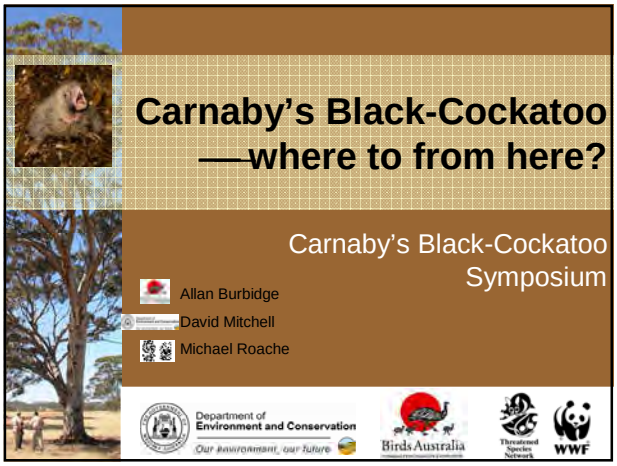
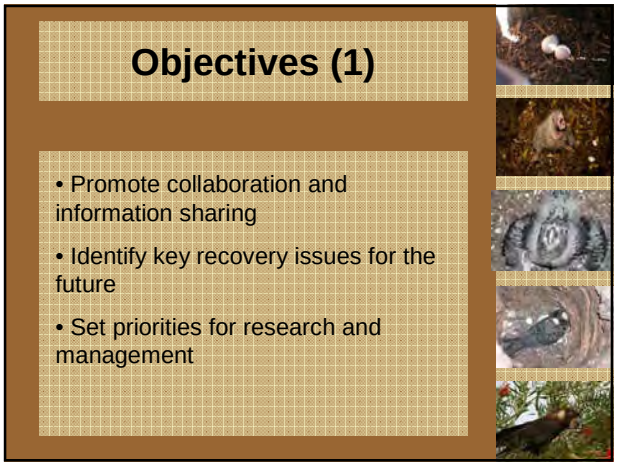
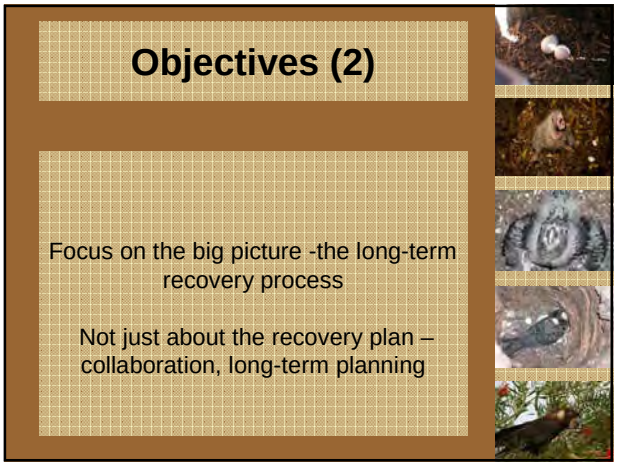
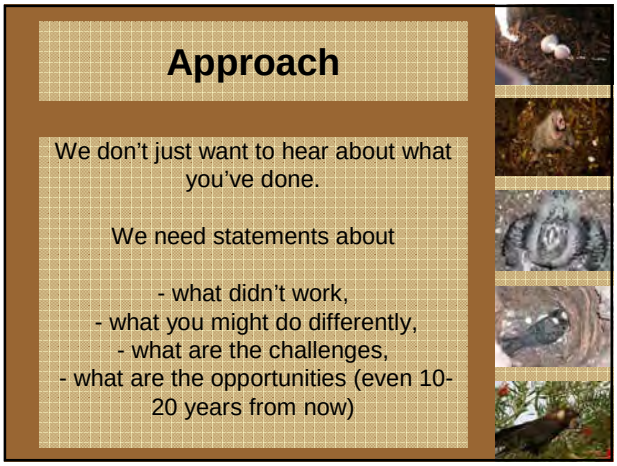
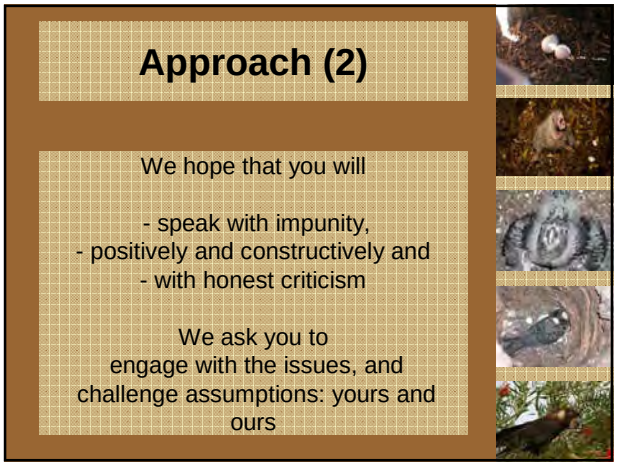

Carnaby's Black-Cockatoo —where to from here?
Carnaby's Black-Cockatoo Symposium
Allan Burbidge
David Mitchell
Michael Roache
Department of Environment and Conservation
Our environment, our future
Birds Australia
Threatened Species Network
WWF


Objectives (1)
• Promote collaboration and information sharing
• Identify key recovery issues for the future
• Set priorities for research and management


Objectives (2)
Focus on the big picture -the long-term recovery process
Not just about the recovery plan – collaboration, long-term planning


Structure
Symposium
– threat ranking,
– framework of recovery actions
Please add your thoughts – spoken or written
Workshop - prioritisation


Approach
We don't just want to hear about what you've done.
We need statements about
- what didn't work,
- what you might do differently,
- what are the challenges,
- what are the opportunities (even 10-20 years from now)


Approach (2)
We hope that you will
- speak with impunity,
- positively and constructively and
- with honest criticism
We ask you to
engage with the issues, and
challenge assumptions: yours and ours

Approach (3)

Make use of morning tea and lunch to

catch up on missed questions….
develop new contacts ……

Please forgive the logistics – challenge to organise for this many people

Outcomes

Clearer understanding of the issues and challenges ahead

Visionary ideas for sustainable recovery of the cockatoos

More collaborative partnerships between stakeholders

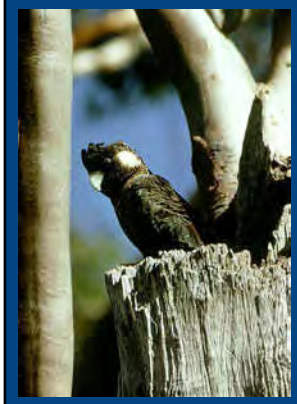
A strategic framework for the recovery of the species

By working together, we can achieve this

Carnaby's Black-Cockatoo Symposium

Allan Burbidge
David Mitchell
Michael Roache

Department of Environment and Conservation
Our environment, our future
Birds Australia
Threatened Species Network
WWF

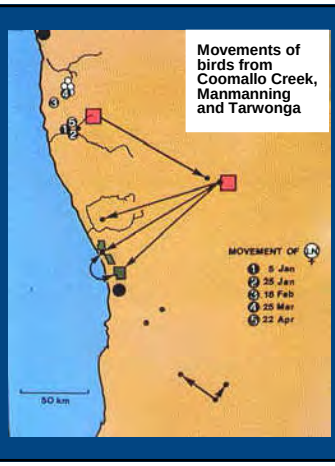


Carnaby's Black-Cockatoo

Marking and Movements

Denis Saunders

Patagial tagged birds at Manmanning

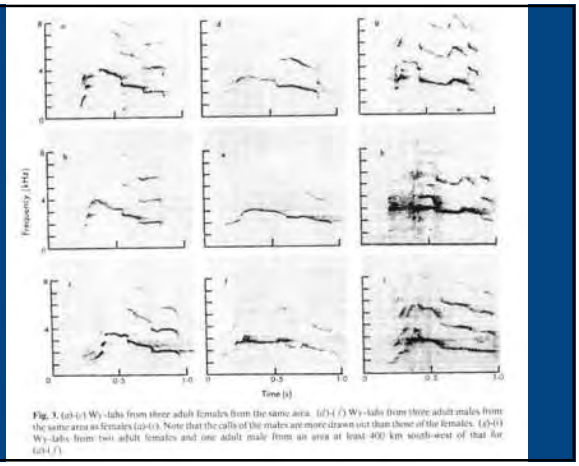


Observed rate of return to breeding area at Coomallo Creek for adult females

Patagial tagged females	59% (42-76%) N = 172
Banded females	100% N = 12

Observed rate of return of female fledglings breeding at Coomallo Creek

Patagial tagged female fledglings	1.3% N = 150
Banded female fledglings	12.8% N = 71



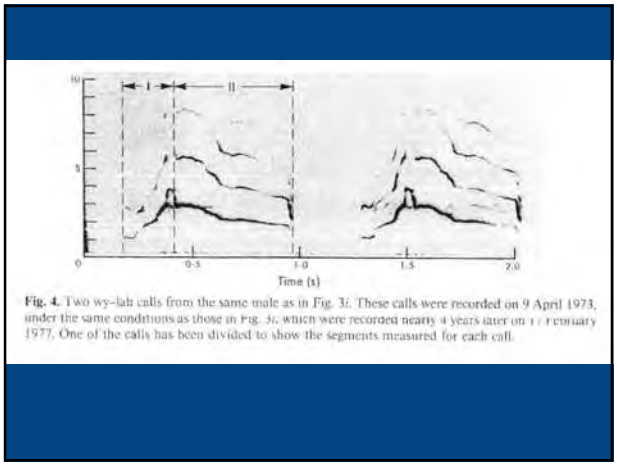
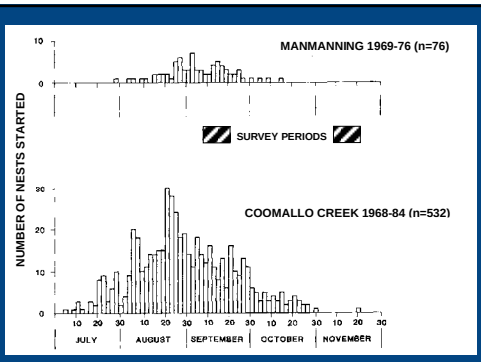
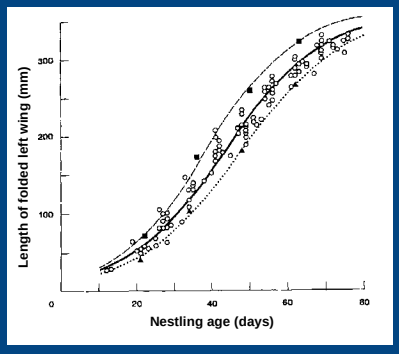


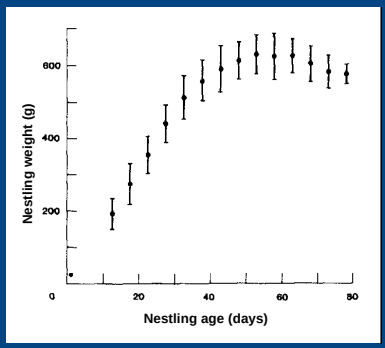
Fig. 4. Two wy-lah calls from the same male as in Fig. 3i. These calls were recorded on 9 April 1973, under the same conditions as those in Fig. 3i, which were recorded nearly 4 years later on 11 February 1977. One of the calls has been divided to show the segments measured for each call.



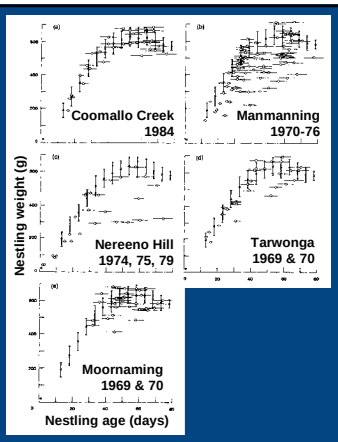
Breeding season for Carnaby's cockatoo at Manmanning and Coomallo Creek based on the dates of the first egg laid in each nest hollow for which laying date could be determined.



Growth of length of folded left wing of 21 nestlings of known age from Coomallo Creek, 1970-76



Growth rate of nestling weight for 246 nestlings at Coomallo Creek, 1970-76



Weights of nestlings compared with those of known-age nestlings at Coomallo Creek, 1970-76

Table 1. Observed rate of return to the breeding area of patagial tagged (*a*) and colour-banded (*b*) female Carnaby's cockatoos at Coomallo Creek, Western Australia

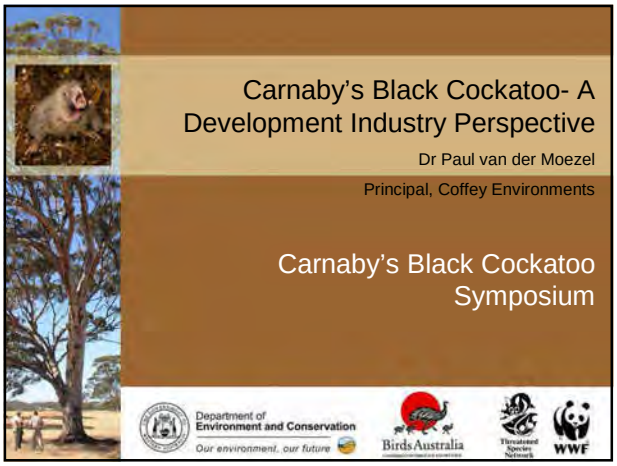
Data on patagial tagged birds from Saunders (1986). Observed annual rate of return to the breeding area 1971–86 of patagial-tagged birds (including second and subsequent years after tagging) was 61·9%.

	Patagial tagged						
	1971	1972	1973	1974	1975	1976	Total
No. tagged	23	43	37	38	19	12	172
No. seen 1 year later	13	18	22	29	14	5	101
% Return	57	42	59	76	74	42	59

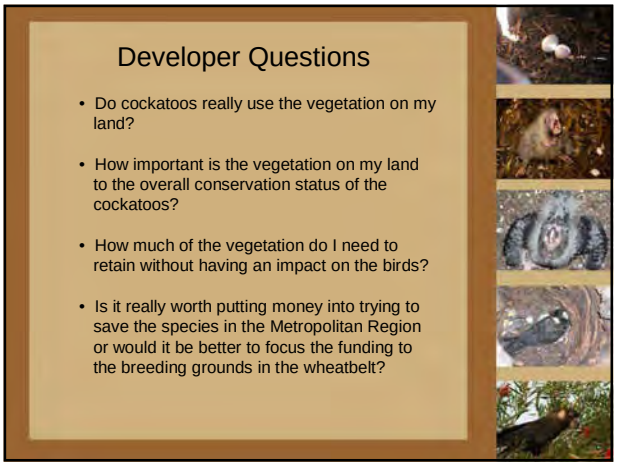
	Colour banded		
	1984	1985	Total
No. banded	4	8	12
No. seen 1 year later	4	8	12
% Return	100	100	100

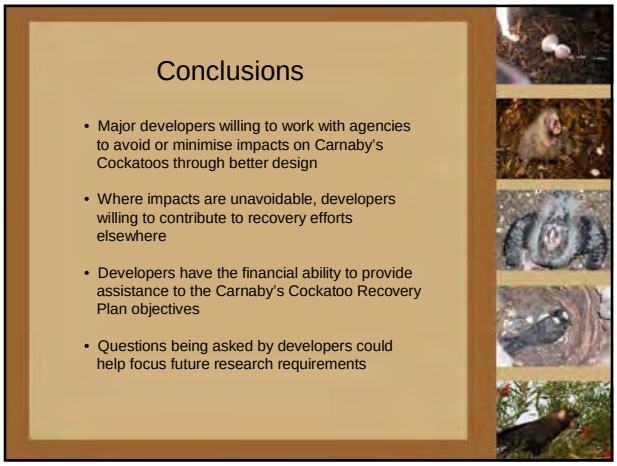
Table 2. Rate of return of female fledgling Carnaby's cockatoos returning to breed at Coomallo Creek 1969–82

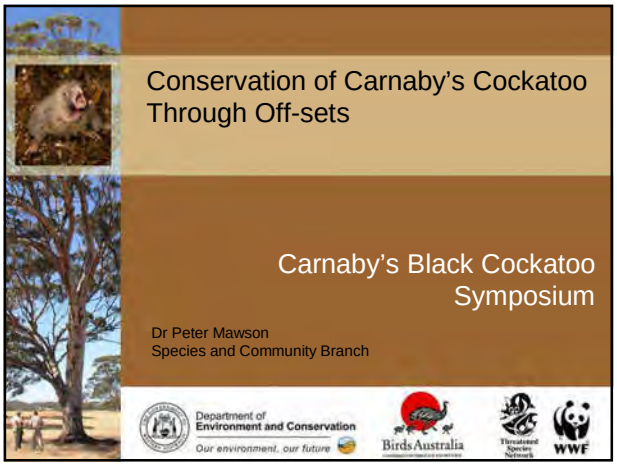
Year of fledging	Banded only		Tagged	
	Total fledglings (both sexes)	Number of females returning to breed	Total fledglings (both sexes)	Number of females returning to breed
1969	8	1	0	0
1970	25	1	0	0
1971	0	0	30	0
1972	0	0	47	0
1973	0	0	41	0
1974	0	0	65	1
1975	0	0	38	1
1976	0	0	48	0
1977	30	2	5	0
1978	26	2	0	0
1981	24	1	0	0
1982	28	2	0	0
Total	141	9	300	2


Carnaby's Black Cockatoo- A Development Industry Perspective
Dr Paul van der Moezel
Principal, Coffey Environments
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
Threatened Species Network
WWF


Impact of Carnaby's Cockatoos on Development (or vice versa?)
• Land zoned for development in Perth and Peel Region contains Carnaby's Cockatoo habitat
• Land development requires clearing
• Assessment of clearing on Carnaby's Cockatoos is part of the process for developers
• EPBC Act obligations


Developer Questions
• Do cockatoos really use the vegetation on my land?
• How important is the vegetation on my land to the overall conservation status of the cockatoos?
• How much of the vegetation do I need to retain without having an impact on the birds?
• Is it really worth putting money into trying to save the species in the Metropolitan Region or would it be better to focus the funding to the breeding grounds in the wheatbelt?


Conclusions
• Major developers willing to work with agencies to avoid or minimise impacts on Carnaby's Cockatoos through better design
• Where impacts are unavoidable, developers willing to contribute to recovery efforts elsewhere
• Developers have the financial ability to provide assistance to the Carnaby's Cockatoo Recovery Plan objectives
• Questions being asked by developers could help focus future research requirements



Offsets

Provided for through

- State EPA approval process (EPA Guidance Statement No. 19)
- Commonwealth EPBC approval process

Off-sets invariably result in a net loss of critical habitat, but can result in better protection of existing habitat.

Application of Offsets

•None through EPA process to date.
•Several through EPBC process

Offsets Can Include

•Purchase of land for inclusion in conservation estate
•Rehabilitation of degraded habitat
•Contribution towards targeted research to fill key knowledge gaps
•Contributions towards covenanting of key habitat

Purchase of Land

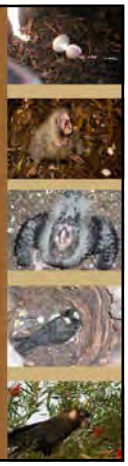
•Same land system, vegetation type?
•Proximity to affected site?
•Like for like in terms of size (or better)?
•What's on the market?
•Preventing price spiral and bidding 'wars'?

Rehabilitation

•Is it possible?
•Can it achieve the same diversity or only a sub-set?
•Like for like in terms of size (or better)?
•Who does the work?
•Who is responsible after the life of the original development activity?
•What happens if it fails?

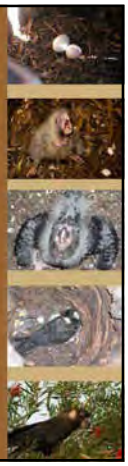
Research

- What constitutes key knowledge gaps?
- Who decides?
- Who does the research?
- What happens if it doesn't deliver any useful outcomes?
- How do you get best value for money?



Covenants

- Binding in perpetuity.
- Incur small costs to establish.
- Don't guarantee protection of habitat through neglect.
- Arise as a result of process that usually involves a net loss of habitat.
- Mean a third party is often responsible for on-going management after the life of a development.



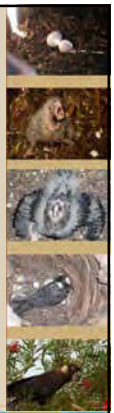
Carnaby's Black-Cockatoo and the EPBC Act

Tess Ward (Policy development)
Andrew Weavers (WA & SA Assessments)

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Protects Matters of "National Environmental Significance" (NES):

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- World Heritage properties
- National Heritage places, and
- nuclear actions



Carnaby's black-cockatoo

Carnaby's black-cockatoo is listed as Endangered under the EPBC Act

- listed due to:
  - population decline of at least 50% over the past 3 generations (or 45 years)
  - declines in the area of occupancy and quality of habitat.

The EPBC Act allows us to respond to these threats in a number of different and complementary ways.

- recovery plans
- policy statements
- strategic assessments, and
- case-by-case assessment.

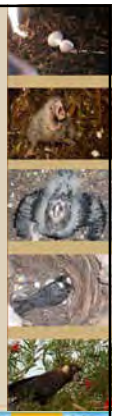
Recovery planning

- National recovery plans, prepared under the EPBC Act, set out the research and management actions necessary to support the long term recovery of threatened species and ecological communities.
- A recovery plan for Carnaby's black-cockatoo is being prepared by the WA Department of Environment and Conservation to be submitted for consideration for adoption under the EPBC Act.
- Commonwealth funding has been provided to support recovery of Carnaby's black-cockatoo. Activities to date include:
  - coordination of cross-regional recovery activities
  - purchase of land to secure important habitat
  - fencing of habitat threatened by domestic stock
  - restoration/revegetation of habitat
  - protection of nesting sites
  - population monitoring

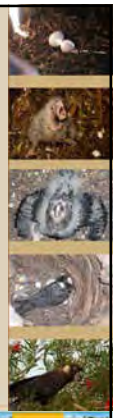
Policy statements

- Carnaby's Black-Cockatoo occurs in areas that are experiencing rapid growth and high development pressure
- EPBC Act Policy Statements aim to:
  - communicate the Department's expectations in relation to actions in/near cockatoo habitat
  - ensure a consistent, scientifically robust basis for decision making
  - have a strategic focus on conservation outcomes

1) Southern Swan Coastal Plain – due early 2009
2) Whole of range – due mid 2009



Strategic assessment



Advantages of a strategic assessment

- The Minister can approve actions, or a class of actions, under an endorsed policy, plan or program. Individual projects which are consistent with the endorsed policy, plan or program then do not need to be referred
- Provide greater certainty for the local community and developers over future development
- Address large-scale, complex actions as well as achieve better environmental outcomes and address cumulative impacts
- DEWHA is currently in the early stages of negotiating how strategic assessments can be integrated into WA planning and assessment processes so as to reduce administrative burden for proponents and all tiers of government, and achieve a better conservation outcome for the environment.

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

Assessment and Approvals

Vision - to support the persistence and recovery of threatened species

Need to protect the functioning of the landscape

Cumulative impacts addressed through significant impact thresholds that understand context, species, threats & needs

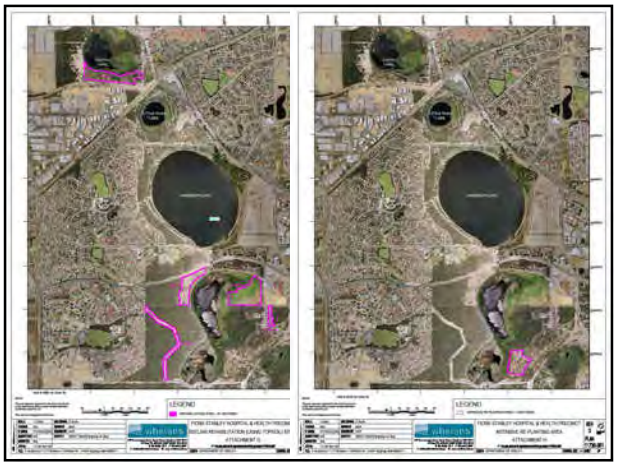
Projects should create more habitat than they clear

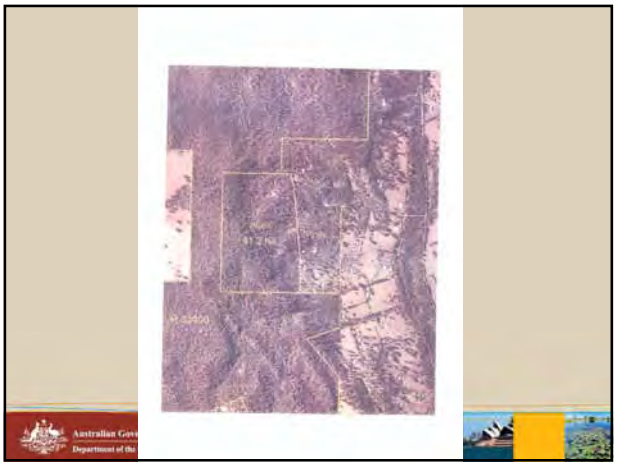
'Like for like' and 'in close proximity'

On-site mitigation in preference to distant offsets

Minister wants future projects affecting black cockatoos to achieve comparable outcomes to Fiona Stanley Hospital

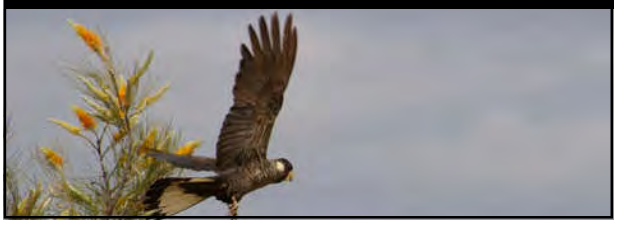
Australian Government
Department of the Environment, Water, Heritage and the Arts





Carnaby's Black-Cockatoo Recovery Project.

Raana Scott, southern region Project Officer



Carnaby's Black-Cockatoo Recovery Project overview

- Project history
- Community education
- Community capacity building
- Private landholder engagement- nesting sites
- Protecting habitat on private lands
- Nesting site identification

South Coast project history

- Project Officer started November 2006
- Initial focus on community awareness/capacity building
- 2007 nesting season focus to the west
- 2008 nesting season expansion to the east
- Artificial Hollow Trial
- West Tambellup TSN Grant

Nesting Sites

Site comparison

Site comparison

Opportunities

Community education

Flagship species

Solely dedicated to Carnaby's Black-Cockatoo

Foster partnerships between organisations

Data collection

Challenges

Limited resources

Knowledge gaps

Monitoring

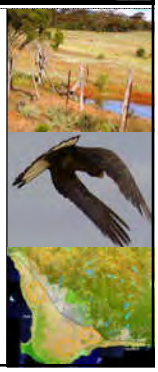
Negative perception in community

Funding rounds

Maintaining momentum

Area to cover

Revegetation/Covenants



Where to from here?

Caring for our Country Grant

Strategic planning

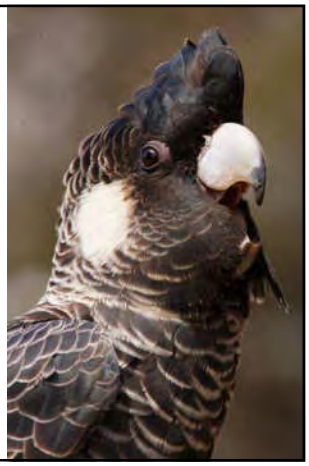
Strengthening partnerships

Recovery Plan: strategy for recovery

"Regular monitoring…will provide information on the size of the breeding population and breeding success of the cockatoos... [and] the number of breeding pairs and use of hollows..."

Recovery Plan Cont.

"Saunders (1986) [method of assessing chick health] can be used to monitor the status of breeding populations..."



Recovery Plan Cont.

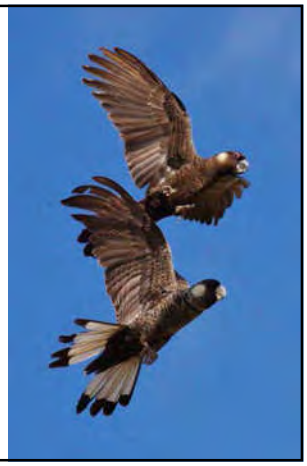
"Additional monitoring and research at Coomallo Creek could provide information on the age structure, survival and longevity [to assist] in determining the viability of populations..."

Background

- Birds Australia engaged community in cockatoo conservation
- Volunteers recruited to find and monitor nests of cockatoos
- Practical outlet for community goodwill
- Positive experience for landholders
- Excellent means of locating potential nesting trees

Monitoring methodology

- BA annually monitors 6 breeding populations with >15 known nest trees
- 'knock/flush' (3 properties)
- 'sit/watch' (1 property)
- 'climb/confirm' (2 properties)
- Once-off visits (5/6 properties)

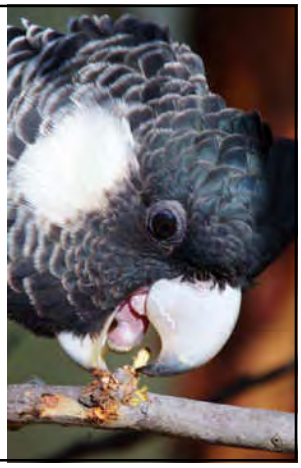


What have we found?

- Distribution of nesting populations
- Identity of likely breeding hollows
- Presence (vs. breeding record)

Where are the weaknesses?

- Subjective data collection (unconfirmed assumptions)
- Not systematic (eg. Different volunteers recording different data, 'blank' records)
- Once-off visits (nestling mortality and health)

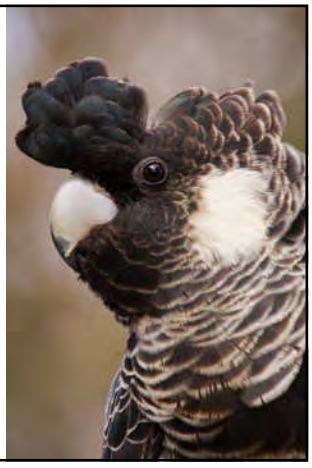


What data are missing?

- Nestling survival
- Nestling health
- Temporal changes in populations (eg. Coomallo Creek)

Why do we monitor?

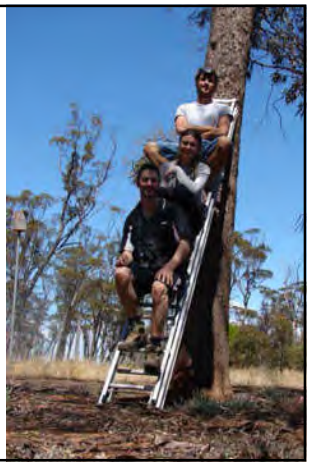
- Current monitoring is not sufficiently informative
- Are we simply engaging volunteers, or are we intending to answer questions about the species status and reproduction?
- Urgent need to clarify our aims.



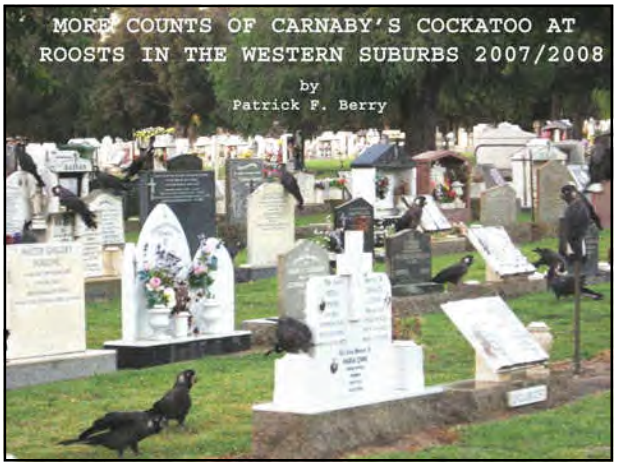
Where to now?

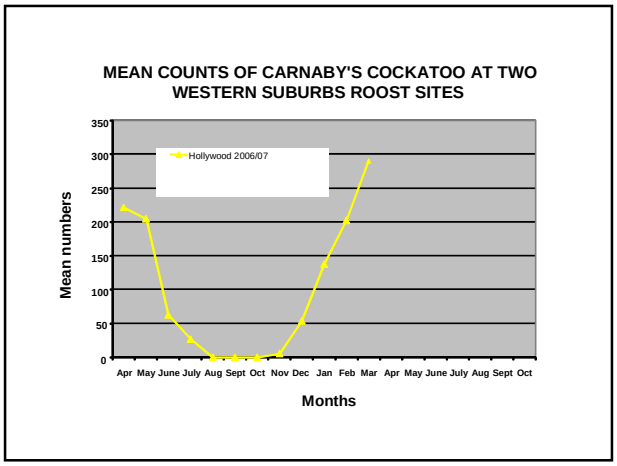
- Many challenges (old recovery plan, data sharing and privacy, staffing, time, funding...)
- Need for:

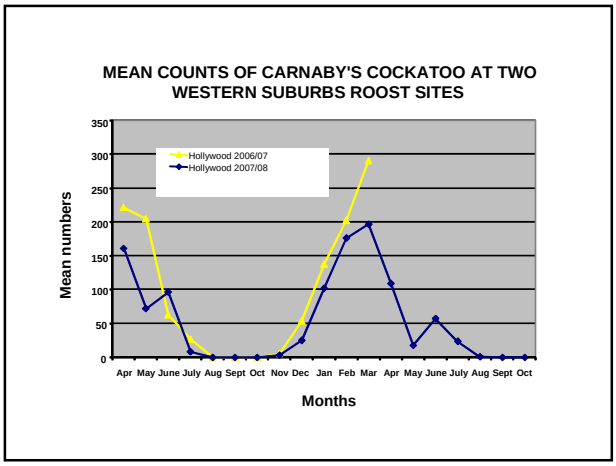
1. Careful planning
2. Critical review
3. COOPERATION

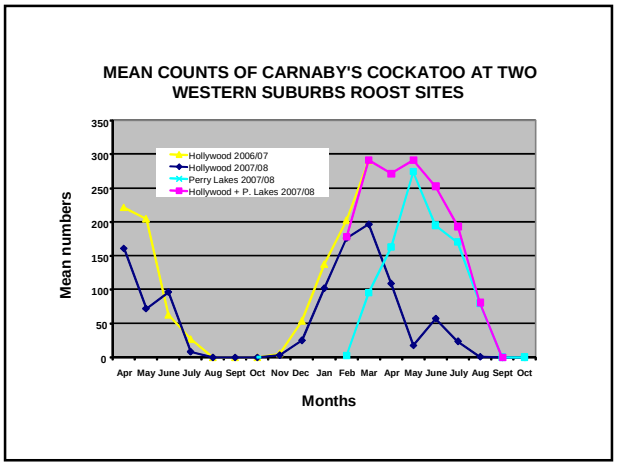


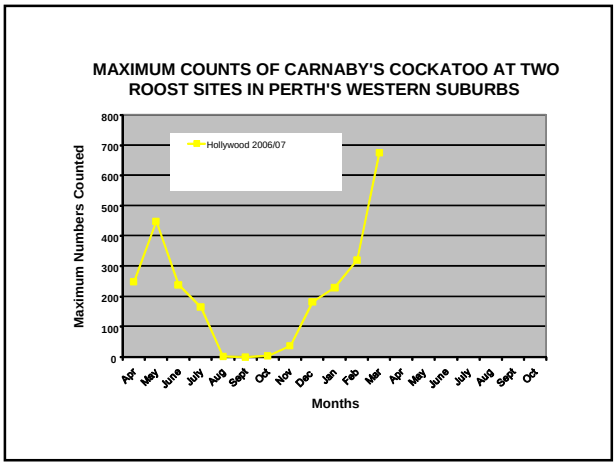

Carnaby's Black-Cockatoo
Recovery Project
Birds Australia
CONSERVATION THROUGH KNOWLEDGE
WWF
SOUTHCOAST
nacc
AVON
Department of Environment and Conservation
Greening Australia

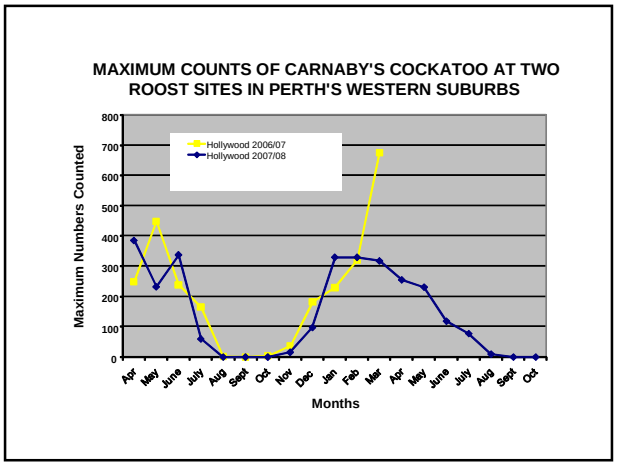

MORE COUNTS OF CARNABY'S COCKATOO AT ROOSTS IN THE WESTERN SUBURBS 2007/2008
by
Patrick F. Berry

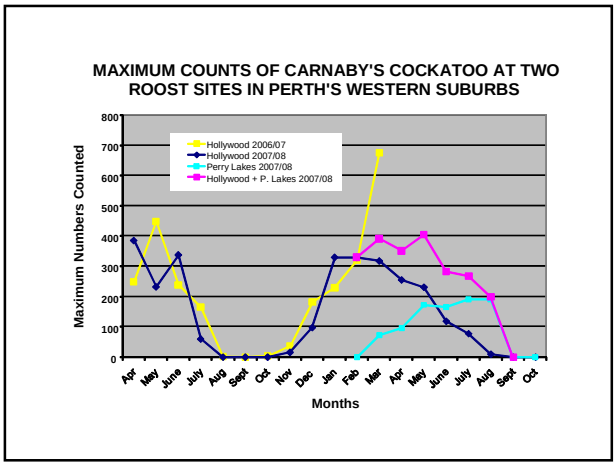

MEAN COUNTS OF CARNABY'S COCKATOO AT TWO WESTERN SUBURBS ROOST SITES
Hollywood 2006/07
Mean numbers
0
50
100
150
200
250
300
350
Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct
Months


MEAN COUNTS OF CARNABY'S COCKATOO AT TWO WESTERN SUBURBS ROOST SITES
Hollywood 2006/07
Hollywood 2007/08
Mean numbers
0
50
100
150
200
250
300
350
Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct
Months


MEAN COUNTS OF CARNABY'S COCKATOO AT TWO WESTERN SUBURBS ROOST SITES
Hollywood 2006/07
Hollywood 2007/08
Perry Lakes 2007/08
Hollywood + P. Lakes 2007/08
Mean numbers
0
50
100
150
200
250
300
350
Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct
Months


MAXIMUM COUNTS OF CARNABY'S COCKATOO AT TWO ROOST SITES IN PERTH'S WESTERN SUBURBS
Hollywood 2006/07
Maximum Numbers Counted
0
100
200
300
400
500
600
700
800
Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct
Months


MAXIMUM COUNTS OF CARNABY'S COCKATOO AT TWO ROOST SITES IN PERTH'S WESTERN SUBURBS
Hollywood 2006/07
Hollywood 2007/08
Maximum Numbers Counted
0
100
200
300
400
500
600
700
800
Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct
Months



Mean monthly composition of flocks of Carnaby's Cockatoo at the Hollywood Roost site

YEAR	mean % single birds	mean % pairs	mean % with juvenile (triplets)	n (# singles, pairs & triplets counted)
May 06 - Apr 07	4	58	38	3859
May 07- Apr 08	3	60	37	1930
May 08 - JUL 08	6	63	31	108

Carnaby's black cockatoo – a Landholder Perspective

Presented at the Carnaby's Symposium, Perth
December 1 2008
Alison Doley

I farm "Koobabbie", a 7,173 ha property 270 km north of Perth in the Waddy Forest district. As I have lived there all my life I should be able to give an account of Carnaby's black cockatoo numbers from my youth. However it was not until 1987 when Denis Saunders spoke to the Coorow Wildflower Group on the subject of cockatoos that John and I learnt they were threatened. At the time Denis was enrolling volunteers to keep a weekly checklist of bird species seen, something I still do. I started to make notes on where they were nesting.

In 1995 John and I realised that Western long-billed corellas were taking over nest holes regularly used by Carnaby's cockatoos. We removed corella eggs from five salmon gum hollows and observed that Carnaby's cockatoos re-occupied and successfully reared chicks in two of them.

However, the Carnaby's cockatoos from nest 34 were not so lucky. On 4/9/1995 I removed 3 corella eggs that were about to hatch from that very accessible nest. On 6/9/1995 Carnaby's were using the nest. Ten days later, 16/9/1995, two corellas were looking out. They had broken the two Carnaby's eggs, so I removed them. On 19, 20 and 21 September Carnaby's were leaving the nest hole. On 22 September two corellas left. There were no eggs. On 10/11/1995 one Carnaby's flew out. On 18/11/1995 the nest was empty.

In November 1996 Neil Johns came to work on "Koobabbie" and in February 1997 commenced a programme of shooting corellas, galahs, cats and foxes when it was convenient.

By 2002 Leonie McMahon was working as project officer for the Carnaby's project and arranged for shooters from Perth to assist with corella control. The first group were dispensed with after a year as unsatisfactory. Leonie contacted the Sporting Shooters Association and since 26/6/2005 they have been coming up on roughly a 6-weekly basis. They are a very responsible and effective group.

For the eleven-plus years 8/2/1997 to 22/11/2008 the statistics are 4,265 corellas, 9,267 galahs, 317 foxes (41 days + Alison), 41 cats (14 days + Alison), 462 rabbits, three laughing turtle doves, 1,603 kangaroos, 947 Port Lincoln parrots and 25 ravens).

Currently there are fewer corellas and galahs along the main timberbelt past the house while the Carnaby's cockatoos are very much in evidence with 20 known active nests. During the first week in November this year 12 chicks were banded, five were too small and three nests had eggs. The first pair of twins was recorded. There are 80 numbered nest sites, seven of them artificial.

John Laurie is a Birds Australia volunteer who has enlisted the help of other volunteers to extend the life of some trees by repairing holes in the trunks using flat galvanised sheeting. The repairs do not worry the birds and have extended the life of a number of trees as nest hollows.

Under a project organised by Stephen Davies, John made an excellent job of erecting seven artificial nests. I estimated the nests cost $555 each including the value of farm labour. The aim of the project was to gain information for when artificial nests are needed in the future. They were erected in 2004 and the Carnaby's took to them without hesitation. For the first three years five nests were used, last year four and this year two. Galahs are a problem in two of the nests, while corellas were removed from one in 2006.

Planting of salmon gums is being done but with 130 plus years' wait they are no help in the short term. Stephen Davies did some research on tree spacing and advises us to plant salmon gums 18 metres apart if they are to develop as nest trees. Planting by DEC on the farm uses two-metre spacing and less to combat weeds.

The other part of the equation for successful breeding by Carnaby's cockatoo is the food supply. The only food obtained close to the nests is Erodium for a short period. The birds fly west to feed mainly off the property on wild radish, *Banksia prionotes* and *Banksia attenuata*, *Hakea priessii* and latterly canola. The rapid inclusion of canola in their diet suggests Carnaby's are very adaptable. I am not concerned about their food supply.

<u>Challenges for the future</u>

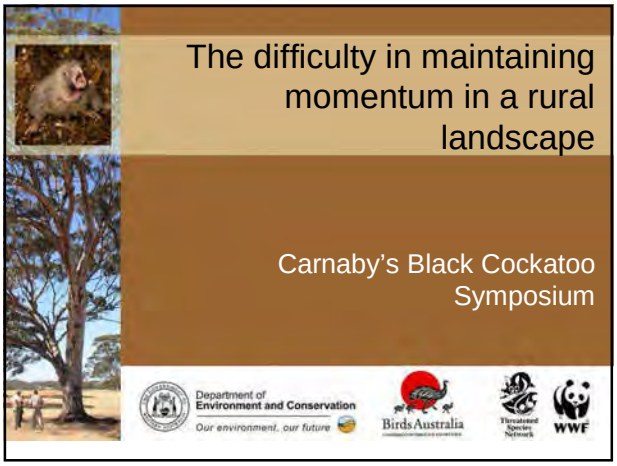
1. There is a greater knowledge and awareness of the bird's needs in the general public than in 1987, but it is still important that the education and publicity continue.
2. The most important factor determining the bird's survival is the control of corellas, galahs and cats by shooting. This depends on Neil and the members of the Sporting Shooters Association

maintaining their enthusiasm. Distance and fuel prices do not seem to be a problem for the latter.

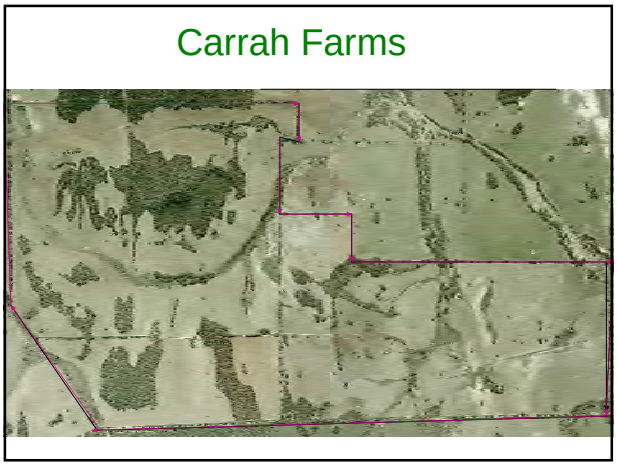
3. Birds Australia volunteers are invaluable for nest repairs and monitoring of nests. Repairing nests is definitely a superior investment to constructing and erecting nest boxes. It would help the survival of some trees if branches were lopped, but would be very expensive.
4. Artificial nests will be required eventually. Research should continue into their effectiveness.
5. Revegetation to supply nests is very long term, and needs to be thought through. Suitable species need wider spacing to develop.
6. Food supply is not a problem here, but should be considered.
7. Bait stations for bees must be made available as soon as possible. Bees have taken over one of last year's nests.
8. Should a member of the Sporting Shooters Association be invited to join the recovery team?

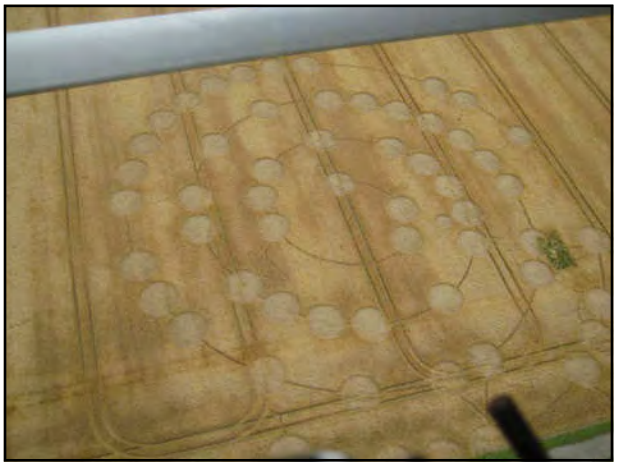
To conclude, I believe the local population of Carnaby's cockatoos is secure as long as corella and galah numbers are controlled by Neil Johns and the Sporting Shooters Association. The birds and I owe a lot to them and to people like:

1. Leonie McMahon, the first Carnaby's cockatoo project officer
2. Stephen Davies for his research into artificial nests, tree spacing and feeding habits
3. Rick Dawson and his helpers for monitoring and banding
4. Nicole for her work on DNA
5. John Lauri and the other Birds Australia volunteers for nest repairs and monitoring
6. Denis Saunders for generating interest in the first place.


The difficulty in maintaining momentum in a rural landscape
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


COCKYS
FOR LANDCARE
Environmental Farming for Tomorrow, Today

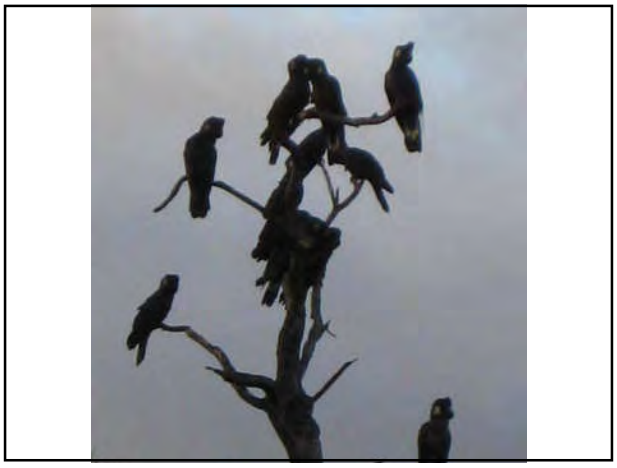

Carrah Farms



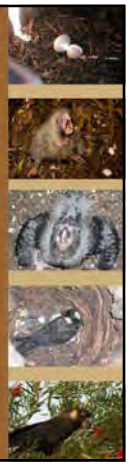

Natural Heritage Trust
Helping Communities Helping Australia
An Australian Government Initiative
AUSTRALIAN Government
envirofund
LANDCARE

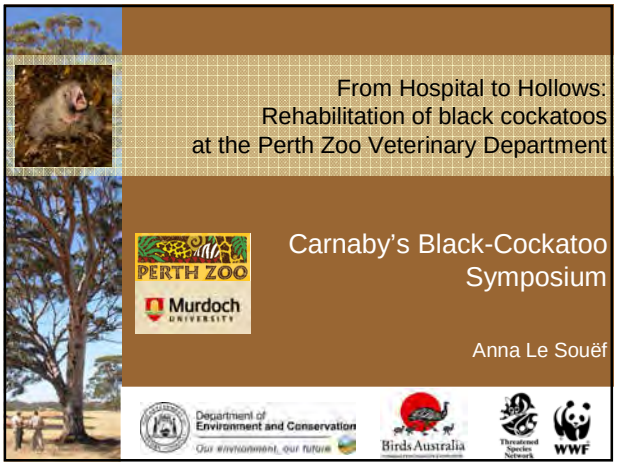

RESERVE


Shire of Victoria Plains
Take a
DRIVE FOR LANDCARE
COCKYS FOR LANDCARE
COCKYS
FOR LANDCARE



Cockys for Landcare in decline like Carnabys





Veterinary treatment of black cockatoos at Perth Zoo

- Large number of traumatic injuries – especially in Perth metro area
- Program since 2000 (DEC and PZ) to treat debilitated birds
- Development of standard protocol for treatment and work-up
- Primary aim to release to wild flocks
- Conservation value and prognosis score given to each bird
- >500 cockatoos seen since 2000
- No formal analysis of records

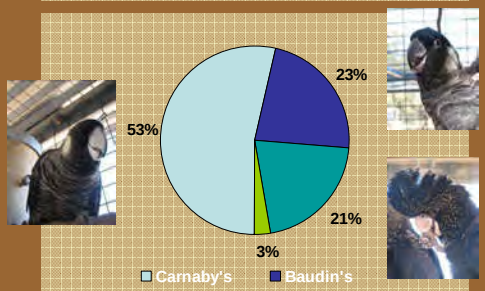
Research aims

- To further develop existing prognostic indicators and conservation values for admitted cockatoos
- To perform a study on medical records of cockatoos treated at Perth Zoo from 2000-2009 to improve accuracy of prognostic indicators
- To analyse the impact of life history, specific disease conditions and injuries on the success of rehabilitation
- To determine unequivocally the gender and reproductive activity of admitted cockatoos using endoscopy
- To investigate tracking options for releasable cockatoos
- To create an aging curve for black cockatoos using pentosidine analysis

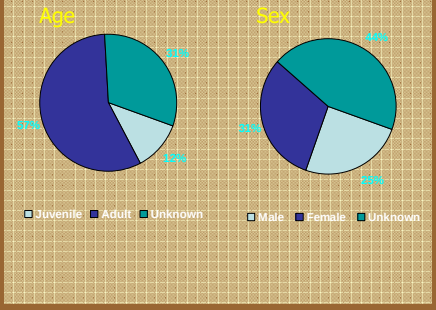
Analysis of past records of admitted cockatoos

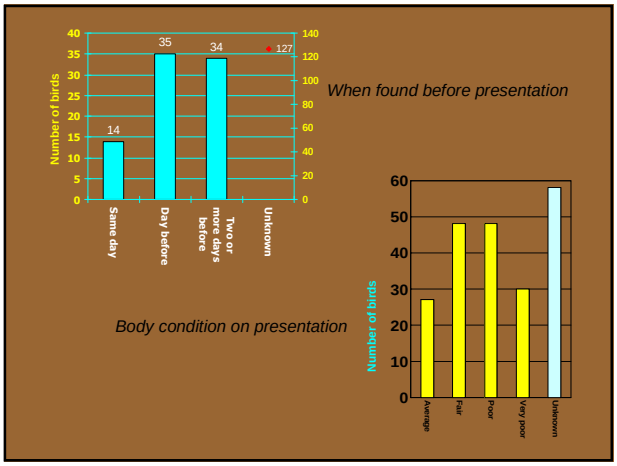
- Years 2000-2004 completed
- 211 cases so far
- Total (to mid-2009) likely to be ~600
- Injuries categorised to varying detail
- Limitations on early data – changes in:
  - Record keeping – vet department and rehab centre
  - Protocols for treatment
  - Recognition of characteristics of age/sex (definitive sexing)

Frequency data – species



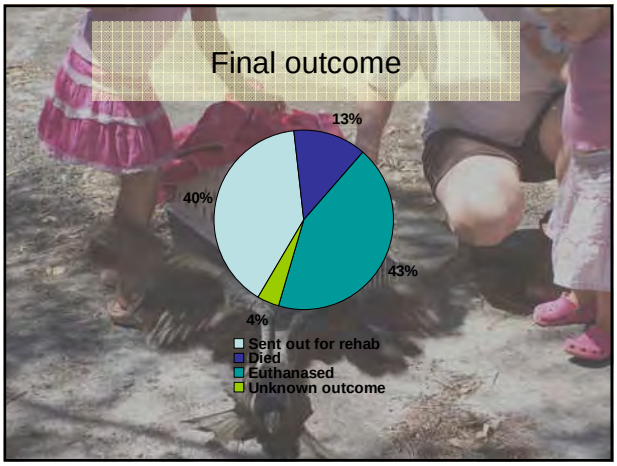
Frequency data – age and sex





Signs on presentation

PRESENTING SIGN	NUMBER OF BIRDS/211
Fractures/s	147
Open wounds	71
Shot	25
Paresis/paralysis	25
Head trauma	11
Ataxia/neurological signs	9
Dyspnoea	6
Diarrhoea	6
Eye injury	4
Regurgitation/vomiting	3
Angular limb deformities	3
Head tilt	2
URT signs	2
Metabolic bone disease	1



Factors significantly affecting outcome

- Birds presenting in 'very poor' body condition were 7 times more likely to die or be euthanased than those presenting in 'average' body condition (OR=7 (95% CI 2.29-21.42))
- Birds that did not receive fluids on presentation were nearly twice as likely to die or be euthanased than those given fluids on presentation (OR=1.93 (95% CI 1.2-4.2))

Other factors to be compared against outcome

Haematology – leukocytosis, monocytosis, anaemia, hypoproteinaemia (RR to be established)

Presence of infection with *Chlamydophila*

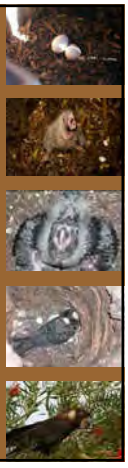
Treatment received – fluid therapy, analgesia, antibiotics, antifungals

Length of hospital stay and number of anaesthetics given

Effect?

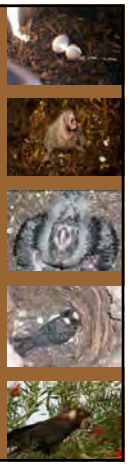
Outcome

(died/euthanased/sent to rehabilitation centre/released)



Creating an aging curve for black cockatoos

- Curve for future use to estimate ages of cockatoos of unknown age
- Implications for studies of population demographics
- Aid in species survival programs



Creating an aging curve for black cockatoos

- Pentosidine analysis used to age wild birds in the US
- Concentration of pentosidine accumulates in collagen with age
- Small skin sample from the patagium
- Requires samples from a range of cockatoos of known age
- Captive birds held at zoo and rehabilitation centre; wild hatchlings

Creating an aging curve for black cockatoos

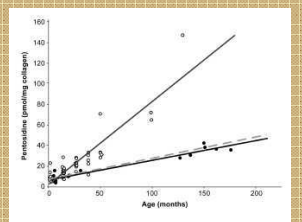


FIG. 3. Pentosidine concentration as a function of age in Ruffed Grouse (open circles) and Double-crested Cormorants (filled circles). Dotted line represents results from Cheney et al. (2003).

Tracking – does the perfect cockatoo transmitter exist?

- Important component of research into post-release survivability
- Potential to provide vital ecological, habitat and demographic data
- Aviary trial in collaboration with the Carnaby's Black-Cockatoo Project
- 'Dummy transmitters' to test methods of attachment and suitability of certain models
- Harnesses /backpacks, tail-mounts, collars
- Lead on to future study tracking cockatoos post-release

Tracking – does the perfect cockatoo transmitter exist?

Tracking – does the perfect cockatoo transmitter exist?

- Always a compromise with tracking equipment
- Ideal avian transmitter:
  - Long-lived battery (compromise with weight)
  - Super light (<*22g*) (compromise with battery life)
  - Indestructible (!) (compromise with function of unit)
  - Low morbidity/mortality risk to the bird (compromise with secure attachment)

Tracking – does the perfect cockatoo transmitter exist?

- Challenges in tracking black cockatoos:
  - Large strong beaks
  - Foliage
  - Difficult to catch wild birds
  - Wide habitat range
  - Predation
  - Long lived, endangered (= high value of individual bird)
  - Catching wild birds to attach transmitters
  - Recapture very unlikely
- Challenges of ordering different transmitters from different companies

What we've decided upon…

HOLOHIL A121C COLLAR (VHF transmitter)

• Weight: 20g

•Advantages: Strong material, secure attachment, low interference with movement/flight, in-built loop antenna

• Concerns: Detachment system, chafing, snag risk (low), interference with crop (probably low)



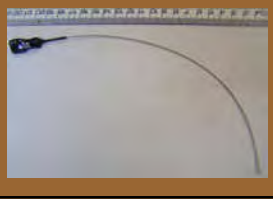
What we've decided upon…

SIRTRACK TAILMOUNT (VHF transmitter)

• Weight: 6g

• Advantages: Very low risk to bird, certainty of eventual shedding, some success when used to track Yellow-tails and Glossies

• Concerns: Vulnerability to chewing, loss with feather when moult occurs



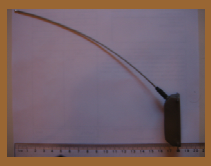
What we've decided upon…

NORTHSTAR BATTERY POWERED HARNESS (Satellite transmitter)

• Weight: 20g

• Advantages: The only satellite transmitter of this weight on the market

• Concerns: Snagging risk if don't fit harness correctly, upper limit of percentage bodyweight for black cockatoos



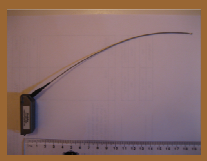

What we've decided upon…

NORTHSTAR SOLAR POWERED HARNESS (Satellite transmitter)

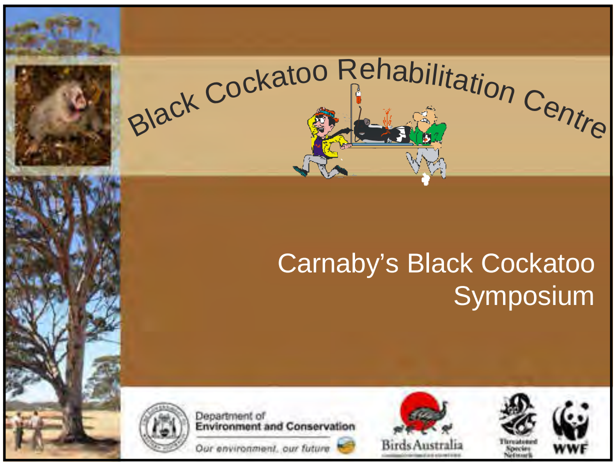
• Weight: 12g and 16g

• Advantages: Longer life compared with battery powered transmitter of same weight

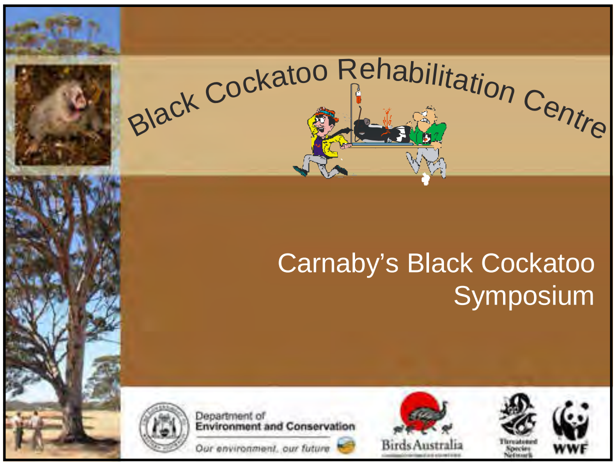
• Concerns: Fragility of solar panels, snagging risk if don't fit harness correctly, possibility of feathers or foliage blocking solar panels



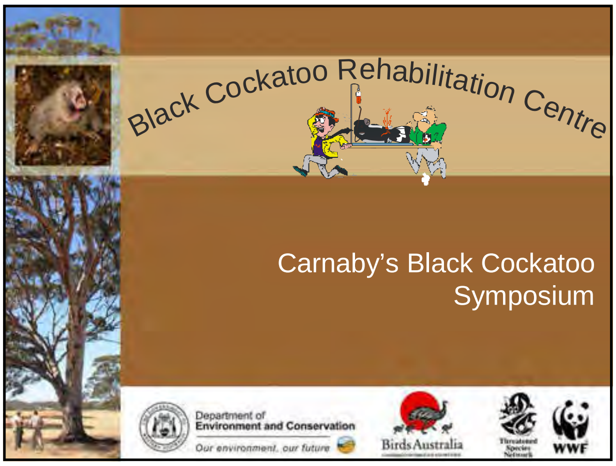

Thank you…. Questions?


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF


Black Cockatoo Rehabilitation Centre
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
WWF

Conservation Genetics and Wildlife Forensics of Black-Cockatoos in south-west Australia

Nicole White - PhD Candidate
Wildlife Genetics Lab
Murdoch University

December 2008

Dr. Peter Spencer
Wildlife Genetics Lab

Dr. Michael Bunce
Ancient DNA lab

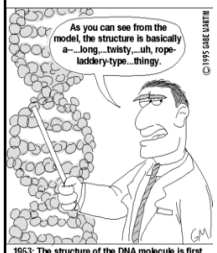
Nicole White

2005 Bachelor(s) of Science
Conservation Biology
and Biological Sciences

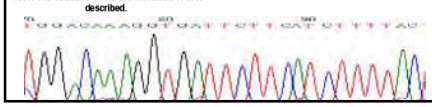
2006 Honors degree in Conservation Biology
Genetic significance of island and mainland populations of the Western Chestnut mouse

2007 PhD candidate
Molecular ecology, conservation, management and protection of Black-Cockatoos in SW Australia

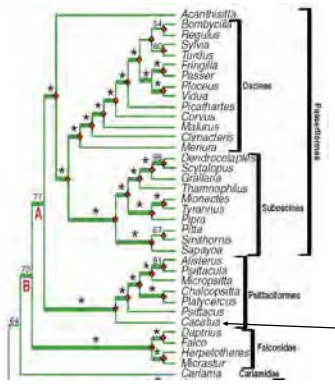
Presentation Overview



- Phylogeny
- The relationship of WTBC
- DNA provenance database
- Genetic bottlenecks
- Pair-bond & nest-site fidelity
- Wildlife forensics



Phylogeny - the family tree



The questions...

Where do WTBC sit within the Australian cockatoo family?

Who is the closest relative (sister taxa) to WTBC and what are the measures of genetic distance?

When did Carnaby's and Baudin's split into separate species?

How genetically different are Carnaby's and Baudin's?

Australian Cockatoos

Hackett et al., (2008) A Phylogenomic Study of Birds Reveals Their Evolutionary History. *Science*; Vol.320, 1763-1768.

The genetic relationship of Carnaby's and Baudin's

The DNA evidence
Four mitochondrial DNA genes
CR (1000 bp), ND2 (1000bp), CO1 (500 bp), Cyt-b (900 bp)

Three nuclear genes
TGFB2 (700 bp), EEF2 (900 bp), HMGN2 (550 bp)

Twenty nuclear microsatellite loci

Management Implications
Distinct species OR
Same species with distinct populations?

Defining the management units for conservation

Genotype or Phenotype

Hackett et al., (2008) A phylogenomic study of birds reveals their evolutionary history. *Science*; Vol. 320, 1763-1768.
Kimball et al., (in prep) A well-tested set of primers to amplify regions spread across the avian genome.
Weir, J.T., and Schluter, D. (2008) Calibrating the avian molecular clock. *Molecular Ecology*; 17, 2321-2328.

Abzhonov et al., (2006) The calmodulin pathway and evolution of elongated beak morphology in Darwin's finches. *Nature*; Vol.44, 563-567.

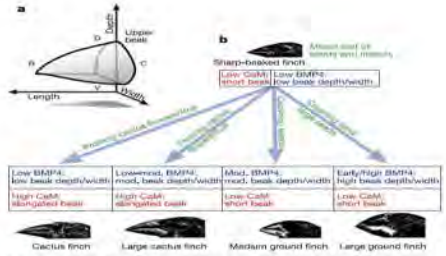
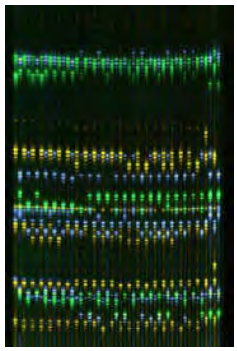


Figure 4 | BMP- and CaM-dependent signalling regulates growth along different axes, facilitating the evolution of distinct beak morphologies in Darwin's finches. **a**, Developing avian beak is a three-dimensional structure that can change along any of the growth axes. **b**, A beak of the sharp-beaked finch reflects a basal morphology for *Geospiza*. The model for BMP4 and CaM involvement explains development of both elongated and deep/wide beaks of the more derived species. Abbreviations: C, caudal; D, dorsal; R, rostral; V, ventral.

DNA profiling Black-Cockatoos



Cockatoo CSI

An efficient DNA profiling system with a high degree of confidence

1 in 27 billion Black-Cockatoos will have the same "DNA profile"

DNA sources
-Feathers
-Eggshell
-Dried skins
-Blood
-Bone
-Scats

Panneerchelvam, S., and Norazmi, M.N. (2003) Forensic DNA Profiling and Database. *Malaysian J of Medical Sci.*; Vol.10,No.2.

DNA provenance database

The questions...

Are Carnaby's populations closed (i.e. little to no gene flow) or open (freely interbreed)?

Do nesting areas have distinct genetic profiles?

Which nesting areas have the highest levels of genetic "health"?

How far do Carnaby's travel (via gene flow)?

Where do the "juveniles" nest when sexually mature?

Management Implications

Prioritize on-the-ground management actions

Targeted release programs (rehabilitated birds)

Genetic bottlenecks

Using museum specimens

DNA has been extracted from museum skins collected in 1920, 1946, 1954 and 1959

The question...

What has been lost from the "gene pool" in the last 50 years since population(s) decline?

Case studies	Summary
Greater prairie chicken	Genetic diversity of pre- and post-bottleneck populations
Mauritius kestrel	Genetic monitoring of a pesticide-induced bottleneck
Greater prairie chicken	N_e and temporal genetic variation in bottlenecked populations
White-headed Duck	Loss of genetic diversity
Peregrine falcon	Pesticide-induced bottleneck in Canadian falcons
Spanish imperial eagle	Effects of fragmentation on spatiotemporal genetic structure

Leonard, J.A., (2008) Ancient DNA applications for wildlife conservation. *Molecular Ecology*; 17, 4186-4196.
Wandeler et al., (2007) Back to the future: museum specimens in population genetics. *Trends in Ecol and Evol*; Vol. 22, 634-641.

Pair-bond and Nest site fidelity

Study site - Koobabbie
"Cockie Club-Med"

95 chick/eggshell samples have been collected from 2003 to 2008

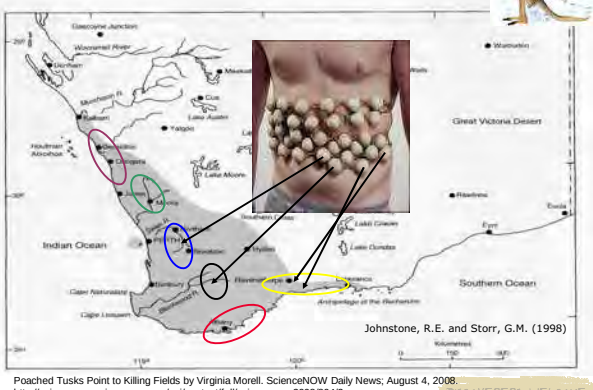
70+ nesting hollows monitored every year

The questions...

How loyal are breeding pairs to individual nesting hollows?

Truly monogamous?

Wildlife Forensics



Johnstone, R.E. and Storr, G.M. (1998)

Poached Tusks Point to Killing Fields by Virginia Morell. ScienceNOW Daily News; August 4, 2008.
http://sciencenow.sciencemag.org/cgi/content/full/sciencenow;2008/804/2

Summary

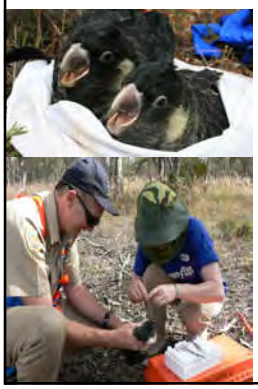
This DNA study will allow us to develop an understanding of the current genetic structure, diversity, and movement of Black-Cockatoos.

This DNA study provide further insight into existing information on the biology of these birds and in the development of scientifically sound conservation and management responses.

The established genetic profiles (DNA provenance database) will enable the successful prosecution of individuals suspected of poaching/smuggling these birds.



Acknowledgements



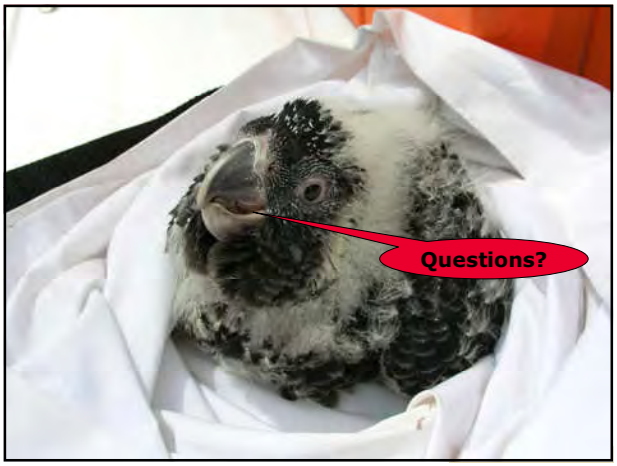
Research scholarship
Mr. Robert Hammond

Research funding 2007
Murdoch University
Dept. of Environment and Conservation
Birds Australia

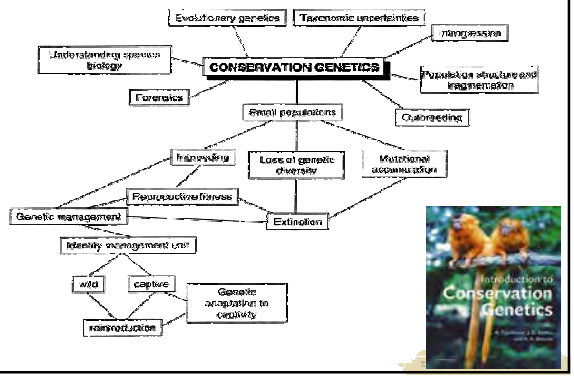
Research funding 2008
Murdoch University
Dept. of Enviro, Water, Heritage and the Arts

Research funding 2009
Murdoch University
?

In-kind support and Sample donation
Dept. of Environment and Conservation
West Australian Museum
Perth Zoo
Birds Australia



Conservation Genetics



Carnaby's Cockatoos in the South-west

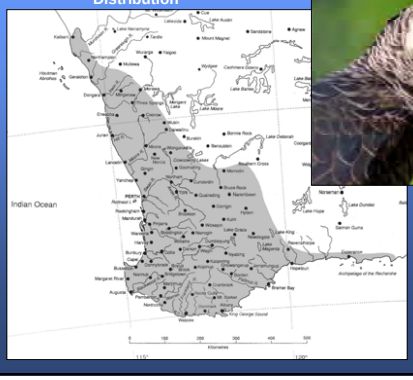
Ron Johnstone
Curator of Ornithology
Western Australian Museum

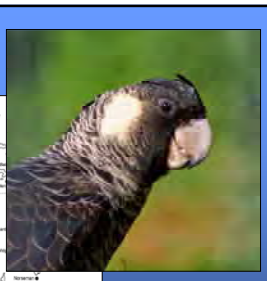
Tony Kirkby
Field Research Officer
Western Australian Museum

Current studies on Distribution, Status, Breeding, Food and Movements

Carnaby's Cockatoo

Distribution

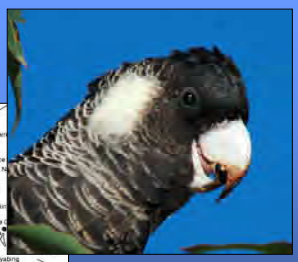




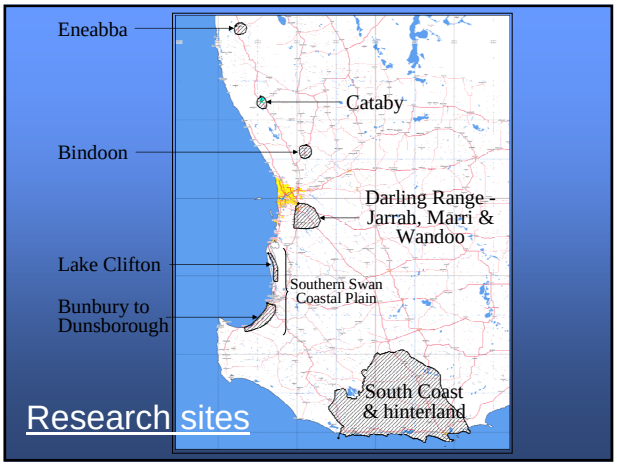
Flock call (wee-looo)

Baudin's Cockatoo

Distribution



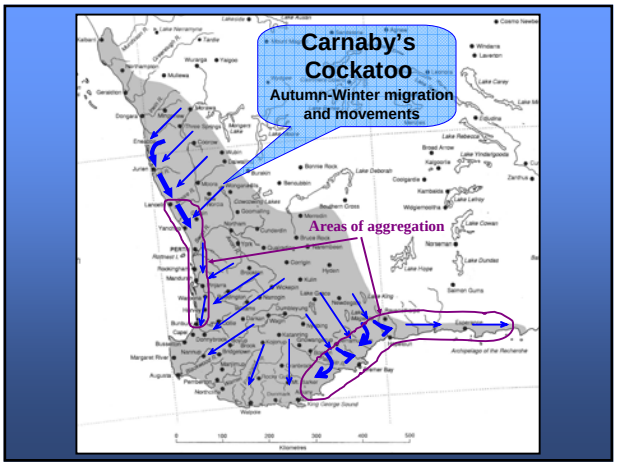
Flock call (whicha-whicha)



Research sites

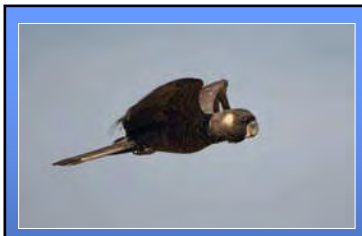
- Post-breeding -

- Breeding in northern wheatbelt completed by end of January or early February.
- February to April – large transit flocks forage in Banksia and pines on Northern Swan Coastal Plain between Lancelin and Perth.
- Some examples of these large flocks –
  - 2,000 Ellenbrook – 26 Feb 2005,
  - 3,000 Gnangara – 28 Feb 2005,
  - 3,000 Landsdale – 9 Mar 2005,
  - 7,000 Mariginiup – 1 Mar 2004,
  - 5,000 – 7,000 Tamala Park – 29 Apr 2003,
  - 2,000 Nilgen – 28 May 2003.



- Return migration -

- Reverse movement of transient birds returning to wheatbelt is evident in July-August e.g.
  - 7,000 Yanchep – 3 Jul 2006,
  - 8,000 – 10,000 near Wanneroo – 24 Jul 2006,
  - 700 to 6,000 – 7,000 Wanneroo – Jul/Aug 2006,
  - 1,000 Burns Beach – Sept 2005,
  - 600 Nilgen – Sept 2008.
- Exceptions to westward and southward movement e.g.
  - 300 adults & juveniles at Eneabba in Autumn,
  - 200 in Stirling Range.
- Resident population at Lake Clifton (50-100 pairs), Bunbury and ?Baldivis.



Males paired with females, all unbanded

Young males returning to breed at Cataby

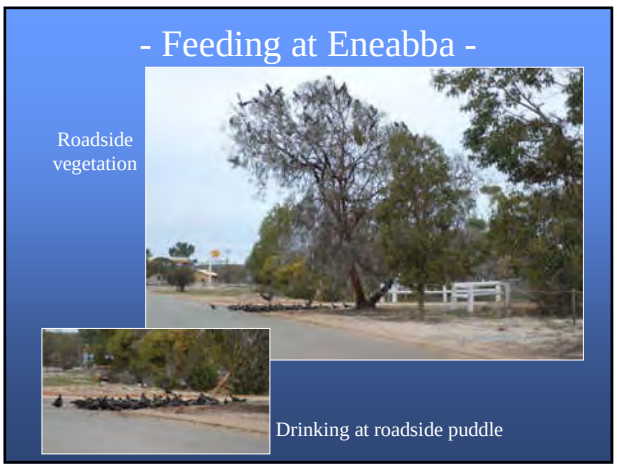
Known nest trees, Cataby

Nest trees, Cataby

Checking hollow

Chick to be weighed & measured; artificial hollow repaired.

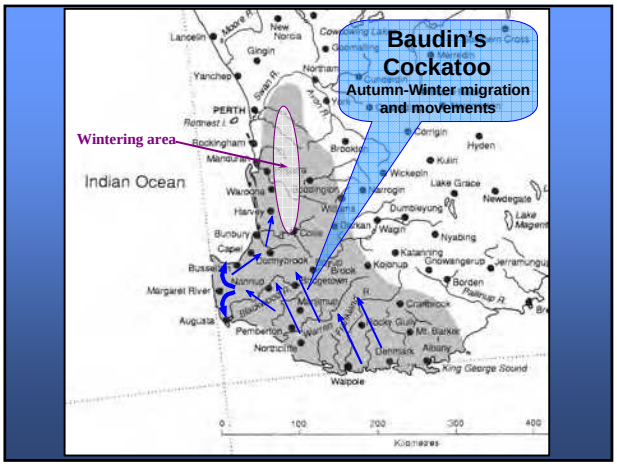
Known nest trees, Bindoon



Ground Truthing

Broad scale assessment of the level of usage of the Southern Swan Coastal Plain region (Bunbury to Dunsborough) by Carnaby's Cockatoos -

- Historical records.
- Feeding (both old and recent evidence).
- Breeding.
- Migration and movements.
- Roost sites.



Threats and Potential Impacts

- Habitat loss and destruction – on the Coastal Plain 90% of original vegetation cleared.
- Loss of veteran and stag trees (233 years for suitable hollows to develop).
- Nest hollow competition – feral European honey bees and invading tramp species eg. Galahs and Eastern Long-billed Corellas.
- Climate change?
- Fire, mining, forest management, dieback, poaching, road kills, water abstraction (Tuart & Banksia loss)

Recommendations for Further Work

- Targeted surveys to the south west region accounting for seasonal variations.
- Monitor known nest hollows to determine timing of nesting events etc.
- Assess over the next few breeding seasons the size and health of isolated populations.
- Continue to study the food resources used by Carnaby's.
- Assess the impact of hollow competitors.

Questions?

Thanks to Tony Kirkby for photo images and to Kim Sarti for his assistance.

Food Resources of Carnaby's Black-Cockatoo in the GSS: potential impacts of pine removal

Carnaby's Black-Cockatoo Symposium 2008

Dr Leonie E Valentine[1,2], Prof William Stock[1] and Jackson Parker[3]

[1]Edith Cowan University, [2]Department of Environment and Conservation and [3]Forest Products Commission

Gnangara Sustainability Strategy

- Multi-agency taskforce
  - DoW, DPI, DAFWA, Water Corp, FPC, DEC and CSIRO
- Framework for balancing water, land & environmental issues on Gnangara Groundwater System
  - Gnangara Mound (superficial aquifer)
  - Leederville and Yarragadee (confined aquifers)
- 60% of Perth's water supply
  - Concern due to declining ground-water levels and decreasing rainfall

Pine Plantations and Carnaby's Black-Cockatoo

- 23,000 ha is plantation forestry
  - Mostly (> 95%) Maritime Pine (*Pinus pinaster*)
- Plantations prevent recharge into aquifer
  - Scheduled for removal over next 17 years
- Pines source of food & nocturnal roost sites for CBC
  - Perry 1948, Saunders 1974, 1980, Shah 2006
- Removal may impact CBC populations
  - Cale 2003, Garnett and Crowley 2000
  - Need to quantify availability of food resources in environment

Objectives

1. Availability of food resources in pine plantations
2. Availability of food resources in remnant vegetation
3. Habitat use and foraging ecology in pine and banksia woodlands
4. Energetics of seeds from target food species

Seed Energetics – Background

Cooper *et al* 2002: pivotal in CBC food energetics

- Basal Metabolic Rate (0.86 ± 0.18 mLO_2/g/h) for CBC
- Field Metabolic Rate (726 kJ/day) for CBC
- Energy content of some food species
- Estimates of minimum number of seeds/cones required

Species	Seed energy content (kJ/g)	Total energy content (kJ/cone)	Minimum cones /day (to meet FMR)
Pinus radiata	25.4	39.4	18
Banksia attentuata	22.0	63.9	11

*Adapted from Cooper *et al* 2002 *Australian Journal of Zoology* **50**: 67-76.

Combine with literature to examine availability of food in 1 ha of pine plantation and banksia woodlands

Assumptions

Cooper *et al* 2002 assumptions:

- Food required for FMR represents minimum amount;
- 100% assimilation of seeds;
- No metabolic cost of feeding;
- No differences in handling time between species
- 100% of seeds in each cone are consumed

Our assumptions

- Density of *Banksia attenuata* woodland is constant
- 100% of mature *Banksia attenuata* trees produce cones annually
- External factors do not influence density or cone productivity
- Values represent the **MAXIMUM** number of birds supported

Availability of Food Resources

The **maximum** number of birds that could be supported in 1 ha of pine or banksia woodland

Species	Annual cones or flowers/tree	Proportion producing cones (%)	Density (trees / ha)	CBC / ha / day[a]	CBC / ha / 6 months[a]
Pinus radiata	20.3[b]	45[b]	1000[c]	495.8	2.8
			500[c]	247.9	1.4
			250[c]	123.9	0.7
			125[c]	62.0	0.3

[a] Calculations based on Cooper *et al* 2002
[b] Hopkins and Butcher 1993 – Gnangara Plantation
[c] Thinning stage (J. Parker *pers com.*)
[d] Bamford and Bamford 2004 – Jandakot area
* No information – assume 100%

How does this relate to the GSS study area?

Food Resources in GSS Pines

The **maximum** number of birds that could be supported in 1 ha of pine

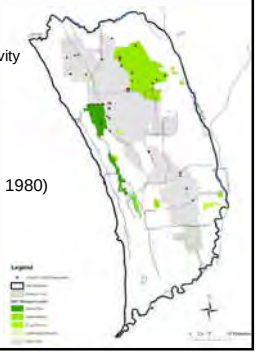
Species	Annual cones or flowers/tree	Proportion producing cones (%)	Density (trees / ha)		CBC / ha / 6 months[a]
				Current Area	
Pinus pinaster	20.3[b]	45[b]	250[d]	14,500 ha	0.7
			125[d]	2,500 ha	0.3

[a] Calculations based on Cooper et al 2002
[b] Hopkins and Butcher 1993 – Gnangara Plantation
[c] Thinning stage (J. Parker *pers com.*)
[d] Bamford and Bamford 2004 – Jandakot area
* No information – assume 100%

GSS Plantations: could support 10,684 CBC for 6 months

Food Resources in GSS Remnant Vegetation

- Estimated 1.1 CBC / ha / 6 months
- Refine estimate to include
  - Differences in density & productivity
  - Influence of external factors
- ~ 40 sites in remnant vegetation
  - DEC-Estate
- 2 Vegetation Complexes (Heddle 1980)
  - Bassendean North
  - Cottesloe North
- Range of Fire Age (1 – 26 YSLB)
  - 4 Fuel Age categories



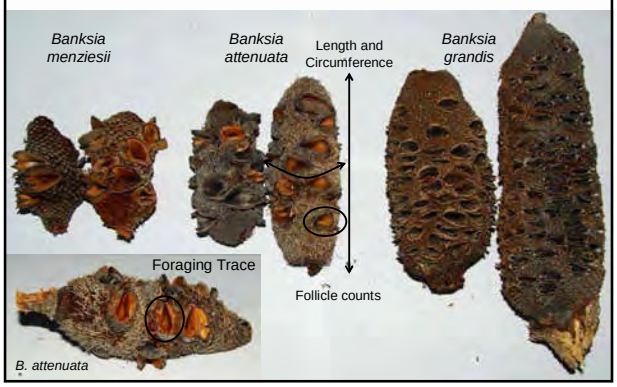
Data Collection

- Sites surveyed late spring (October – November)
- Quadrats: Target species were counted
  - 19 species targeted
  - *B. attenuata* & *B. menziesii* dominant
- Reproductive structures counted for five individuals
  - Typically for *B. attenuata* & *B. menziesii*
- Cones (~ 5) collected from dominant banksia species

Reproductive Structures

Standing crop of available food resources

Counting Follicles



Preliminary Results

- Data still being collected
  - May detect differences in density, amount of cones and proportion of plants containing unopened cones
  - Incorporate differences in food resource analyses

Vegetation Complex	Fire Age (YSLB)	Unopened Cones (mean count)	Prop with unopened cones	Density (ha)	CBC / ha / 6 months
Bassendean North	1 – 5	9.1	0.84	297.6	1.1
	6 – 10	10.8	0.96	184.0	1.0
	11 -15	13.0	0.85	264.0	1.5
	>16	5.8	0.69	288.0	0.6
Cottesloe North	1 – 5	3.3	0.52	342.6	0.3
	6 – 10	8.5	0.83	115.2	0.4
	11 -15	6.7	0.80	156.8	0.5
	>16	4.6	0.75	284.0	0.5

Food resources vary depending on factors affecting banksia woodlands

Future Directions

- Pine plantations
  - Importance of roost sites, preferred locations and foraging areas
- Foraging Ecology
  - Handling time of food species?
  - Metabolic cost of feeding?
  - Amount of food destroyed before ripe?
  - How much of each cone do CBC eat?
  - Preferred foraging areas?
- Importance of non-seed resources?
  - Nectar content of species
  - Protein from invertebrates

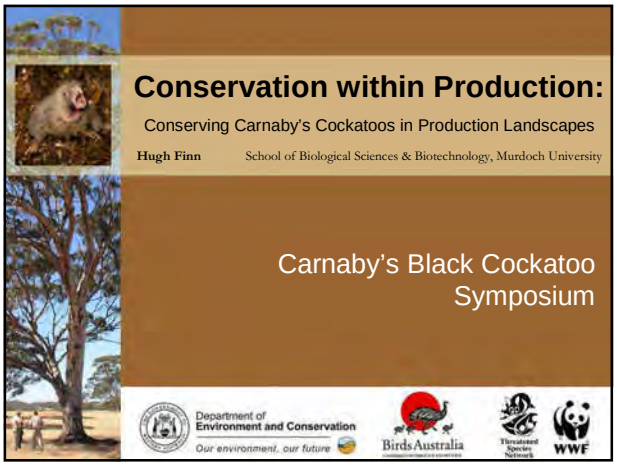
Acknowledgements

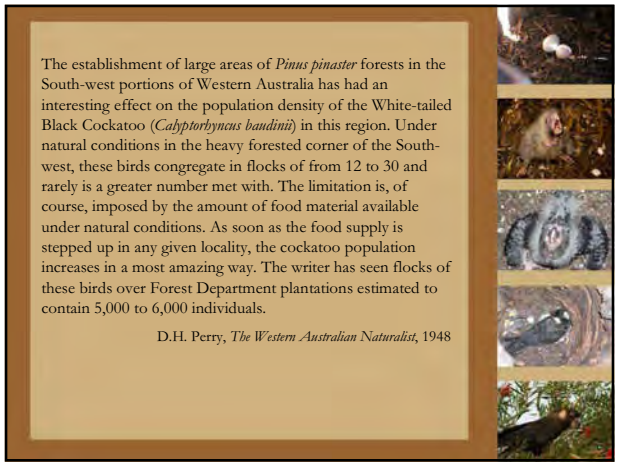
Funding Sources
- Forest Products Commission
- Department of Environment and Conservation
- Edith Cowan University

DEC: GSS Biodiversity Team
- Paul Brown, Barbara Wilson, Janine Kinloch, Alice Reaveley, Tracy Sonneman, Katy Montgomery, Marnie Swinburn, Natalia Huang, Dave Mickle and Rob Davis.

ECU: Seed de-husking team
- Jarreth Howard, Simon Blane and Jessica Allia

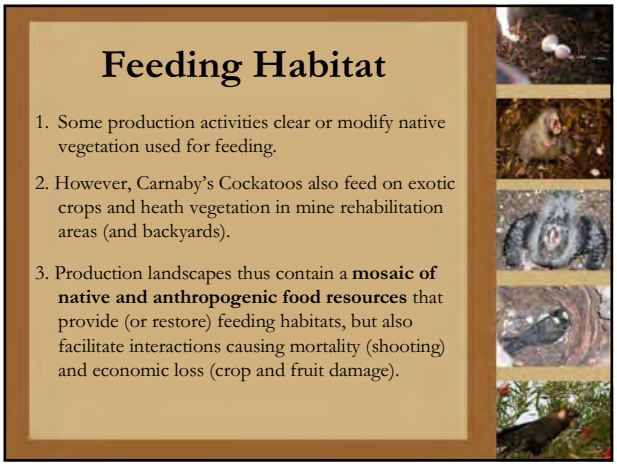
Thanks
- Birds Australia
- Rob Davis
- Rebecca Fisher


Conservation within Production:
Conserving Carnaby's Cockatoos in Production Landscapes
Hugh Finn
School of Biological Sciences & Biotechnology, Murdoch University
Carnaby's Black Cockatoo Symposium
Department of Environment and Conservation
Our environment, our future
Birds Australia
Threatened Species Network
WWF


The establishment of large areas of *Pinus pinaster* forests in the South-west portions of Western Australia has had an interesting effect on the population density of the White-tailed Black Cockatoo (*Calyptorhyncus baudinii*) in this region. Under natural conditions in the heavy forested corner of the South-west, these birds congregate in flocks of from 12 to 30 and rarely is a greater number met with. The limitation is, of course, imposed by the amount of food material available under natural conditions. As soon as the food supply is stepped up in any given locality, the cockatoo population increases in a most amazing way. The writer has seen flocks of these birds over Forest Department plantations estimated to contain 5,000 to 6,000 individuals.
D.H. Perry, *The Western Australian Naturalist*, 1948


Introduction
Production landscapes:
landscapes devoted to natural resource production
contain remnant, restored, or exotic vegetation
Examples:
Farms
Mine sites & rehabilitation areas
State Forest
Private forest
Tree plantations
Fruit orchards

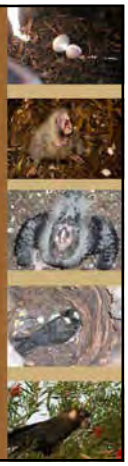

Introduction
1. Much remaining breeding & feeding habitat is located within production landscapes.
2. Production activities:
remove or alter native vegetation
will continue for the foreseeable future
often over-lap
sometimes provide anthropogenic food
3. We need better strategies to integrate natural resource production and habitat conservation.


Feeding Habitat
1. Some production activities clear or modify native vegetation used for feeding.
2. However, Carnaby's Cockatoos also feed on exotic crops and heath vegetation in mine rehabilitation areas (and backyards).
3. Production landscapes thus contain a mosaic of native and anthropogenic food resources that provide (or restore) feeding habitats, but also facilitate interactions causing mortality (shooting) and economic loss (crop and fruit damage).


Feeding Habitat
Potential Collaborative Research Areas
1. Cropping rotations in silviculture
2. Mitigation of harmful interactions
3. Mine-site rehabilitation prescriptions
4. Native vegetation conservation and restoration in agricultural landscapes
5. Others?
Many of these areas can be addressed by providing input to other research or through cross-disciplinary research.

Breeding Habitat

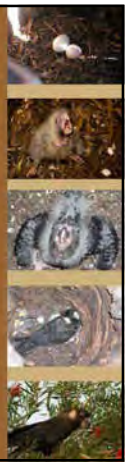
1. Production activities remove large hollow-bearing trees that can be restored in the long-term.
2. Artificial nest boxes provide only short-term **mitigation** as they require continual maintenance.
3. Thus the best strategy remains **conserving veteran trees in place within production landscapes**, along with sufficient food resources to support breeding pairs.



Breeding Habitat

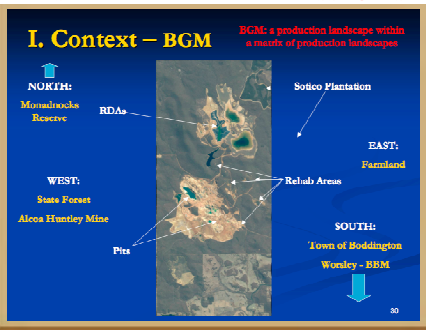
An example from the northern jarrah forest

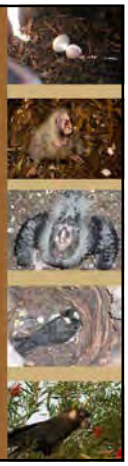
- Bauxite reserves are concentrated along ridges and upper slopes.
- In the northern jarrah forest, large marri and wandoo are often low in the landscape (with exceptions).
- This suggests a cost-effective tradeoff in which bauxite mining operations attempt to minimise impacts low in the landscape (e.g. construction of infrastructure such as haul roads).



Breeding Habitat

A key problem: cumulative & over-lapping impacts



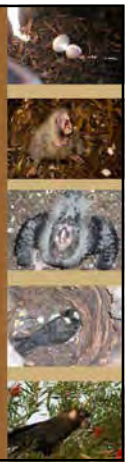


Breeding Habitat

Potential Collaborative Research Areas

1. Factors influencing the incidence of large hollows at a landscape and site-specific scale.
2. Factors affecting nest site suitability.
3. **Forest-wide modelling of hollow availability**
   - existing DEC databases
   - destructive sampling during production
   - ground-truthing
   - integration of other data

Objectives for Production Landscapes:
(1) Identify high-value breeding habitat
(2) Manage hollow-bearing trees



Department for Planning and Infrastructure
Government of Western Australia

East Java Delegation

Selamat Pagi

Cate Gustavsson-Andrianto
Team Leader-State Strategic Policy

Department for Planning and Infrastructure
Government of Western Australia

East Java Delegation

The Town Planning and Environmental Framework in Western Australia

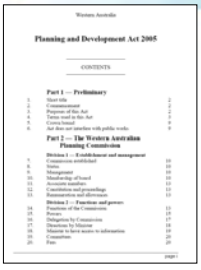
Cate Gustavsson-Andrianto
Team Leader-State Strategic Policy

Department for Planning and Infrastructure
Government of Western Australia

Sustainable Development

- There is an emerging consensus that a more sustainable approach to our environment is required. The way in which housing is located, built and maintained has a profound impact on the environment.
- The governments of Western Australia (State and Local) do this through integrated neighbourhood planning (Liveable Neighbourhoods policy) to include energy, water and transport infrastructure.

Department for Planning and Infrastructure
Government of Western Australia



Planning and Development Act 2005

CONTENTS

Part 1 — Preliminary

Part 2 — The Western Australian Planning Commission

Division 1 — Establishment and management

PROVIDES THE 'HEAD OF POWER' FOR STATUTORY DECISION MAKING

Legislative Framework

Part 2 - Western Australian Planning Commission

Part 3 – State Planning Policies

Parts 4, 5, 6- Region & Local Planning Schemes, Interim Development Orders

Parts7, 8 – Planning Control Areas, Improvement Plans

Part 10- Subdivision & development control

Part 11 – Compensation & acquisition

Department for Planning and Infrastructure
Government of Western Australia

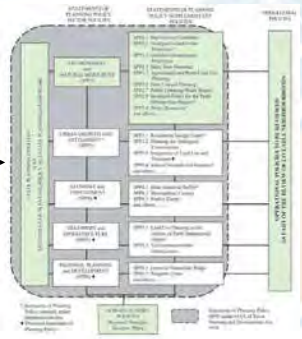
Approvals Framework

Policies	Plans
State Planning Strategy	Network City
State Strategic policies	Regional plans eg MRS*
State sector specific policies	Sub-regional plans eg Corridor plans
R Codes*	Town Planning Schemes*
Operational policies	District structure plans
Planning Bulletins	Local structure plans

Policies and plans may be statutory or non-statutory*

Department for Planning and Infrastructure
Government of Western Australia

State Planning Policy framework



Department for Planning and Infrastructure
Government of Western Australia

OPERATIONAL POLICY

Subdivision assessment under Development Control policies.

Liveable Neighbourhoods being trialled since 2000 as a design and assessment tool for subdivisions and structure plans.

Policy documents provide objectives and guidance.

Department for Planning and Infrastructure
Government of Western Australia

POLICY FRAMEWORK

Eight main Elements:

1. Community design
2. Movement Network
3. Lot Layout
4. Public Parkland
5. Urban water management
6. Utilities
7. Activity Centres and employment
8. Schools

Department for Planning and Infrastructure
Government of Western Australia

Federal legislative framework
DEWHA

The Department of Environment, Water, Heritage and the Arts advises the Australian Government on its policies for protecting the environment and water resources.

Key functions include:
- *Environmental Protection and Biodiversity Conservation Act 1999*
- ecological sustainable development
- greenhouse issues
- international activities and commitments
- water.

Department for Planning and Infrastructure
Government of Western Australia

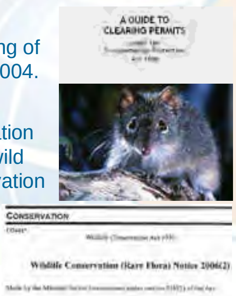
Key objectives include:
- protection of the environment – national significance
- protection and management – natural and cultural places
- promote ecologically sustainable development.

Department for Planning and Infrastructure
Government of Western Australia

State legislative framework
Environmental Protection Authority (EPA)
Department of Environment and Conservation (DEC)

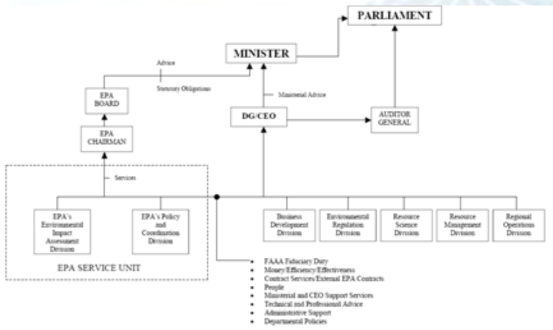
Environmental Protection Act 1986
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Wildlife Conservation Act 1950
- Policy Statement No. 9 Conservation of threatened flora (DRF) in the wild
- Policy Statement No. 33 Conservation of threatened fauna (DRF) in the wild.



Department for Planning and Infrastructure
Government of Western Australia

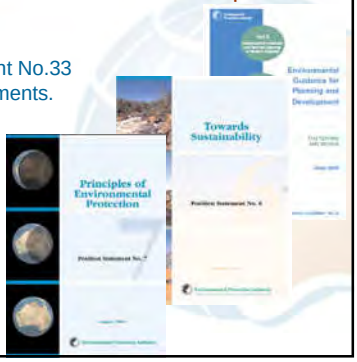
Accountability structure



Department for Planning and Infrastructure
Government of Western Australia

State environmental policies

DEC/EPA policies
- Guidance Statement No.33
- EPA position statements.



Department for Planning and Infrastructure
Government of Western Australia

Environmental planning

State and Regional Planning Division
- The division develops forward plans and policies to ensure land supply, land uses, infrastructure development and services can be successfully delivered across the State, while at the same time seeking to protect the environment and achieve more sustainable outcomes for the community.

State Strategic Policy Directorate
- The directorate contributes to DPI activities to ensure the appropriate balance of facilitating land use and infrastructure planning and development with environmentally sustainable outcomes.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface

Planning steps
- strategic planning
- land zoning or reservation
- subdivision
- development.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface

Planning tools
- strategies
- structure plans
- statutory planning schemes
- policies
- conditions.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface
Strategies

Strategies
- regional in scale
- developed by state government agencies or local governments
- broad land use and development
- long timeframe
- non-statutory
- EPA advice possible under section 16 of Environmental Protection Act.

Department for Planning and Infrastructure
Government of Western Australia

STRATEGIC PLAN FRAMEWORK

Sub- regional plan examples:

North west corridor structure plan sets land use intent, road network, retail centres, industry…. within MRS framework.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface
Structure Plans

Structure plans

- blueprint for future stages of planning
- endorsement by WAPC
- shorter timeframes
- non-statutory
- EPA advice possible under section 16 of Environmental Protection Act.

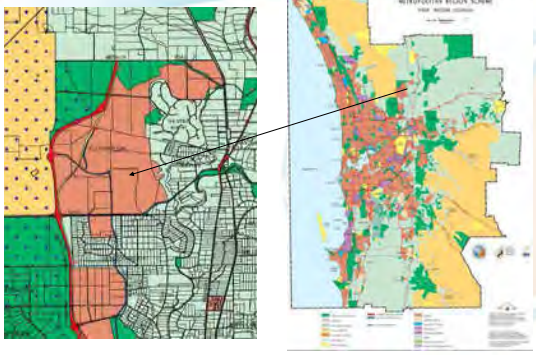
Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface

Statutory planning schemes – regional

- broad zoning scheme
- reservation of land for regional purposes
- WAPC prepares, governor approves
- EPA assessment under section 48A of Environmental Protection Act.

Department for Planning and Infrastructure
Government of Western Australia



Department for Planning and Infrastructure
Government of Western Australia

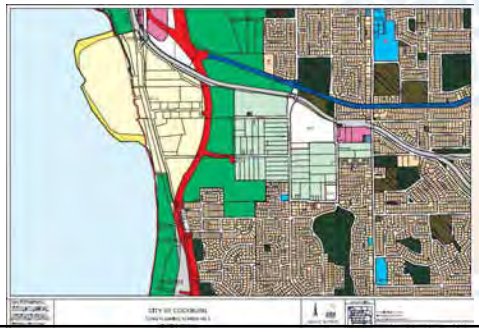
Town planning & environmental protection interface
Local Town Planning Schemes

Statutory planning schemes – local

- specific zoning
- provisions to control and guide land use and development
- local government prepares, Minister approves
- EPA assessment under Section 48A of Environmental Protection Act.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface
Local Town Planning Schemes



Department for Planning and Infrastructure
Government of Western Australia

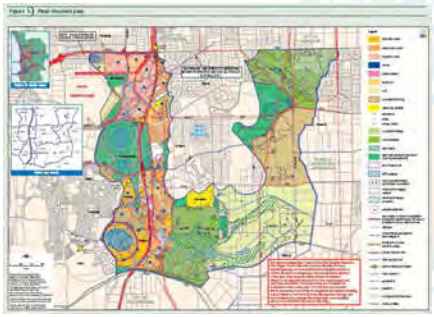
Town planning & environmental protection interface

Statutory planning schemes – local

- Structure plans (district and /or local level) establish road networks, distribution of land uses, centres, open space etc.
- Plan and report.
- Provide the framework for subdivision.
- May have statutory elements.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface Structure Plans



Department for Planning and Infrastructure
Government of Western Australia

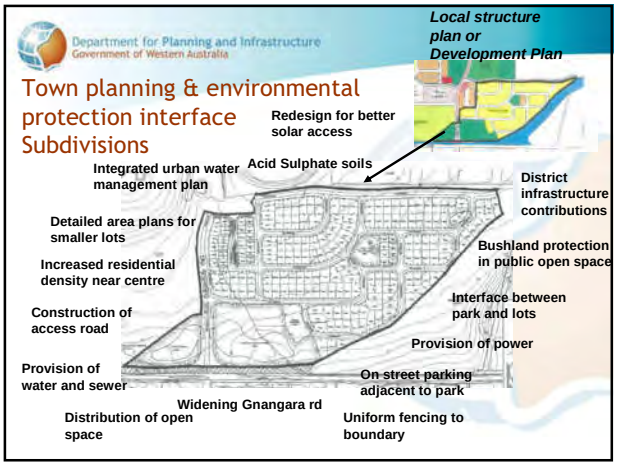
Town planning & environmental protection interface Subdivisions

Statutory planning schemes – subdivisions and development applications

- WAPC or local government
- legal requirement to carry out actions
- examples include provision of appropriate drainage, definition of a building envelope and the provision of public open space free of cost
- EPA assessment under section 38A of Environmental Protection Act.

Department for Planning and Infrastructure
Government of Western Australia

Town planning & environmental protection interface Subdivisions



Department for Planning and Infrastructure
Government of Western Australia

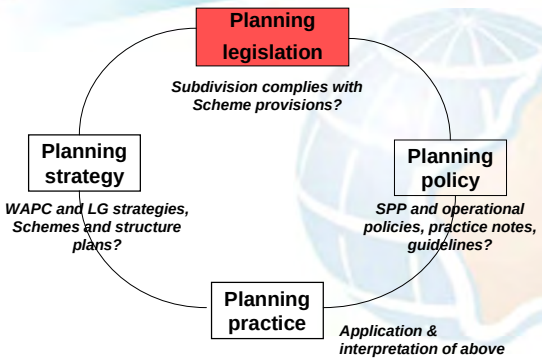
Town planning & environmental protection interface

DPI/WAPC policies

- guide future planning decisions
- State planning policy under part 3 of the *Planning and Development Act 2005*
- strategic policies
- operational policies
- planning bulletins
- EPA advice possible under section 16 of Environmental Protection Act.

Department for Planning and Infrastructure
Government of Western Australia

THE FOUR 'P' S



Department for Planning and Infrastructure
Government of Western Australia

East Java Delegation

Terima Kasih

www.wapc.wa.gov.au

www.dpi.wa.gov.au

cate.gustavsson@dpi.wa.gov.au

Cate Gustavsson-Andrianto
Team Leader-State Strategic Policy