to go but in particular we need an understanding of the detailed requirements of these species. We need to understand where the critical habitat is both in terms of roosting and feeding. We've heard also that their movements over the course of the year are changing. I've certainly been worried myself in that in my neighbourhood I see very few Carnaby's now even though I live near the Collier Pine

plantation. But as you have just heard I see lots of Forest Red-tails these days. And one of the reasons why I was happy to come along today was to find out what was happening in my neighbourhood. Why have the Carnaby's disappeared? Why have the Forest Red-tails appeared? I may have learnt an answer to the second, we have Cape Lilacs in the street. So they've found our Cape Lilacs and they were certainly there a few weeks ago, stripping just about every growing tip from that particular tree that was just down the road from my place. We have also heard of the importance of understanding those large scale movement patterns. We have heard of the importance of avoiding further clearing, restoring already cleared land to carry habitat and focussing on other cleared land for further development rather than clearing new bush.

The first slightly provocative statement is beware offsets! Really beware offsets. For a while I was a bit of a convert. For a while I was a convert because I thought that what offsets could deliver was more national park, more nature reserve, more areas protected in perpetuity. That is not what I have seen. It's possible to get an agreement to reserve land for nature conservation, but to see that agreement implemented is very hard to see. So beware offsets.

We have heard from Kristina [Huelin] this morning and Margaret [Owen] as well talking about her own work and work of Paddy [Berry] and then Cheryl [Gole] this afternoon about the importance of community science. I think that's something where we have seen the pendulum swing. When Murdoch University was first formed we actually had courses in community science. We taught community science as a subject. You could study and take out a major in community science. Then it became a little bit ho-hum. It had the ring of being a little bit 'hippie' for a while. But I think it's come back. I think that we are recognising now that the community can do real science. There are people like Paddy, whose name I hadn't heard of before today, who has a very long data set in terms of the Hollywood

Hospital. I have heard of others who have been doing bird surveys along a single track every day for 20 years. There is a lot of community data out there and I think one of the things that the professional science community needs to do is to recognise and embrace the value of that community science.

I'm sure we were all entertained by Leighton [de Barros] talking about the filming that he has been doing with respect to Carnaby's. So my next suggestion is that once we know when that film is going to be broadcast we collectively need to be ready. We need to be ready because there will be a surge of interest that night. There will be a surge of interest the following day. That is something that those NGO's and professional organisations concerned with black cockatoo conservation should prepare for so that we can actually harness the interest in black cockatoo conservation that will emerge after the screening of that film.

We have heard about education and what education can do in terms of encouraging people to put up artificial nest hollows. I think we also need to make sure that we can start early enough with our primary school kids and secondary school kids. One of the concerns that I have with development of the national curriculum for primary schools and secondary schools is that the "back to basics" rhetoric can also be a "let's forget about all those important steps we've taken in terms of educating children to care and educating children to take steps to produce a better world". I think we must make sure as educators and even as parents ourselves to make sure, that we don't lose all of those good ideas from the eighties and the nineties.

David [Mitchell] gave a brief review of the problems with policy and legislation and there are indeed serious problems with policy and legislation. Environmental Impact Assessment will never be enough. Environmental Impact Assessment can only deal with the large scale projects. It will not deal with small scale developments and it will not deal with past poorly-designed development. We have seen the problem with land use planning. Many years ago the Environmental Protection Authority recommended against developing

Underwood Avenue. That seems to have now changed. So land use planning alone is not sufficient.

The urgent need in terms of legislation is to follow the Commonwealth's lead and produce some serious, mature biodiversity conservation legislation. The Act that we currently suffer under, and it is an Act that we have to suffer under, because it does very little else other than make us suffer, was last amended to any significant extent before some of you were born. Certainly it was last amended in 1976, only a few years after I arrived in Australia. It is seriously moribund. I was tempted to bring along a newly acquired soft toy. The Norwegian Blue from Monty Python fame. I hope some of you know about the Norwegian Blue from Monty Python fame. We should send the *Wildlife Conservation Act* the way of the Norwegian Blue. It should be no more, it should be replaced with decent legislation that can support what needs to be done. It needs to not just recognise threatened fauna and flora. Obviously that's important. It needs to recognise habitat requirements of that flora and fauna. Those messages we learnt two decades ago but no government in WA has heard that lesson. Governments of all persuasions over two decades have not heard that lesson.

We also need to try to put in place some sort of regional view of how we achieve biodiversity conservation. It is a cumulative thing, the loss of biodiversity. The conservation of biodiversity is also a cumulative thing. We need to look at it at a regional scale. We need to have in that legislation recovery plans given the force of law. We've heard about the black cockatoo recovery plans. We've heard about the large numbers of people who have been devoting lots of hours to the recovery of black cockatoos. Is it not a shame when others can ignore them? We need recovery plans to be binding we need them to be funded.

We also need to deal with, through legislation, the various threats that black cockatoos and biodiversity generally can face. It still surprises me that environmental protection and biodiversity conservation are at a major disadvantage when it comes to government policy and government legislation. If you look

at the breadth of legislation that affects natural resources you will see that environmental legislation has to take into account economic considerations. You cannot see economic legislation that has to take into account biodiversity considerations, other than indirectly through the environmental legislation itself. I think it is time that we had legislation in the State that not just mirrors the *Environment Protection and Biodiversity Conservation Act* but goes way beyond the EPBC Act and requires all decision makers public and private to act in a precautionary way when it comes to biodiversity conservation and environmental protection.

Underpinning all of that is of course the research and knowledge generation that we have heard about today and the knowledge dissemination that Murdoch University is proud to be part of as with the other universities given that some of them do need to follow the leader. We have heard about the requirements for nesting trees, for feeding sites and Nicole White's work on genetics. All of that is important in enabling us to prepare recovery plans that will actually do the job that we expect of them.

Quite a few years ago now, just before Steve Hopper became lost in part to WA when he took up the job of Director of the Royal Botanic Gardens at Kew, he gave a presentation at UWA looking at some of the causes behind the large plant biodiversity in south western Australia and he ended that talk with a quote that I still recall. That is that "we need to learn how to live in a biodiversity hot spot". We have not yet learned how to do that. In fact I think that what we wish to do is to learn how to live in a biodiversity hot spot until it ceases to be a hot spot. Remember that one of the reasons it's a hotspot is because the biodiversity is at risk. Wouldn't it be nice to cease to be a hotspot because we have now protected our biodiversity and enhanced it?

One of the questioners earlier on today asked the question "How do we change what we are to do?" Well I put forward a few suggestions and I am going to put forward a few more now. We understand that habitat is as important as species. But for many of us it's the iconic species that we dream about at night. It's the

iconic species that we look at in the foyer of a lecture theatre and Caroline Minton's heart goes "plop plop", when she looks at it, was it Caroline, was it you who made that comment? Someone made that comment, about the cockatoos up the back. So I think we can use cockatoos to pull together multiple people interested in the Swan Coastal Plain, interested in biodiversity conservation in forests in the wheatbelt. In the eastern states that approach has been tried and it works well to bring together different communities because they feel that they own, not just the species, they actually own, the individuals that comprise the species that move between the farms and the various habitats; that move into the forest and then on to the Swan Coastal Plain and eventually end up, for a while, in my front yard.

I suggest we follow the title of this symposium. We think of all three black cockatoos as one. They are "the black cockatoos". That becomes the message that we put out. The black cockatoos and their conservation unites various people in the vision that I have for the future. So we share a sense of ownership for all black cockatoos. They are not yours to put at risk by removing those trees from your property. They are yours to care for so that they will fly on to someone else's property. Recalling the tracking project that we learnt about today, that's tracking observations, what about tracking the care of those cockatoos, so you almost pass them on as children from yourself to the property down the road, and that we all take a share in conserving all of the habitats that they need over the year. So I think that's one suggestion. We think about some way of capturing the idea of black cockatoos as a force for change for them and for all other species. But that's not enough.

My experience over many decades is that we need to find some sacrificial lambs amongst ourselves, those are the people we ask to join government. Those are the people we ask to aim to be members of the EPA, to sit on advisory committees, to steer that delicate course between remaining true to their principles and achieving change more efficiently than we can do from outside government. I believe we need both. I have done both and I believe we need both. We need the noise from outside, we need the

research from outside, we need the independence from outside and inside. That's how you achieve change. Birds Australia has a very high reputation both outside of government and inside of government. So perhaps a role for Birds Australia if it's not already doing this, and, maybe it is, is to try to make sure that they have a seat around all of the tables that matter. A face to face conversation is worth a thousand letters or 10,000 postings on a web site. Get to know the people who need to make the decisions that affect black cockatoos.

We also need to ask questions of ourselves and get others to ask questions of themselves with respect to all that we do and all that we might do in the future. My next provocative comment is to suggest that it is time that we stopped native forest logging. It is time that we stopped native forest logging. We have a drying climate, be that climate change or otherwise, we clearly have a drying climate. We have changes to the way in which our cockatoo species spend their week and spend their months and spend their years. I don't know whether that is a response to stress or just one of these things that happens from time to time. I don't believe that we can take the risk of continuing native forest logging in the face of this sort of uncertainty.

The EPA in its report of a couple of months ago almost said we should stop logging in the eastern Jarrah forest. I think we should stop logging in the eastern Jarrah forest. I think we should stop logging in all of the Jarrah forest. At the very least we should identify the critical habitat for black cockatoos and for the other species that have critical habitat requirements as well and protect them in reserves or in some other way. I am convinced that if we do that there will be so little forest left that could be logged that it would become pointless to continue logging that forest. I genuinely believe that this is now achievable. The current Forest Management Plan that Jan Starr referred to earlier on today will need to be renewed by 2013. The preparatory work for that I suspect will start next year, the year after in earnest. The year after is an election year, now is the time to do it. We have three years and an election in the middle. The opportunity is there for the taking.

A greater challenge is I think with respect to clearing, particularly for urban development on the Swan Coastal Plain. I'm not as optimistic in this area as I am with respect to forest management. It's a much greater challenge because there are many more players involved. But a few ideas just to start. I'm not sure whether the Tasmanian Forest Agreement is a good one or not. I don't know enough about it to know if it is a good one or not. But it appears that the positive steps that were taken were taken in part by convincing shareholders of Gunns to change their thinking. That led to a new managing director, that led to a change of policy, that's one idea. Another well understood idea is the soft underbelly of managing directors has often been their daughters and sons and their grand daughters and grandsons. When they have to admit to what they have been doing around the breakfast table that's another face to face conversation that can be awkward.

Reference was made to whether Murdoch can lead by example for other universities. Maybe we can find some urban development companies that can lead by example for other companies. We could track down where all of the environmental science graduates have gone, and suggest that those who now work for Satterleys maybe, should achieve some sort of agreement that they will no longer put at risk black cockatoo habitat in their urban developments. So some of you could take up that particular challenge.

Cheryl [Gole] looked a teeny bit embarrassed but then went ahead anyhow when referring to the need to have politicians with balls. I hope that they don't all have balls because that would disturb the gender balance, but, nevertheless let's keep going. In some cases the face to face conversations and the arguments will be all that they need. We have seen a lot of data here. I think when you see the picture that Ron [Johnstone] gave at the beginning of the day of the three black cockatoos occupying this corner of Australia and how they move around, perhaps supporting each other, perhaps not. Right the way through to the last presentation when we are concerned, and Caroline [Minton] is concerned, that maybe the Carnaby's won't have any food left when they come back.

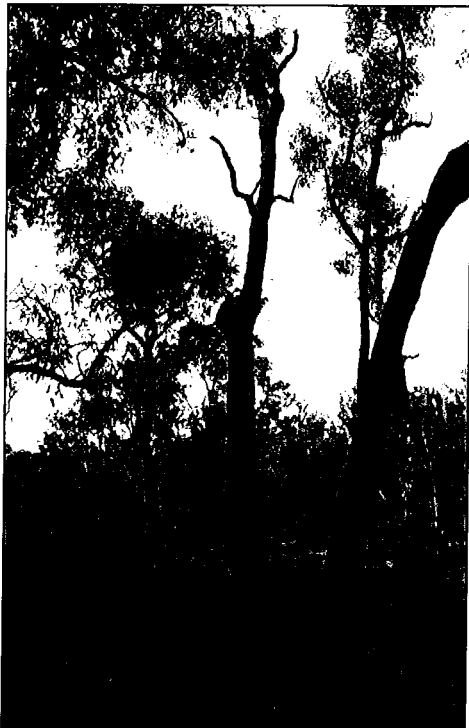
Those arguments can convince some. If they don't we change them, the politicians that is, not the arguments.

In federal politics we have just seen something very strange. We have seen green politicians elected, we have seen alliances broken and new alliances made. What we will now see is an overt attack on green politics from both sides of party politics. It has started, it will get worse, coming up to the next federal election it will be awful. So without being party political while at the same time being party political and I'm actually not party political, I'm not a member of the Greens Party. They may need our support an awful lot over the next few years to maintain their role in federal politics. Hopefully to maintain their role in multiple State jurisdictions as well so that they can at the very least be the conscience of the government in power.

That though won't be enough. It can never be enough to rely on government we have to rely

on each other as well and I'm encouraged by this lecture hall being well filled for the whole day on a Friday that indicates to me that there are a lot of people who are prepared to work together, and that's what we need to do. We need to work together to make sure that some people do sit around the right tables, other people do meet politicians face to face, that researchers don't have to scabble for funding all the time to do their research, that long term monitoring is something that will actually happen rather than occur for a few years and then fall into a heap. That's why days like today are so important and I have been very encouraged by this symposium. We need further symposia like these.

So I would like to close by congratulating the organisers in having such a symposium and I look forward to future symposia like this, thank you.

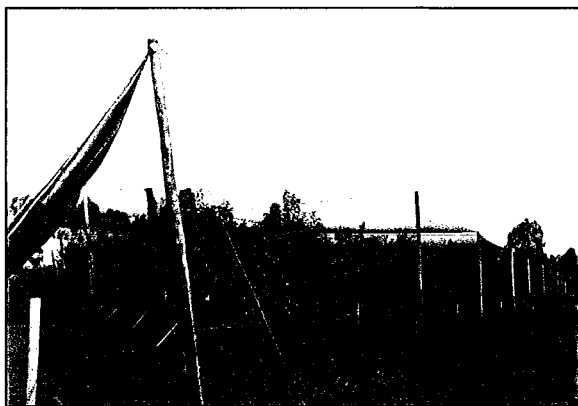


◀ Red-tailed Black Cockatoo nest tree (Nest 050), near Boulder Rock, August 2004

▼ Same tree in January 2005 after wildfire



Endangered Black Cockatoos in Western Australia



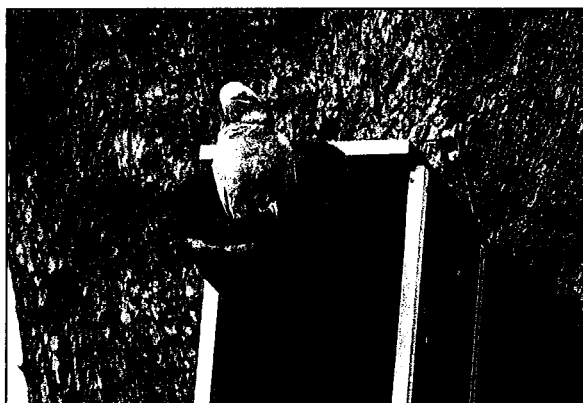
- ◀ Netting of orchards provides protection from pests including cockatoos



- ▲ A common cause for vehicle strikes is drinking at roadside puddles



- ◀ Feral European honey bees taking over nest hollows



- ▲ Competition for breeding hollows by super-abundant native species (Galahs & corellas)



- ▲ Use of a PVC 'Cockatube' to repair a damaged and sub-standard hollow



- ▲ Destruction of habitat in the loss of food and hollow-bearing trees

QUESTIONS AND ANSWERS

Please note that unfortunately no questions were recorded for Geoff Barrett or David Mitchell.

Ron Johnstone

Q1: What is being done about control of bees in the nesting hollows?

A: Starting in 2006 the Department of Environment and Conservation (DEC) has been working on the control of feral bees. There are trials underway in use of Fipronil to kill hives and once the results are out, this knowledge will be useful to landcare groups. The process of eradicating wild hives of European bees is being investigated.

Q2: What can be done under the EPBC Act to change the Regional Forest Agreement?

A: This is a question for Andrew Weavers at the Commonwealth Environment agency.

Q3: What about removal of pines and Banksia?

A: In the Museum we have been examining historical data. Reports from the 1970s show 2000–5000 birds roosting in pine plantations around Mount Lawley. Flocks of 6,000 were regularly seen in the Somerville and Collier plantations around where we are now.

Sixty year old pine plantations provided food and roosting areas for cockatoos and became a regular excellent food supply. They were planted in the 1920s. The impact of logging in the Jarrah forest and the removal of pines has devastated feeding grounds. Taking the pines out puts the pressure on the Banksia woodland. The impact of logging through our southern forests has been horrendous.

Q4: Do nasos have a permanent breeding area?

A: Some populations of naso [Forest Red-tailed Black Cockatoo] have a small home range and don't move far. The Serpentine area is crucial. We have all three species breeding there and in an area of 2–3 hectares there are 12 breeding pairs. We think drying summers have created pressure for birds to move great distances.

When you look at massive deaths of Tuart and Marri from canker and other losses around Yalgorup and elsewhere, we need targeted

surveys to find out where the birds are breeding. They often breed close together. The Museum has developed techniques and has identified sites as critical habitat. We need to continue that targeted work from Lancelin to Dunsborough so we can quickly preserve identified habitat areas. We need to treat remaining woodland as a precious resource.

Kristina Huelin

Q1: What proportion of the sightings were of feeding birds?

A: Most of the sightings were of flying birds.

Q2: How was the Cocky Count promoted?

A: Mainly the notice was placed in newspaper announcements; the University released a statement; at least 6 local papers covered it; 2 radio interviews happened; word of mouth was most cited; small community groups got the word out and family and friends forwarded emails.

Leighton De Barros

Q1: How do you cockatoo proof a camera?

A: Use 3 mm steel.

Q2: Did you find nests with twins?

A: Going back to look at nests, there were 4 or 5 sets of twins. In the area where we filmed there were lots of mortalities; predators ate them, they died. Once we found a massive python in the nest hollow, which had eaten the female cockatoo.

Cheryl Gole

Q1: Why choose proteaceous plant species for the trial?

A: In our observations in the wheatbelt, the Carnaby's were mostly eating plants in the Proteaceae family. And nurseries were not growing many plants from this family and we were trying to encourage property owners to grow a greater mix of plants.

(Editor's note: food plants in the Proteaceae family include Banksias, Grevilleas, Hakeas)

Q2: After the ten years of the project have you been able to quantify and measure success?

A: We have not done it in terms of counting the number of hectares planted or the number of kilometres of fence or the total number of volunteers. We have not yet demonstrated that we have protected black cockatoos in all of those areas where we worked.

Q3: What about the role of the Water Corporation?

A: The Water Corporation was a good sponsor and then dropped out. They were a strong supporter of the Museum and Cockatoo Care. I could not tell you what is currently happening. The history of corporate sponsorship shows that views shift periodically. It would help if we all wrote to the Water Corporation and said you used to do a fabulous job for the cockatoos. Please do it again.

Q4: What is the long-term aim for Birds Australia for the cockatoos?

A: We would like to see the cockatoos secure in both the breeding part of their range and in the non-breeding part of their range. It's difficult in both. The drying climate and the senescing woodlands make it more difficult than it was in some areas. The politics of urban development make it harder to retain what habitat we need. We would like to see the birds secure in their full range. To do that we need, am I allowed to say, politicians with balls.

Q5: We know of some significant roost sites in Jacoby Park; these have been used long-term as roost sites for Baudin's Cockatoos. The Water Corporation is planning to build a water treatment plant in that area.

A: Add the request to your letter to the Water Corporation that the water (treatment) plant be put elsewhere.

Margaret Owen

Q1: I understand UWA requires money from developing land and think the land should be traded so the Underwood Bushland can be protected.

A: We need the will of the state government. How difficult it is to fight for something for 11 years. We have put in lots of effort, trying everything.

Comment: (Max Hipkins) I have had long association with the Underwood Bushland site and UWA had no intentions of developing this site and then changed its mind. Compensating the university is not appropriate as UWA has not fulfilled the conditions for developing the land.

Q3: What about a private landowner buying the land from the university?

A: The university believes the land to be worth \$100 million or \$20 million per year over 5 years. It would be difficult to find a buyer at such a high price.

Q4: How did a Bush Forever site get used for development?

A: It was private land given to the University in 1904 and it was deemed to be party to a negotiated planning solution so all parties were to negotiate a solution to satisfy all parties.

Noongar people believe it is an important site. There is a pair of interlocking Jarrah trees. The Royal Perth Hospital bushland includes an aboriginal campsite and place of refuge.

Comment: (David Wake) This points to our need for a strategic approach. Fighting battle by battle does not get us very far. Twenty-five years ago we were founded and now we are surrounded by suburbs. We need to act now and act differently.

Vicky Stokes

Q1: What level of thinning of trees do you do?

A: Many of our stand densities of 2,500 stems are planted in the restoration and we thin down to 600–800 stems per hectare.

Q2: Why rehabilitate during summer? On what time length is that based?

A: Based on decades of operations for Dieback management; they landscape the pit so it becomes continuous with the unmined forest surrounding it. They replace two layers of soil, the layer above cap rock and the top layer, which contains the seed bank.

Machinery moving lots of soil would be logistically difficult in moist conditions. In moist conditions the risks of spreading Dieback are greater.

Q3: How many organisations do you work with and do you have long term relationships with other organisations?

A: We have long-term relationships with other organisations, such as Department of Environment and Conservation.

Our close working relationship with DEC is important as they regulate us and we have stringent completion requirements we must adhere to. DEC will often require we go back and replant areas if they are too open. Strong ties with the four universities help us understand how effective our rehabilitation is, and looking at specific species like black cockatoos contributes lots of funding to restoration work.

Q4: What's the average age of trees where you mine?

A: They have been quite heavily logged in the past. You struggle to find any large veteran stag trees. If you walk through unmined forest you see big stumps. Some of our 20-year old restoration does not look that different from unmined 100-year old regrowth forest.

One of the limits of our restoration is that we lack those habitats that take hundreds of years to develop, with downed wood and tree hollows, which is one reason we are wanting to trial artificial nest boxes.

Q5: Do you use non-local species in restoration?

A: You remember restoration with Eastern states species and contour ripping, practices which were discontinued before 1988. This was practiced due to concerns about Dieback and Jarrah susceptibility, but that policy changed as it was found that Dieback effects on Jarrah are quite patchy through the forest.

Q6: You have used the term restoration many times and have been mining for decades. What percentage of mined areas have been handed back to people of the State? How much are you expected to return back to the State of Western Australia?

A: We are expected to hand it all back. Most of the Jarrahdale mine site has already been handed back, except for areas which have not yet met completion criteria. The life of the mining operation in a location is usually 10 to

20 years (10 years of mining and restoration plus a few more years). We have recently handed back Del Park near Huntley after meeting completion criteria.

Nicole White

Q1: Can you use feathers for obtaining DNA?

A: Yes I predominately use feathers we pull from chicks.

Obtaining DNA depends on how long the feather has been sitting in the sun.

It's not impossible, but the yields of DNA are a lot lower.

Q2: Recently 3 dead Carnaby's Cockatoos were found in the Spearwood area so what is the best way to preserve them for the post mortem examination at the zoo?

A: Normally we say refrigerate the body as it is best for some toxicity tests that the tissues are not frozen.

Q3: Is there DNA on the outside of the egg? Do we get the mother's or the chick's DNA from the eggshell?

A: The mother's DNA comes from the matrix and hard exterior of the eggshell and we can extract it from the eggshell. The chick's DNA can be collected from the remnant blood material on the inside of the eggshell. Ants tend to get into the hollow and clean the eggshell very well before I get to it.

Francis Smit

Q1: Can you put a nest box next to a house?

A: At the top of the escarpment all 3 species are breeding; you are looking for places where they are breeding. If there is a hollow there they will probably use it. They nest next to roads and next to houses. Go to where they are breeding.

Q2: How do we allow for growth in the circumference of the tree?

A: We don't wrap chain at the bottom really tight. Recently working with the arborists they suggest trees will grow over the chains anyway.

Q3: What is the sacrificial timber used in the posts inside the nest box?

A: We're using Marri, Jarrah and some Tuart.

Q4: Are you selling these nest boxes to the public?

A: Yes we sell Cockatubes for \$375 each and delivery is negotiable. Installation requires a cherry picker as they must be hung above 8 metres, so to make it cost effective mostly it is best to install 6 to 10 of them in one day.

Q5: In what direction do you orient the nest box?

A: We try to orient the nest boxes in a northeast direction to regulate the temperature, but the thickness of the wood around it also affects the temperature.

Q6: Are they working?

A: We have sold and installed 300 nest boxes over the last 5 years. We have had some information back from organisations such as from Birds Australia. From all accounts there is a deal of success with the nest boxes.

Caroline Minton

Q1: Do you have support from the (Murdoch) University Board for conservation and can they be a role model?

A: We have had grant support through our campus Friends' Group and the university has been supportive. Weeding and fencing are expensive.

Quite a lot of land was set aside long term as native vegetation by the university as part of our master plan. We are advanced in this area as I attended a sustainability conference for universities and they all discussed moving forward with technologies but none of the others mentioned conserving biodiversity on their campus. Murdoch is leading in this.

Having that resource on campus is important for students, for researchers and for the community.

Comment: (Rob Greenwood) We ought to replace the term "remnant" with "biodiversity gem"; each small patch is important.

Q2: Would we expect Carnaby's to nest on the Swan Coastal Plain?

A: Yes, none are nesting yet on campus although elsewhere on the Swan Coastal Plain there are reports of nesting. Lots are roosting here, but we just have blind faith with nest boxes at this stage.

Q3: Did increased numbers of Carnaby's correlate with clearing of Jandakot Airport and Fiona Stanley Hospital clearing?

A: Those areas were important for feeding. Many areas were damaged in the hailstorm, and many roosts were lost in those weeks.

Note that they've been observed eating 100 Marri seeds per day, 600 Jarrah seeds per day and 2,000 Hakea seeds per day.

If anyone is looking for a research project we would like a student to examine how much food is available in our campus reserves. This would support our management plans.

Q4: Do you have any information on introduced plant species impacting on Carnaby's health and digestion?

A: (Ron Johnstone) The Museum staff has studied pine cones. Pine nuts can gum up digestion for the birds. The Munghlinup dead birds [January 2010] had lots of canola residue in their digestive system and this could have been a factor in their deaths during the heat spell.

A: (Caroline Minton) Horse troughs on campus are well used by Red-tails and Carnaby's Cockatoos – the water source attracts them.

