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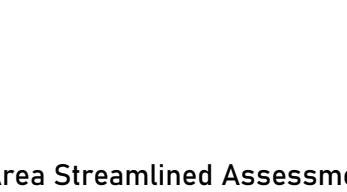
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to read
about me!**

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Cymatoderma elegans

Courtesy of Brian Wilson

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ECA COUNCIL MEETINGS

The ECA Council meet every three months to discuss and deal with any current business of the association. Any member who wishes to view the minutes from any of the ECA council meetings may do so by contacting the Administration Assistant Amy Rowles admin@ecansw.org.au

Message from the President

Dear Members,

ECA Council

By the time you read this message, the newly-elected 2019/20 ECA Council would have met in Sydney for its first meeting (2 September 2019). It is an extremely exciting time for the new council because we have a: full house for the first time in a number of years (all council positions were filled at the AGM on 25 July 2019); greater representation of members from regional NSW; and good mix of new and experienced council members, which augers well for the long-term future of the organisation.

So, I am sure that you all join me in welcoming our new members to council (Stephen Bloomfield, Damian Lacari, Kate Hammill, Joe May and Yogesh Nair), as well as returning council members (Belinda Pellow, Jason Berrigan, Judie Rawling, Adam Greenhalgh, Andrew Lothian, Alison Hunt, Veronica Silver, Narawan Williams and Ashleigh McTackett).

The scheduled dates of council meetings in this current term are 2 September 2019, 2 December 2019, 2 March 2020 and 1 June 2020. We are here to run the ECA and promote best-practice ecological consultancy on your behalf.

If you have any issues that you would like the ECA Council to consider at these meetings, or in the lead-up to them, then please contact us through our tireless ECA Administration Officer, Amy Rowles admin@ecansw.org.au, ECA Secretary, Adam Greenhalgh secretary@ecansw.org.au or, indeed, any ECA Councillor in your neck of the woods. I am also available most times to discuss issues with you, either by email president@ecansw.org.au, phone or, if the opportunity exists, face-to-face.

It would be totally remiss of me not to thank the previous ECA Council. Much of its activity over the last 12 months was in response to changes that resulted from the implementation of the NSW Biodiversity Conservation Act 2016 and the associated Biodiversity Offset Scheme (BOS). This resulted in the ECA having a greater working relationship with the Office of Environment and Heritage, OEH (now in the Department of Planning, Industry and Environment, DPIE) and the Biodiversity Conservation Trust (BCT). Most of this work was spear-headed by Past President Belinda Pellow, who also developed closer ties with the Federal Department of Energy and Environment (DEE) on matters affecting the

ecological consulting industry. The current council will be working to strengthen these ties, to help promote best-practice ecological consultancy and to also meet the needs of our members.

Special thanks to Martin Denny, John Travers, Daniel McDonald and Danny Wotherspoon, all of whom stepped down from the ECA Council this year. They have put in a great amount of time and energy into running the ECA over the years. Their contributions, along with others on past ECA Councils, have developed the foundations upon which the 2019/20 and future ECA Councils can build.

2019 ECA Conference

This year's ECA Conference was held at the Hunter Valley Retreat in Quorrobolong on 25 July 2019. A record 225 conference attendees listened to officers from the Department of Planning, Industry and Environment (DPIE), Biodiversity Conservation Trust (BCT) and Lake Macquarie Council present updates of the NSW Biodiversity Offsets Scheme (BOS) and its application to real-life situations. It was also an opportunity for ECA members, and Accredited BAM (Biodiversity Assessment Method) persons in particular, to give their personal feedback to the government officers in attendance on how they thought the BOS was progressing. A fuller account of the conference is provided in this edition of Consulting Ecology, so I won't go into the details. But I will take this opportunity to thank the DPIE and BCT officers for attending the conference, filling us in on progress, flagging what we can expect in the near future, and for listening to the feedback from other conference attendees. A delegation from the ECA Council hopes to meet with representatives of DPIE in late September or early October to follow through with some of the points raised by government officers and ECA members at the conference. We will let you know how that meeting goes via an ECA Information Email.

Liaison with the Federal Department of Energy and Environment (DEE).

The ECA NSW, along with other ECA state groups and the EIANZ, meets once every six months with representatives of DEE to discuss issues that are relevant to ecological consultancy and the EPBC Act. Over the last 12 months, Belinda Pellow has represented the ECA NSW at these meetings. The next meeting will be held in Canberra on 28 August 2019, and Andrew Lothian will be the ECA NSW representative. Items that will be discussed at this next meeting include: (a) government initiatives to streamline regulation; (b) environmental offset implementation projects; (c) stakeholder engagement projects; (d) the EPBC Act statutory review 2019; and (e) feedback by environmental practitioners on EPBC issues. The ECA Council will provide feedback on outcomes of this meeting to members in due course.

Nest Box Workshop: A Personal Reflection

The Nest Box Workshop, held on 26 July 2019 at the Hunter Valley Retreat was a huge success, with over 80 people attending. Some of Australia's leading experts on the use of tree and artificial hollows by fauna, presented their findings about the design and value (or otherwise) of artificial hollows. The ECA's original idea for the workshop was to kick-start the process for developing guidelines for nest box design for use by ecological consultants.

The workshop took a 90-degree turn very early on in the day when one of the expert panellists indicated that nest box design was not the most important issue when using them to offset impacts. The primary question is: should they be used as an offset in your particular development project? There are growing numbers of data sets that suggest that reliance on artificial hollows can potentially wipe out local populations of threatened species that are

being targeted, especially if the boxes are placed in the environment in very high densities. This is because the nest boxes can also favour predators of the target species, which either use the nest boxes themselves for shelter or learn that they are shelters for their prey species. The range of issues that need to be considered in deciding the viability of artificial hollows as an offset include connectivity of habitat in the landscape, densities of targeted species and predator/competitor species, availability and dimensions of natural hollows in the landscape, location and positioning of nest boxes and artificial hollows, and microhabitat structure.

Therefore, the main recommendation that came out of the workshop was, rather than focus purely on nest box design, consultants, consent authorities and proponents of developments should have a “decision tree” to help them to decide what species (if any) should be targeted (for a specific site and project); if the provision of nest boxes / artificial hollows is a viable option for offsetting at the site; if so, what environmental data need to be collected to determine densities, locations, positioning and nest box designs; and application of those data to reach conclusions about the use or otherwise of nest boxes and artificial hollows. The ECA Council will be discussing with others over the coming months on how best to facilitate this process.

Special thanks go to Narawan Williams for being the driving force behind the workshop, the large panel of experts from universities, government agencies and ecological consultancies for their wonderful advice, and to the audience of consultants, council officers and students which contributed significantly to discussions.

Other Workshops

The Camera Trapping Workshop, run by Dr Paul Meek of the NSW Department of Primary Industries, will be held at the Asquith RSL, 1 Lodge Street, Hornsby. Camera trapping technology has advanced rapidly and considerably over the last 12 months, Paul is a world expert on the subject, so register for this important event now!

The ECA is also planning to run workshops on Native Orchid Identification and Environmental DNA Surveys in 2020. We will let you know more details closer to the events. But if you have ideas for other workshops, then let us know, because the ECA wants to continue to provide professional training opportunities that are of value to its membership.

ECA Facebook Page.

Jason Berrigan has been fastidious in setting up, managing and posting messages on the ECA NSW Facebook Page https://www.facebook.com/NSWECA/?ref=py_c. Please check it out. Jason posts quite a lot of links to stories of interest to members, that either he or other members have come across. There are also a number of closed discussion groups on the Facebook page, some of the more interesting ones include the ECA Accreditors Forum; Microbats: Ecology, Surveying and Call Analysis; Threatened Fauna; Threatened Flora; Bush Regeneration and Vegetation Management Plans; and Passive Infrared (PIR) Cameras. Only a few ECA members have subscribed to the ECA Facebook Page or contributed to discussions, so it would be great if we had a bit more member activity at this site.

Where to From Here?

It's actually quite hard to give a definitive answer to this question when the current ECA Council has yet to have its first meeting, but there has been quite a bit of email discussion between us in the lead up to it. Priority issues

likely to be pursued, and which have not been discussed above, include:

- Exploring ways of improving the content and delivery of Consulting Ecology by appointing an editor and encouraging members to contribute more material for publication.
- Ongoing liaison with environmental government agencies to help promote best-practice ecological consultancy and management in line with the expectations of our members.
- Encouragement of members to become Certified Practising Ecological Consultants (CPECs) under the ECA's certification scheme. Promotion of this scheme was put on hold while the NSW Government's BAM Accreditation Scheme was being set up. However, the current ECA Council will be promoting its own CPEC scheme, with the purpose of certifying individuals who have a range of ecological consultancy abilities that extend beyond the BAM process.

Okay, until next time, that's all folks. Happy consulting!

Dr Stephen Ambrose
ECA President.

PHOTO COMPETITION

Brian Wilson (ECA journal editor) entered a photo into the competition, as one of these was anonymously selected there is no winner this edition.

Thank you to everyone who entered our photo competition. All entries have been included in the ECA Photo Gallery on the back cover

Email your favourite flora or fauna photo to admin@ecansw.org.au to enter a competition and have your photo on the cover of the next ECA newsletter.

Win your choice of one year free membership or free entry into the next ECA annual conference. The winner will be selected by the ECA council. Runners up will be printed in the photo gallery. Please ensure that your photo is clear with a high resolution.

Photos entered in the competition may also be used on the ECA website

FOR SALE / WANTED

If you have 2nd hand ecological equipment that you would like to sell or would like to purchase you can place an ad in this newsletter. Free for members or \$40 for non-members. Contact admin@ecansw.org.au.

EUROKY

Euroky: ability of an organism to adapt to changes in the environment

If you have any interesting observations or useful hints and information that you would like to share in the euroky column, please forward them to the newsletter editor or administration assistant to be included in the next edition.

HAVING PCT'S REMOVED FROM SPECIES ASSOCIATION

Andrew Lothian

From a recent correspondence with LMBC, it appears you may be able to add/remove a PCT association to/from a species. If you feel this might be the case or something worth pursuing please contact bionet@environment.nsw.gov.au.

Figure 1: Location of monitoring site within landscape of cleared pine plantation. Cliffline habitat can be seen to the southeast, east and northeast.



LARGE-EARED PIED BAT ACTIVITY AND BUFFER ZONES

Andrew Lothian

During regular monitoring surveys on Newnes Plateau in April this year, we came across an interesting find. An Anabat express was deployed for two/three nights at one of our regular sites which is now situated in a narrow Newnes Plateau Shrub Swamp located wholly amongst recently cleared pine plantation (within last 5 years). On the first night, only a few passes were obtained for the Large-Eared Pied Bat. This has happened on and off for a number of years. On the second night, over 100 passes were recorded over a period of 7 hours (18:44-01:59). This kind of prolonged activity would usually be used as justification to assume roost presence in the vicinity. Only one problem with this: the area contains no rocky habitat. The nearest cliffline habitat is 1.3km across open ground (Figure 1).

The swamp in question does connect to large areas of native vegetation with rocky canyons, but this is over 2.7km downstream (2.2km as the crow flies). For any who consider the 2km threshold in the recent bat survey guidelines/BAM as overly cautious, it is clear this species can make use of foraging habitat in excess of this figure. It is also important not to rule out areas of rocky habitat that may seem isolated from a development site, as the species may be traversing open areas to get to foraging locations.

LARGE-EARED PIED BAT ROOST LOCATIONS

Andrew Lothian

Attached below are a series of photographs taken of Large-eared Pied Bat roosting locations in a breeding area currently being monitored. Hopefully it will show people that you do not need large cliff lines, big holes or super dark areas to form habitat for the species.

Roosts can be in typical big dark zones amongst boulders or collapsed cliff lines.



Or can simply be in the roof of hollowed out boulders (not big enough to show up on topographic mapping), head height, amongst small honeycombed holes in sandstone.



Honeycombing in roof/walls of overhang, doesn't have to be a dark zone.



Sometimes it can simply be a long slit in exfoliating sheets of sandstone.



Can be in tall cliff lines with flaking sheets or honeycombing.



HOW TO ADDRESS SPECIES CREDIT SPECIES IN SMALL AREA STREAMLINED ASSESSMENTS

Andrew Lothian

In Michelle Cox's presentation at the recent ECA annual conference, there was mention of how non SAIL Species Credit Species are not required to be surveyed for under the small area streamlined assessment (unless they happened to be seen on site during the site/plot visit). This appears to be news to many of us as it is not worded explicitly in the method. The relevant clause is in Chapter 6 of Appendix 2 Table 13: "Appendix 7 – Identify if any threatened species on the candidate species list that is established at Paragraph 6.4.1.16 in Step 2 are in the very high sensitivity to gain class according to Table 21 and information in the Threatened Biodiversity Data Collection". Apparently we were meant to read that as exclude non-SAIL species from target survey. The rationale for this was explained by such small areas being unlikely to form significant habitat for the non-SAIL credit species. Thus the loss of such a small amount of habitat would be insignificant. This is odd in that the minimum area threshold varies due to the size of the lot. Why a particular piece of 1.5 ha habitat is insignificant on a lot of 40 or more hectares, but not on a lot of less than 40 ha is unclear. Why is 1 ha of native vegetation and threatened species habitat valued differently depending on the size of an arbitrary planning boundary?

DPIE were going to release a note on it with various other updates. These have been held up. Apparently, there will be a release soon that will explain how to deal with this in the calculator. Currently the only option for treating species surveyed at section 5 of the calculator (even within the streamlined module) is to select from the following options: "Yes surveyed", "yes expert report", "yes assumed present", "no surveyed" and "no expert report". It is unclear whether DPIE would like us to rule the species out by selecting "no" for habitat in section 4 of the calculator, or select "no surveyed" under section 5. Now that there has been an amendment to the calculator it is possible to select the box "survey month outside the specified months". Is this the appropriate way to deal with small area

assessments? Hopefully clarity is not the carrot dangling from that stick I can see in front of me.

WHEN IT'S A GOOD IDEA TO TELL PEOPLE WHERE YOUR CAMERAS ARE

Jason Berrigan

Infra-red cameras are a 'go to' survey tool these days, particularly for targeting arboreal mammals like the Squirrel Glider and Brushtailed Phascogale, which are listed as Species Credit species under the *Biodiversity Conservation Act 2016*. While initially acquiring two Scoutguards and two Reconyx HC600's back when the Australian dollar was highly competitive with the US dollar, I'd seldom used them, as the market drove habitat evaluation and predictive occurrence as the preferred assessment method. With the pendulum swinging the other way, and massive cost savings for proving a Species Credit species is absent via effective survey, I've since invested in 40 Reconyx Hyperfire 2.

I've invested in the Reconyx as the HC600's never failed to take photos, are reliable, and also took very good photos, even at close range (50cm), especially compared to the glaring infra-red flash of the Scoutguard which obliterates all recognisable features unless a meteorite with a bushy tail had chanced to strike your bait station. The Scoutguard's have also outlived their life expectancy and now reside forgotten in my shed or pretending to work as a thief deterrent at the end of my driveway (the "smile for the camera" sign negates the need for batteries or memory card).

Investing into this technology is not cheap of course, and unfortunately, camera traps have two predators.

The first and most insidious, is people (*Thievis bastardus*). We've all heard those horror stories of long term monitoring projects where months of data has been lost due to some twit breaking open a security case to steal batteries and a memory card; or those really creative souls using petrol-fuelled metal saws and 4WD winches to remove cameras from metal security boxes which would make Ned Kelly blush, just because they might identify their weekly irrigation activities on their private horticultural enterprise. Or they really, really need 12 AA batteries for a life-saving emergency.

Most of my camera sites aren't likely to be subject to more than a month of monitoring or habituated by

Colombian drug dealers, so I've taken the minimum necessary precautions and bought python cable locks. My tip: buy them from Amazon in bulk and get them with the same key (they will have the same code stamped on them). This will save taking 40 different keys for 40 different locks, thus avoiding the dreaded role of a Dungeon's and Dragon's keymaster when preparing for a survey. Not only will you have 79 spare (they come with 2 per lock) in case you lose one, but you'll avoid that frustration of shuffling through all 40 possible keys while precariously hanging off a ladder as you probe the lock which always ends up on the opposite side of the tree.

The other enemy of cameras is bushfire. The best example (so far) of course is the loss of dozens of Reconyx cameras deployed by the Australian National University as part of research on (ironically) fire regime and military training on the Beecroft Weapons Range in Jervis Bay. A prescribed burn several kilometres away got just a little out of control (burnt over 4000ha), massacring the innocent cameras and incinerating valuable data, as demonstrated in this graphic photo below.

Figure 1: A victim of the Beecroft "controlled burn" 2017



I recently learnt an expensive lesson on a simple job: sometimes it is a good idea to let people know where you have installed a camera.

In this situation, I was assessing the re-development of a motel adjacent to a golf course, industrial area and residential caravan park. Not the place you'd expect fire, but I did not take serious consideration of the stockpile of greenwaste, plastic chairs and other motel

debris when I installed one of my HC600's in a Tallowwood about 8m away from said pile.

Fast forward three weeks and I return to collect my cameras. All good until I get to the last one. Absentmindedly I note the stockpile has been burnt. And what a burn. I'm sure there were concerned calls to emergency services in Hiroshima about the glow when that went up. The nearby line of Black Oak along the former boundary fence were present as charred skeletons only. The large Blackbutt about 10m to the right has canopy torch 25m up.

And the Bloodwood and Tallowwood I had a camera and bait station on opposite respectively, well, it looks like radiant heat from the minor white dwarf implosion has led to spontaneous combustion of the rough bark on the trunk. Expletives were uttered aloud as I approached the scene of the crime with a lead weight sinking my stomach into my pelvic girdle.

Much use of expletives. On the plus side, the cut proof cable 'survived!

So, the takeaways from this experience:

- Duly consider the risk of fire when setting out PIR cameras, especially when deploying cameras over a significant area of fire-prone bushland with significant limitations on being able to undertake an emergency rescue in the event of fire.
- Consider insuring cameras if deploying a lot of them in a fire prone area. The longer you leave them out, the higher the risk. Set out cameras in summer and late winter at your own risk.
- Notify any relevant person who may consider lighting a fire (eg. for fuel reduction) on the property, and ideally neighbouring properties. Provide your contact details so they can call you in the event of a fire.
- Install the RFS *Fires Near Me* app on your phone, and monitor daily.
- Lack of consideration can be a catastrophic disaster in terms of lost data and economic loss (and contract commitments!). Consider where you install them and what the fire risk could be according to the situation, season, drought, arson, etc; and how you may be alerted to a fire event and rescue your cameras.
- Have a plan for emergency evacuation, but do not put yourself or anyone else at risk. Cameras are replaceable: lives are not.
- Sometimes, it is a good idea to let people know where the cameras are, even when they may be comparatively safe. They may be the one who says "Better not burn off Bob, that ecologist fella has some

expensive gear in there."

- Don't let language barriers prevent you from ensuring the right people are aware of the fact the equipment is expensive and the data important.



Figure 2: The scene of the crime – camera was on tree in centre



Figure 3: This was all that was left of a faithful hard-working friend after the premature Viking funeral



Figure 4: Cable lock with post-traumatic stress and unable to work again.

HAND HELD SPOTLIGHTS FOR NIGHT FIELD SURVEY

Danny Wotherspoon

Hand held spotlights are specified for night field survey for nocturnal fauna. The requirement is taken as a 12 volt 30 or 50 Watt halogen bulb.

“A minimum of 30 watts of power must be used for open forest and woodland environments. In tall or closed forests, particularly along the Great Dividing Range and coastal ranges, a minimum of 50 watts of power must be used (preferably with a gel filled 12 volt battery).”

DEC, 2004, *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*, New South Wales Department of Environment and Conservation, Hurstville, NSW.

So far the options are generally weighty, with limited battery life.

For example the Lightforce hand held spotlight is very light weight but requires a 12v gel cell battery weighing 3.4 kilograms. For an extended walk I usually carry a spare so my load is a heavy backpack plus hip mounted active battery carrier. A litre of water and chocolate fuel adds to the load. One diminishes more rapidly than the other.

To get four hours light from a battery has the further issue that a gel cell or lead acid battery is damaged once the charge is drained to below 80% of capacity. The colour of light emitted also goes from white to yellow, or as the advertisers say, “warm white”.

Now that LED lighting has arrived hand held torch lighting has burst onto our screens as “must-have” and “military grade” and “top secret battle field technology”. Attendant claims are for extreme light outputs that would ignite a bushfire at hundreds of metres and blind a fox on a distant hill.

The simple idea would be to get a light weight hand held light that is equivalent to the 12v 50W halogen bulb. I have been investigating this for a while now but

have not been adequately illuminated. A request to public service officers at OEH fell on deaf ears – no response, too hard?

The Mirabella lighting company has recently published data (Table 1) for halogen bulbs of various wattages in lumens output. That enables us to consider LED torches, all of which are marketed with output measured in lumens. Given that the OEH standard is 30 and 50 Watt halogen bulbs, the equivalent performance in lumens will be say 500 and 800 lumens.

There are two main contenders as best in market LEDs for the portable and spotlight application, being Lumileds and CREE. In spite of email requests such companies are unwilling to engage in conversation with a naïve end user at the other end of the planet, so we rely on published data.

The new version of Lumiled V (as opposed to the previous product) claims an output of 1700 lumens, which will satisfy field work requirements in a hand held torch. However the technical data sheet specification only shows a ‘typical’ maximum 580 lumens (if I read the data sheet correctly).

There are various CREE LED models, all of which have different performance characteristics. The minimum outputs range from 342 to 920 lumens and maximums range up to 1,987 lumens.

Digging deeper, one finds that the maximum possible outputs claimed can only be sustained for a few seconds or perhaps one hour, so the minimums are a better guide.

Torch manufacturers boast of LED efficiency at low and high settings, torch efficiency (mA per lumen per hour) at maximum setting, claimed maximum run of the torch time at maximum setting (hours) and ultimately a claimed light output in lumens (Table 2). The mode settings such as High, Medium and Low can be regarded as equivalent to a dimmer switch for OEH requirements.

Table 1: Light output of halogen bulbs in lumens

Product	GLS hal-ogen	GU10	GLS hal-ogen	GLS hal-ogen	GLS halogen
Wattage	28	35	42	53	72
Lumens	360	500	600	800	1150

Table 2: Claimed performance of Nitecore P30 Flashlight (1000 Lumens)

Mode	Output	Runtime:
Turbo:	1000 Lumens	1 Hour
High:	400 Lumens	3 Hours
Medium:	220 Lumens	5 Hours
Low:	70 Lumens	17 Hours
Lower:	1 Lumen	680 Hours
Beam distance	618 metres	

As a rough guide it appears that the claimed output is the maximum possible so is probably twice or triple the actual sustainable output. Since we need 800 lumens and have that sustained for two to four hours, the torches to consider would have claimed output of 1,600 to 2,400 lm. An example is the Nitecore EA81 torch with CREE XHP50 LED which claims 2,150 lumens. The Jetbeam BC40-GT uses that LED, emitting a maximum 2,750 lm for 2.6 hours and 1,817 for 4.4 hours. A new Jetbeam model, the BC40 Pro emits maximum 2,930 lm for 2.6 hours and 1,817 for 4.4 hours. Those times are suitable for a night of spotlighting and two spare AA batteries are light enough to not notice in the backpack.

Retail sales representatives have so far in my experience been universally unable to grasp the concept of light output. They wax lyrical about reflectors and beam, with the startling concept that light will travel for 800 metres and even up to one kilometre. So much for how starlight, or even sunlight manages to get to us here on earth.

Here is an example enquiry that I have made to a supplier:
“I am trying to reconcile the CREE MT-G2 product performance with the torch Jetbeam WL-S4 performance claim of 1140lm for four hours. CREE has three models of MT-G2 and five temperature ranges, all with different outputs, ranging 560 to 920 lm. I need absolute minimum 800 lm guaranteed to comply with government specification. More is better.”
The supplier did not respond.

Another key parameter is mass of the unit with batteries included. I don’t like the idea of carting 500 grams around at the end of one elevated arm and binoculars on the other. The higher the light output, the greater the mass of the torch in most cases.

However in the relevant output range with the CREE XHP50 LED the torch plus battery mass ranges from 151g for the Armytek Viking Pro v3 (option red filter), Jetbeam BC40-GT at 260g, Jetbeam BC40 Pro at 338g to 496g for the Nitecore EA81.

What about the old favourite, Lightforce? The Lightforce Enforcer with an unidentified Lumileds LED is 450g and price starts at \$270 but they do not reveal light output. There is thus no basis for assessment or comparison.

Most torches are small, with a small reflector, making it easy to pack but easy to lose. The Lightforce range has a 170mm reflector making it bulky, taking storage space, but easy to find when you put it down.

Eyeshine varies according to species and the wavelength of light from a torch may reflect differently from different LEDs. Even so, a red filter is advisable for extended viewing where an animal needs to be identified with binoculars. Some torches, such as LightForce, Armytek and Olight, come with an optional red filter.

The Verdict

I have bought a Jetbeam BC40 Pro for \$280 including charger and spare high capacity batteries. Watch this space for a Review. Anybody is welcome to share their experience on this matter.

GRASSLAND EARLESS DRAGONS IN NSW

Gerry Swan

It’s all changed! The earless dragons (genus *Tympanocryptis*) in NSW were a fairly stable bunch and probably not hugely exciting. Swan, Sadlier & Shea (2017) record four species (*Tympanocryptis lineata*, *T. pinguiicola*, *T. tetraporophora* and an undescribed species resembling *T. intima* which they called *T. cf intima*).

In 2019 Melville *et al* did some very detailed taxonomic research on the earless dragons from Canberra, the Monaro Plains and Bathurst. The species in the ACT had been known as *T. pinguiicola*, the same species as found around Melbourne. However Melville *et al* found that the Canberra animal was in fact *T. lineata* and all the animals in NSW, SA and Vic, previously

known as *T. lineata* are a group of four undescribed species. At the present time they are known simply as *T. cf lineata* until they are formally described.



Tympanocryptis lineata, Canberra

T. lineata was described in 1863 by W. Peters from a specimen collected by Dr Lhotsky in 1834. No collection information was attached to the specimen other than 'New Holland', however Lhotsky was in both the Canberra and Monaro Plains regions during his explorations. According to Melville *et al* the specimen appears most similar to the earless dragon in Canberra which means that the Canberra earless dragon is now *T. lineata* (Canberra Grassland Earless Dragon) with *T. pinguicolla* (Victorian Grassland Earless Dragon) restricted to the Melbourne area. As the last confident sighting of *T. pinguicolla* was in 1969 it is quite possible the species is now extinct.

The animal on the Monaro Plains is also a separate species and has been described and named *T. osbornei* (Monaro Grassland Earless Dragon), while the animal from Bathurst is now *T. mccartneyi* (Bathurst Grassland Earless Dragon).

All three species are small, cryptic and difficult to detect. They are only known from very restricted areas and they appear to have either declined over their ranges or have become less detectable. The grassland earless dragons as a whole are very cryptic. During a gas pipeline installation in Qld Steve Wilson and I found several earless dragons in the trench over several days, all in just a small area. We both searched

the adjacent areas of grassland very thoroughly on several occasions but without success. We tentatively recorded these as *T. lineata* but they turned out to be a new species, *T. wilsoni* (Roma Earless Dragon).

Identification could be a bit of a problem. At present if it is an earless dragon from Canberra then it is *T. lineata*. If it is a specimen from the Monaro Plains then it's *T. osbornei*, and if it was found around Bathurst it is *T. mccartneyi*. In all cases you should try to get some photos for positive identification because no-one is going to believe you without some evidence.

So there are now six known species recorded in NSW:

Tympanocryptis cf intima (Smooth-snouted Earless Dragon)

Tympanocryptis lineata (Canberra Grassland Earless Dragon)

Tympanocryptis cf lineata (Lined Earless Dragon)

Tympanocryptis mccartneyi (Bathurst Grassland Earless Dragon)

Tympanocryptis osbornei (Monaro Grassland Earless Dragon)

Tympanocryptis tetraporophora (Eyrean Earless Dragon)

References.

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Swan, G. Sadlier, R. & Shea, G. (2017). A field guide to reptiles of New South Wales. Third edition. Reed New Holland , Sydney.

Tympanocryptis osbornei, Monaro Plains



WOMBAT TUNNEL UNDER A FENCE: A SOLUTION TO DAMAGED FENCES

Dr Tony Saunders

Grabine & Foggs Crossing Landcare Group, February 2019

Wombats will burrow under fences and create holes that are then used by other animals. Blocking a hole serves as only a short term solution as the Wombat will usually dig another hole next to the blocked hole and will continue to do this after subsequent holes are blocked.

The holes made by Wombats under our fences are then used by Kangaroos, Wallabies and feral Goats to get onto the property. A common recommended solution has been the construction of a heavy flap gate at the site of the hole in the fence that only Wombats should be able to use. I have looked at several designs for these heavy gates and they may be more effective for preventing Wallabies and Kangaroos from moving through a fence, but I think that goats would be able to use them.

I thought that another approach may be worth trialing and decided to build a tunnel for the Wombats at the site of their hole through the fence and then to monitor the tunnel with a wildlife motion detection camera to see if the Wombats would use the tunnel rather than dig another hole.

The tunnel proved to be very successful and was used only by the Wombats. Several other mammals attempted to use the tunnel but could not. We now have 4 tunnels around our fence where Wombats had previously made holes. The first evidence that they were being used were Wombat droppings at the entrances to the tunnels, possible due to disputed ownership. Use of the tunnels was confirmed by the motion camera and since their construction I have had far fewer goats getting onto the property.

The materials and a photo of the tunnel are shown below:

Materials:

- 1.5 m length of poly drainage pipe of 30 cm diameter (can be 45 cm if needed)
- 2 m length of 30 cm wide chicken wire netting
- 2 star pickets
- Fencing wire



The two star pickets were used to secure the poly pipe by fitting them between the external ribbing on the pipe and running some fencing wire between the pickets over the top of the pipe. This prevents the pipe from both sliding and lifting. If the pipe has a smooth surface on the inside, especially if the pipe is on a slight slope you will need to line the inside bottom of the pipe with wire mesh so that the surface is not too slippery for foot traction while moving through the tunnel. The wire mesh was cut so that it was slightly longer than the pipe so that it could be folded back under the pipe and secured between the external ribs near each end with fencing wire.

The 1.5 m length was chosen to make sure that only low animals that could walk through that length could use the pipe tunnel. This gave me 4 convenient lengths from a 6 m length of pipe. The pipe diameter was selected to be 30 cm as small kid Goats would probably be able to use the next size up at 45 cm. Our Wombats were a reasonable size and were able to use the 30 cm diameter pipe. You would probably need the larger size if your Wombats are very large.

The photos below show 2 different Wombats (different markings could be used to distinguish them in other photos). Despite their large size they seemed to have no trouble using the tunnel.



Fox and small Pigs would also be able to use the tunnel but despite 2 months and about 800 photos no evidence was found of either animal using the tunnels. A Fox can easily scale a fence and would not generally dig a hole to get under a fence. Pigs can do considerable damage to fences so perhaps it would be better if Pigs would also use the tunnels to move through the landscape.

My main concern was to ensure that goats could not use the holes created by the Wombats before the tunnels were installed. At the hole where the first tunnel was set-up, 8 Goats of various ages had passed under the fence one after the other where a Wombat had already passed.

Wallabies did attempt to use the tunnels but were not successful. In the photos below a Wallaby was seen to attempt to enter the tunnel and then give up.

CAMERA TRAP WORKSHOP

The ECA held a camera trap workshop on the 19 September with very positive feedback from the day. A huge thankyou to Paul Meek for presenting on the day and sharing his vast amount of knowledge on the subject. Paul generously donated his time which allowed us to run the course at a low attendance fee.

Andrew Lothian would like to share the important points that he gathered on the day.

1. Don't use camera traps just to save time if another method is better for your intended target species (see recent paper by Gillespie in Wildlife Research)
2. CLEAN YOUR CAMERA LENSES. These things require maintenance. From personal experience, once the Fresnel Lens (funky patterned sensor cover) is broken camera is as good as dead, though you may be able to send back to manufacturer. Take care, particularly in transit
3. READ YOUR CAMERA MANUAL. Here you will (hopefully) find information on sensor zones and functionality. Some cameras have a mismatch between the zones of detection and the field of view of camera (you might be getting triggers outside field of view, or animals in field of view not triggering)
4. If doing more than just presence/absence, need to look at complete STANDARDISATION of camera models when looking at occupancy rates or abundance estimates, as sensors and animal responses may differ between camera makes and/or models
5. You may be able to bulk program some cameras with software program, ask manufacturer
6. In terms of SURVEY EFFORT, you need to tailor to your target species. As a general rule use at least 1 camera per 1 target animal home range. Paul uses 30 cameras minimum. Jason Berrigan made a great point of matching camera trap nights to draft survey guidelines existing survey effort (i.e. if you are putting out 25 Elliotts for 4 nights, you would need to substitute with 100 camera trap nights, if choosing cameras instead)
7. Look at using a minimum of 30 nights, the longer the better though
8. SEISMIC sensors may be better triggers for arid zone work where ambient heat and hot backgrounds cause issues with heat-in-motion triggers
9. TIME LAPSE is good for species that will spend heaps of time in front of camera, or reptiles who don't have the heat signature to set off heat-in-motion sensor
10. ACTIVE sensors could prove useful for reptiles, burrowing species and nesting birds
11. VIDEO mode may be needed for hopping mice who are in and out of the field of view really quick
12. Some cameras have SMS and VHF back to base functions for live viewing
13. Check to see how the ILLUMINATION functions. Reconyx have a sensor to judge target distance and scale flash intensity accordingly, others may need baking paper put over LED's to dial back the light intensity to stop flare
14. Animals may respond to camera traps in different ways at different times of year (i.e. if young are present they may be more cautious). This may come into ethical considerations and timing of deployment.

15. TEMPERATURE affects sensor functionality so could impact on your study. I button temp loggers may help to see what time of day you are likely to be missing triggers as the background/ambient temps match the target species temp
16. Want to AIM for target species eyes, nose, ears and anus. These are the hot spots that will trigger heat-in-motion sensor. Chest/body next best thing
17. Cork tiles can be used to provide a uniform temperature BACKGROUND for both vertical mount pitfall camera (see Dustin Welbourne's papers) and horizontal mount. Logs could perform the same function
18. You may be able to adjust the FOCAL length/zoom of the camera lens in some models like Reconyx, or ask the manufacturer to set for you if you have a particular target species in mind
19. Cameras up high may alleviate risk of THEFT but get no animals. Python locks can be severed by machete. Self insure or insurance company??
20. Best deployment arrangement is 0.3-0.5m above ground level, at an angle of 23 degrees to path of animal travel, camera set for 5-10 rapidfire photos per trigger, no delay between bursts
21. For native species don't place randomly. Use the same microhabitat variables you would use if you were trapping
22. BAIT – chicken wings for quolls, jam or Peanut Butter sandwiches for bandicoots/potoroos, Lucerne for rock wallabies (beware of biosecurity issues you may be introducing), normal Elliott bait for everything else
23. If using lures, simple bait holder can be made with metal mesh septic vent caps, 50mm PVC pipe and a push on cap, screwed to stake, or held down with a large thick tent peg
24. Be aware that camera can become a LURE themselves as they create behavioural responses via trigger noise and various forms of flash
25. It is likely you will need WHITE FLASH to identify native rodents for inventory surveys
26. Auto identification software has a way to go yet (same as for bird and bat calls) – Classify Me. Some work is being done on facial recognition and pelage signatures
27. Other SOFTWARE to help = RENAMER for renaming files in bulk, and EXIF PRO for tagging photos for use in database
28. Alkaline BATTERIES lose functionality quickly (especially in low temps). Use NiMH. Lithium are another option – expensive and single use, but last a LONG time
29. Go to Trail Cam Pro website (US) for reviews and how to videos. Also check out Paul Meek on youtube
30. Privacy law if filming animals, Surveillance laws if filming cameras being stolen. If get people on cameras, either delete or hand over to police etc and delete your copy.

Andrew Lothian

Principal Ecologist/Director, Biodiversity Monitoring Services

ECA Treasurer

ECA 2019 ANNUAL CONFERENCE & NEST BOX WORKSHOP

BREAKDOWN OF ATTENDANCE AND THOUGHTS

Judie Rawling

UBM Ecological Consultants & ECA 2nd Vice President

Information received from Amy Rowles identified some 235 people attended the ECA's annual conference and nest box workshop at the Hunter Valley Retreat at Quorrobolong on the 25 July and 26th 2019; the largest conference attendance in the history of the ECA.

Of those who attended, there were:

- 37 representing government or quasi-government departments (including 2 universities)
- 27 came from local government; and
- 138 were from private consultancies.

The main theme of the conference was "BAM Assessment and Stewardship Site Management", and included presentations by government officers from the former Office of Environment and Heritage, OEH (now in the Department of Planning, Industry and Environment, DPIE), Biodiversity Conservation Trust (BCT), and practitioners of biodiversity offsets. The Nest Box Workshop was held on Day 2. With 124 people attending, this proved very popular too.

It was clear that many, if not all delegates at the conference had significant concerns about the fundamental legislative and systemic inadequacies of the NSW biodiversity offset scheme. Judging by the numerous in-depth conversations seen to be taking place, and as most of the presenters made themselves available to discuss issues and concerns during the tea breaks, over lunch or during the conference dinner, it is clear that the conference provided an excellent opportunity for delegates to discuss their concerns with the government representatives. While many of us may not have received the answers we had hoped for, at least the main issues and our concerns were brought strongly to the attention of the government presenters.

Given the large number of delegates attending the conference, It is quite clear that the application of the BAM Assessment, preparation of BDARs and other new applications required to support the Biodiversity Conservation Act and other new legislation is a major cause of concern for our own members and other environmental consultants. This conference topic was clearly a winner.

The ECA is constantly trying to find ways of improving communication channels between DPIE and our members. The forecast demise of the LLBC unit is also causing some disquiet. *Consulting Ecology* is one platform aimed at encouraging discussion and providing support between colleagues. You can do this by contributing a short article, sharing problems experienced, or even just by posing questions – hopefully someone will know the answers.



CONFERENCE ABSTRACTS

Welcome to Country

James Wilson-Miller,

Wonnarua Elder

James Wilson-Miller, now retired, is a direct bloodline descendent of the Gringai Clan of the Wonnarua Nation in the Hunter River Valley, NSW. He retired as curator of Koori History, Culture and Design at the Powerhouse Museum, Sydney for the last 18 and a half years, prior to his retirement - a position secured in the context of a national selection. He was one of Australia's most experienced Aboriginal tertiary teacher educators, having taught full-time as a teacher educator in Universities for over a decade. He is an experienced researcher being a respected and well-known Koori historian and the author of the once best seller, 'Koori: A Will To Win'. He contributed 3 chapters to a prestigious teaching textbook, *Teaching The Teachers*, published by Allen and Unwin in 1999. *Teaching The Teachers* was upgraded and published as *Teaching Aboriginal Studies* 2011. In September 1998, he became the first Aboriginal historian to give the prestigious annual History Council address. He was extensively involved in developing and documenting several university Aboriginal Studies policies and courses of high repute including an Aboriginal Studies two semester sequence for undergraduate students at the University of New England, an Associate Diploma in Aboriginal Studies, and an Aboriginal Studies course for the Australian Army. He was employed by the University of New South Wales as the Assistant Principal Consultant on the "Teaching the Teachers: Indigenous Australian Studies Project of National Significance". His role has involved consulting with a nationally representative project team to devise, develop, resource, and implement a mandatory undergraduate Aboriginal Studies subject for Australian student primary teachers. His expertise as a teacher educator is frequently sought from education authorities. For example, he has served as a member of the Board of Studies NSW syllabus writing committee for the Years 7-10 syllabus and Years 11 & 12 Syllabus. He was also a member of the Aboriginal Studies Examination Board. James Wilson-Miller is also experienced at working with Aboriginal people and is respected by Aboriginal Elders, educators, and community members as well as his non-Aboriginal colleagues. He was a member of the NSW Centenary of Federation History and Civics Committee, NSW, the former President of the national Aboriginal Studies Association, Former President of the Aboriginal Education Council of NSW Inc, was a former President of the New South Wales Aboriginal Education Consultative Group of Southern Sydney. He has represented his people at local, state, and national levels with the Aboriginal Arts Board of the Australia Council, a former ATSIC regional Chairperson and an Aboriginal Hostels Ltd director and at international levels, representing the City of Armidale at the 1994 Glistening Waters Story Telling Conference in Masterton NZ. He was a member of the Centenary of Federation Parade Committee and the Federation Indigenous Grants Committee and was awarded the Centenary of Federation Centenary Medal for Services to the Community. In the past 18 and a half years, prior to his retirement in 2014 he had curated and co-curated more than twenty permanent and temporary exhibitions, taking one to China in 2005. His last exhibition, *Yenalung Yenu: Women' Journey* was opened by the former State Minister for DOCs and now Federal Member for Barton, Linda Burney and the then Powerhouse Director, Dr Dawn Casey. He's most recent exhibition, *Koori Arts Expression* ended in January 2014. He is now a Senior Elder of the Gringai Clan of the Wonnarua Nation and an Acting Director of the Wonnarua Nation Aboriginal Corporation and a member of the Wonnarua Elders Council.

Large-footed Myotis (Myotis macropus) roost selection in concrete culverts

Vanessa Gorecki^{1,*}, Stuart Parsons¹, Ramona Maggini¹ and Monika Rhodes².

¹ School of Earth, Environmental and Biological Sciences, Queensland University of Technology, Brisbane, Queensland 4001, Australia. ² Fauna Surveys on the Wing, Forest Lake, Queensland, 4078, Australia.

The large-footed Myotis, *Myotis macropus*, is Australia's only fishing bat. This species has adapted to living and breeding in urban areas and has been recorded roosting in concrete culverts under roads. However, little is known about the roosting ecology of bats which use these unique roost sites in Australia. We investigated *M. macropus* roost selection in Brisbane, eastern Australia. We developed a stratified sampling design to test which

landscape and structure attributes most likely account for the presence of a bat roost in a culvert. A total of 303 concrete culverts were inspected for the presence of roosting bats over the summers and winters of 2017 and 2018. A total of 23 roost sites were located comprising day, night and maternity roosts.

We analyzed roost selection at a landscape scale using generalized additive models. We found that roost sites are associated with box culverts 1- 2.1 m in height and are located within landscapes with a high density of waterways within 5km from the roost site. Understanding the types of culverts that are likely to provide suitable bat habitat will prevent the disturbance to bat roosts during the breeding season and this will have greater conservation outcomes for this urban adapted bat.

Latitudinal and elevation migration by Australian tree roosting microbats

Amy Rowles

Hawkesbury Institute of the Environment, Western Sydney University

Ray Williams Mammal Research Grant Recipient 2019

Understanding migratory patterns is vital to conservation management, yet almost nothing is known about migration by Australian insectivorous bat species. My PhD will investigate the evidence for seasonal movement of microbats in south-eastern Australia. I will examine existing occurrence records and investigate the use of geographical patterns in stable isotopes to search for migration movements. Long-term acoustic detection will allow a seasonal comparison across elevations and latitudes. Trapping, banding and radio telemetry surveys will address more detailed questions. This novel project will explore an aspect of Australian ecology that is currently lacking and lead to a broad range of future research.

*Translocation of threatened flora using the case study species *Hibbertia spanantha* .*

Chantelle Doyle

Centre for Ecosystem Science , University of NSW

ECA Conservation Grant Recipient 2019

The translocation of threatened plants for either conservation or mitigation purposes is a rapidly expanding field; but success rates are uncertain, particularly when creating a self-sustaining population may take decades to achieve. Likelihood of success can however be increased through adequate planning, funding, understanding of species ecology and biology, maintenance and monitoring. Using the case study species, *Hibbertia spanantha*, a critically endangered subshrub from the Sydney Basin, we undertake a “best practice” translocation including pilot translocation, research of species propagation techniques, pollination requirements, population genetic health and maintenance and monitoring requirements. This research will help advise future conservation measures for this, and other allied species and also contribute to dialogue about how mitigation translocations can use best practice methods.

LMCC experience with establishment of biodiversity offsets

Robbie Economos

LMCC experience in establishing a Biobank site, requirements and practical realities for preparing management plans and ecological monitoring

Martin Fallding

Lake Macquarie City Council

Legislative changes relating to biodiversity and vegetation have had significant implications for local government policy and administration. The presentation reviews the experiences of LMCC with biodiversity offset sites over the past 10 years prior to and post the Biodiversity Conservation Act 2016. Issues with policy around the

establishment, and management of offset sites are identified, although it will take many years before the effectiveness of offset policy and the Biodiversity Conservation Act 2016 to become evident. As local government and other offset providers come to terms with the legislation, ecological consultants can expect further evolution of policy and practice, both local and state.

Undertaking complex community restoration

Dr Paul Gibson-Roy

Manager Ecological Restoration, Kalbar Resources

The feasibility of restoring or reinstating complex grassy communities has been much debated in this country over past decades. Despite good evidence having emerged during that time that this is technically feasible there has been relatively little uptake of such approaches by the restoration sector at scale – despite the clear need to restore such communities. The reasons for this are varied, but limitations on seed resources from the wild and a lack of market drivers to support the investment in infrastructure and the use of seed production (to grow native seed for large-scale restoration) are among the most obvious among them. This presentation will describe the inputs typically required to undertake high diversity grassy community restoration and provide examples of successful restorations. Also discussed will be the various constraints and costs associated with these whole-of-community restorations.

Biodiversity Conservation Trust and Department of Planning, Industry and Environment

The following presentations were given by Biodiversity Conservation Trust and Department of Planning, Industry and Environment, however no abstracts were provided. Answers to questions posted during the conference have been provided in this journal edition.

<i>Developing a management plan and costing a TFD</i>	Catherine Gallery, Manager, Agreement and Technical Services, Biodiversity Conservation Trust
<i>Process for reviewing BSSARs and setting up BSAs</i>	Melissa Huntsman, Senior Project Officer, Agreements and Technical Services, Biodiversity Conservation Trust
<i>The BCT's role in delivering offsets</i>	Maria Kwiatkowska, Manager, Biodiversity Offsets Program, Biodiversity Conservation Trust
<i>Discussion / Question, Answer Panel</i>	Catherine Gallery, Melissa Huntsman, Maria Kwiatkowska and Sam Luccitti (Senior Project Officer, Biodiversity Offsets Program)
<i>Overview and key outcomes from 10 years of the BioBanking program</i>	John Seidel Manager Ecosystem Assessment Team
<i>Issues with the application of the BAM and Biodiversity Assessment Reports</i>	Michelle Cox Principal Project Officer Ecosystem Assessment Team
<i>What is happening next with BAM</i>	Phil Wood Principal Project Officer Ecosystem Assessment Team
<i>Feedback from the Biodiversity Offsets Strategic Project involving Accredited Assessors</i>	Kate Newman Project Officer – Audit and Strategic Programs
<i>Latest on the Accreditation Scheme</i>	Lucian McElwain Manager Ecosystem Programs Team
<i>Market reforms</i>	Mladen Kovač Director Economic and Strategic Analysis

NESTBOX WORKSHOP ABSTRACTS

Nest boxes in Australia: history, early successes, failures, later successes, future

Ross Goldingay

Southern Cross University

Nest boxes and bat roost boxes have been installed to conduct research and to support populations of tree hollow using vertebrate species for many decades. The history of studies involving nest boxes and bat boxes is much more extensive in Europe and North America than it is in Australia. The first detailed nest box studies in Australia were published in the late 1970s and early 1980s. Most of the studies through to about 2005 were predominantly focused on research, using nest boxes to gain access to animals to study their ecology. I published review papers in 2006 (arboreal marsupials) and 2009 (birds and bats) that highlighted the potential to use nest boxes and bat boxes in a management and conservation context, citing examples where this had been done. I also highlighted there were knowledge gaps to fill for this to be effective. Subsequently, nest boxes and bat boxes were installed somewhat extensively as part of new road projects and around open-cut mines where habitat clearing occurred on a large scale. These management installations occurred with little attempt to fill the knowledge gaps that may enable such installations to be effective. I review many of the studies that have attempted to fill some of these gaps and due to time constraints focus on nest boxes. One considerable deficiency in many studies is acknowledgement that nest box designs believed to be highly suited to certain species have little evidence to support such claims. This 'failure of nest box design' leads to claims that nest boxes cater mostly for common non-target species. Sometimes there is also a 'failure of landscape' whereby the landscape where boxes have been installed is unsuited to the target species (i.e. the landscape is highly fragmented and of poor quality). I review a set of contentions that nest boxes are unsuited to support populations of hollow-dependent species: nest boxes are most attractive to common species and exotic species; species of conservation concern rarely use nest boxes; nest boxes lead to heat stress and may deplete populations; nest boxes are expensive to maintain such that long term projects are inviable. I present new data on the use of different nest box designs, recent uses of nest boxes to support threatened species, and some data examining the heat-stress hypothesis.

Biodiversity Conservation Trust: Nest-box Protocol

Joel Stibbard

Biodiversity Conservation Trust

Joel is a Senior Ecologist in the Sydney / Hunter Regional Delivery team of the Biodiversity Conservation Trust. Joel has a diverse background of research in both terrestrial and marine systems, but prior to the BCT had spent the previous 10 years employed in the private sector as a consultant, being both BBAM and BAM accredited. Joel's role within the BCT is equally diverse, from providing regional expertise for BSAR reviews and conducting annual audits for BSA sites, to providing landholder support across the spectrum of Private Land Conservation from BSAs to unfunded Voluntary Conservation Agreements

Box structure and longevity: Failings in nest box structure

Narawan Williams

AMBS

There has been concern over the longevity and quality of nest boxes that are being installed especially where there is no long-term monitoring and maintenance inspections set in place.

Average life of nest boxes can range from 2 to 15 years depending on multiple factors such as material used, construction design and how the box is attached onto the tree. There are also uncontrollable factors which can affect nest box longevity such as weather conditions, termite infestation, chewing of the box by species such as Cockatoos.

The aim of any nest box installation is to provide habitat refuge for hollow using fauna species, so it is important

that we use nest boxes that are of high quality, of suitable design and will stay in position on the tree. A good quality box will often cost more to purchase however if it lasts 5 times longer with no maintenance required then there is cost benefits to the manager and to the fauna that use them.

Over the years I have been observing what has been working well and what has been failing first on nest boxes and looking at ways to alter these features to increase longevity.

The first step was to identify weak points and what often fails first in the commonly used structural design of a nest box. Then look at how we can improve these structural features to make a difference to the life of a nest box.

The attachment is the other key feature that can determine the useful life of a nest box. Expanding attachments are proving to be successful. Large galvanized nails to hang box onto and galvanized coach screws with spaces are also lasting well. Having a combination of two attachments for a box allows for one attachment failure. The box remains in the tree until the failed attachment can be rectified or remains until the other attachment fails or the box falls apart. Annual maintenance inspections from the ground can identify attachment failures or box structure condition decline.

Design considerations in the workshop and the field

Alan Franks

Hollow Log Homes

In the workshop some of the considerations for nest box design are: Materials; are they sustainable; socially responsible and non toxic; Construction; will they last out in the harsh Australian elements; are they time effective to manufacture. In the field considerations include; target species; translating collected data from natural hollows into man-made structures (the answer is not always obvious); Installation methods in host the tree/pole or culvert: Safety of personnel and environment, making sure no harm is done to the host tree both during installation and in the future.

Making an entrance: creating tree cavity access holes rapidly attracts some of the target audience.

Murray V. Ellis^a, Jennifer E. Taylor^b, Susan G. Rhind^c

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Redressing the paucity of tree hollows in the landscape is an important step for conservation of hollow-dependent fauna around the world. The appearance of hollow entrances may take decades after the development of internal damage in developing trees if it depends on stochastic events such as wind storms to expose the damage inside the stem. We hypothesised that it is possible to increase hollow availability in landscapes that lack large old trees by creating entrances into tree stems that have existing voids or internal decay but have not yet developed entrances. Two study areas have been selected: the regenerating woodlands in the centre of Warrumbungle National Park; and, forest on the south coast of New South Wales where the large trees have been logged out. We initially drilled 10-mm holes to assess the presence of internal decay or voids in the lower trunk. If present, the tree is tested again 3 to 4 m above ground level. So far we have located 20 candidate trees in the Warrumbungles and 15 on the south coast. Depending on the diameter of the internal decay we drilled 41, 64 or 92 mm diameter entrance holes. Camera traps were mounted on brackets attached above the drilled hole with the camera aimed horizontally into the hole from about 75 cm away.

Slow camera response, the lack of thermal triggering for some reptiles and camera failure prevented the recording of all fauna activity associated with the holes. However, photographs were obtained of two of the first three drilled entrances in the Warrumbungles being investigated or used within three weeks of their creation.

Two individual feathertail gliders (*Acrobates sp.*), made regular use of one hole over a period of one week. Other animals recorded entering or exiting the drilled entrances included various invertebrates, tree skinks, snake-eyed skinks, robust velvet geckoes, pale-headed snake, antechinus, three species of glider, bats including long-eared bats, sacred kingfishers, kookaburras, white-throated treecreepers and striated pardalotes. On the south coast additional species include bar-sided skinks, juvenile lace monitors, brushtail possums attempting to enlarge the entrance hole, ringtail possums, lorikeets, rosellas and spotted pardalotes. Both sacred kingfishers and kookaburras were recorded excavating the decayed core of some of the stems thus enlarging the internal cavity.

Where mudguts was present inside the stem it often collapsed, especially during windy weather. Consideration is now being given to the positioning of the drilled hole to facilitate the easy egress of such mobile material.

The findings to date is evidence that drilled holes can be a viable way of providing access internal cavities within trees to increase habitat for hollow-dependent fauna. Developing efficient methods for detecting suitable trees and adding entrance holes should improve the cost-effectiveness of this method.

Chainsaw hollows and habitat enhancement for Superb Parrot

Mick Callan

Neophema Environmental

The Central West Councils Environment & Waterways Alliance (Alliance) represents a group of 19 Councils across Central West NSW with the aim of improving environmental outcomes across the region. In 2016 the Alliance received funding from Central Tablelands Local Land Services to conduct a large-scale hollow augmentation (chainsaw hollow) and habitat enhancement project to increase habitat values and awareness of the Superb Parrot.

This project resulted in over 200 chainsaw hollows being created across five Local Government Areas, five community planting events, a range of educational materials being produced, and the basis for a PhD project by Reannan Honey of UTS.

At the time that this project was conducted it was believed to be one of the largest hollow augmentation projects completed in Australia and received media coverage locally, nationally and internationally. The project is now complete with preliminary data showing a wide range of species utilising the hollows, as well as evidence to demonstrate that the thermal properties are equivalent to those of natural hollows.

Making cooler nestboxes: the need, the designs and the trails.

Susan Rhind¹ and Murray V. Ellis²

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²Science Section, NSW Office of Environment and Heritage, PO Box 1967, Hurstville BC NSW 1481, Australia

Many design factors contribute to the attractiveness and use of nestboxes by arboreal fauna. One of these is the temperature inside boxes. Our study aim was to measure maximum temperatures inside nestboxes while using construction design principles to guide modifications to reduce the high temperatures that can be reached inside boxes. A series of 5 paired trials were carried out, each with 10 boxes placed in in full sun. Analyses using Generalised Linear Models was undertaken for each trial to determine which design stayed coolest.

The single modification to nestboxes that provided the most protection from heat gain was the additional of a plywood sleeve over the box to create a covered, double walled box with an air gap at the sides and under the outer lid. This usually kept boxes close to ambient and sometimes below ambient maximum temperature. However, undertaking more than one modification produced better results. Painting boxes white had a significant impact on internal box temperatures and it appeared to be additive - a painted box with a painted sleeve was cooler than an unpainted box with a painted sleeve.

The insulative effects of these modifications were comparatively largest at the higher ambient temperatures which is when heat stress is problematic for fauna. The difference from ambient between the internal temperatures of the worst and the best box design was around 7° C (at 30°C ambient) and 9.5° C (40° C). Box design also greatly influenced the duration of these temperatures. The least effective of our trials was in adding thermal mass to nestboxes, and plain wooden (brown) boxes were the hottest of all boxes when in full sun. When ambient temperatures peaked at 39.1°C and 39.6 °C on two days these poorer performing boxes were >37°C for 7.5 hours with box maximums reaching 39.9 °C and 42.6°C; on another day those boxes were > 40°C for 2.5 hours. Such temperatures seem incompatible with survival of eggs or young animals.

The construction of a shaded air space around a nestbox as an insulator does not seem to have been explored in nest box design and has advantages over alternative ways of insulation e.g.. lightweight (c.f. thicker/denser wood), biodegradable (c.f. polystyrene or foils), inexpensive, can be retrofitted and provides extra weather protection. Painting the sleeve would further improve the box thermal properties and its longevity. In real field situations where summer heat is an issue, nestboxes should ideally be placed on trees in positions of deep shade but this is not always possible, particularly in woodlands, open forests and areas undergoing restoration. Where nestboxes are used it is critical that they are assessed insitu across time to ensure that they keep within the thermal tolerance of the target fauna. If they do not then alternative placements or designs will be required.

Melbourne bat-box project: summary of results from a long-term mark-recapture study

Steve Griffiths

Department of Ecology, Environment and Evolution, La Trobe University

Bat boxes are a popular tool used worldwide to provide artificial roosts for tree-roosting insectivorous bats. In Australia, systematic, long-term monitoring of bat boxes post installation has rarely been conducted, which makes quantifying their true conservation value problematic. Here, I explore this issue by drawing on data from a long-term bat box project in Melbourne. Conservation-focused community groups installed boxes at four sites, comprising a range of box designs that have been used widely in the Northern Hemisphere. Regular monitoring conducted over more than two decades has shown that these timber and/or plywood bat boxes were successful in attracting several bat species, some of which used the boxes throughout the year, including intermittently as maternity roosts. This is the first example of a bat box program effectively providing long-term supplementary roosts for several Australian bat species, including as breeding sites. However, one widespread species with an adaptable roosting ecology, Gould's wattled bat (*Chalinolobus gouldii*), has consistently dominated use of the boxes at all four sites, including during the mating (autumn) and breeding (spring–summer) seasons. As the a priori objective of this bat box program was to provide supplementary roosts for hollow-dependent bats at the community level, it must be acknowledged that, despite a significant ongoing commitment over two decades from a core group of project managers and a large number of volunteers, the project has not achieved its primary goal. These findings highlight the need for bat box programs to have clearly defined objectives and to conduct systematic monitoring to evaluate whether these are achieved. For small-scale projects, such as those run by community groups in urban parks and reserves, the primary objective may simply be to attract any bat species that is present in the local area (regardless of the species' conservation status or level of sensitivity to disturbance), and to provide opportunities for engagement with the public. For larger-scale programs where bat boxes are used to offset the proposed removal (or historical loss) of hollow-bearing trees, consideration should be given to providing artificial roosts for the entire local community of tree-roosting bats, including rarer species, or those that are sensitive to disturbance. However, it is currently unclear whether bat box programs can achieve this goal.

Future directions for RMS nest-box management

Cassie Thompson

Senior Environment Specialist Biodiversity, RMS

Over the last 15 years, RMS has installed over 2000 nest boxes across NSW. This talk provides a quick history of RMS use of nest boxes, its current guidelines and covers the implications of Ross Goldingay's recent review of RMS's nest box programs.

Hume Highway (Brown Treecreeper, Superb Parrot, Squirrel Glider)

Mason Crane

ANU

By 2009 much of the major works, duplicating the Hume Highway between Coolac and Albury NSW, were completed. This required the removal of large numbers of old growth woodland trees. To offset/ mitigate the impacts of the loss of these hollow resources, 587 nestboxes were installed, targeting bats and a number of threatened species (squirrel glider, brush-tailed phascogale, brown treecreeper and superb parrot). Of these boxes the ANU monitored approximately 316 over a five year period. The results were mixed, with little to no uptake by targeted species. The project highlighted the value of monitoring, as it identified some of the problems in the project design, it provided new information to inform future nestbox programs and added real data to the discussion on how to deal with the management of hollow resources in general.

Results of a large nest box monitoring project on Mine site

Mark Semeniuk

AMBS

A total of 210 nest boxes were progressively installed over 5 years (2013-2018) in two offset areas near the Duralie Coal Mine in the Gloucester Valley, NSW, in locations where the density of tree hollows was low. The nest boxes were installed at heights between 1 m and 22 m. Fauna targeted included microbats, gliders, possums, phascogales, antechinus, and cavity-nesting birds ranging in size from pardalotes to owls. Monitoring of the nest boxes was undertaken periodically over the 5 years, with every box checked at least once per year. Evidence of occupation was regarded as either an animal present inside the box and/or signs of previous occupancy (e.g. nesting material present).

Evidence of occupation was observed in 182 nest boxes, or 87%. The majority of the remaining 13% were an older design that were installed in 2013. When these nest box designs were removed from the calculations, overall occupancy was 170 out of 175 nest boxes, or 97%. Nest boxes were used by at least 23 vertebrate species, including 13 mammals, six birds, three reptiles and one frog. Occupancy by feral species was low. Three threatened species were recorded using the boxes, including one box that was used for nesting by a Masked Owl. There were multiple incidences of different species using the same nest box at different points over the 5 years.

Assessing current artificial hollow distribution and interventions to support hollow bearing species in Sydney

Matt Eldridge

Sydney University

The loss of habitats, including hollow-bearing trees, has a significant impact on biodiversity across the world. This loss is recognised as a Key Threatening Process, placing many hollow-dependant species at risk of becoming threatened, due to the extensive time it takes for hollow bearing trees to mature and form hollows. The use of artificial hollows is a technique that is used to mitigate this loss by providing supplementary habitat. However,

the role of sectors that install these hollows, such as Local Governments, has not been looked at in great detail. This study seeks to identify the effort of Local Governments in the Greater Sydney Area have made toward installing artificial hollows, as well as the quality of the hollow and its surroundings.

It was found that while the majority of Local Governments have installed artificial hollows, the amount that they have installed, and the quality of monitoring varies greatly, with a large portion of Local Governments performing low to no monitoring. Additionally, the number of the boxes in poor or usable conditions were found within areas that have not been monitored for over 5 years. There is a great variety of species that have been targeted, however the amount of threatened species that have been targeted is lower than what may be required. Further actions from this study can include the use of systematic conservation: Local Governments joining knowledge and resources to put towards biodiversity.

ECA is on Facebook!



Recognising that the modern consumer loves to consolidate where they spend their most valuable asset (time), and most of all to encourage networking between members, the ECA now has its own Facebook page. Just search “NSW Ecological Consultants Association” to find it.

The home page is open to the public and is used for general announcements, sharing news about conservation and legislation, conferences, etc, that both ECA members and a diverse range of public followers may find interesting.

But the really good stuff is reserved exclusively for members in the page’s groups. In the groups section (where membership will only be approved to current ECA members), members can share tips and observations, seek advice, and collate a range of industry relevant information such as advice from OEHL on how to apply the Biodiversity Assessment Method.

Groups currently set up are:

- ◆ PIR cameras
- ◆ All things Threatened Flora
- ◆ ECA Accredited Assessors Forum
- ◆ EPBC Act and FBA
- ◆ Five Part Tests
- ◆ All things Threatened Fauna
- ◆ Microbats: Ecology, surveying and call analysis
- ◆ Flying Foxes
- ◆ Bush regeneration and VMPs.
- ◆ Frogs
- ◆ Resources, links and stuff that ecologists useful
- ◆ Offsets and offset management.
- ◆ Feral and introduced fauna, and its management

Members are welcome to suggest new groups via inboxing the page.



Ecological Consultants Association of NSW
415 Parishs Road
HILLDALE NSW 2420

12 November 2019

Dear Ms Rowles,

Subject: Ecological Consultants Association of NSW Annual Conference 2019

Thank you for providing on 10 October 2019 a list of questions raised at the Ecological Consultants Association of NSW Annual Conference, attended by the Department of Planning, Industry and Environment (DPIE). Responses to these questions are attached below, please note we have slightly modified some questions to improve clarity.

Many of the issues raised in relation to the Biodiversity Offset Payment Calculator (BOPC) and offsets market Spot Price Index (SPI) have been addressed by the release of the SPI and the revised BOPC on 1 November. A description of the changes to the BOPC is provided on the [BOPC webpage](#) where these tools can be accessed. Assessors were advised of these changes via a Biodiversity Assessor Update (Number 26) and a webinar on 6 November. A recording of this webinar will be made available on the [Biodiversity Assessment Method Support Webinars page](#).

If you have any further questions or require additional clarification on responses relating to Biodiversity Stewardship Agreements please contact the Biodiversity Conservation Trust (BCT) at info@bct.nsw.gov.au or phone 1300 992 688 and for other aspects of the Biodiversity Offsets Scheme, please contact the [Biodiversity Offsets Scheme Support](#) or phone 131 555.

Yours sincerely,

DEREK RUTHERFORD
Director of Conservation Programs

Department of Planning, Industry and Environment (DPIE) responses to questions raised at the Ecological Consultants Association of NSW Annual Conference held on Thursday 25 July 2019

1. How do I recommend additional Serious and Irreversible Impact (SII) entities that aren't currently listed?

If you consider that a threatened species or ecological community meets one or more of the principles according to clause 6.7 of the Biodiversity Conservation Regulation 2017 and the [Guidance to assist a decision-maker to determine a serious and irreversible impact \(PDF 711KB\)](#), you can email [Biodiversity Offsets Scheme support](#) and request a review.

The submission must include information relating to which principles the entity meets and justification of the recommendation, including quantitative data. Submissions will be reviewed by DPIE Science Division. If approved, the entity will be updated in the Threatened Biodiversity Data Collection (TBDC) and Biodiversity Assessment Method Calculator (BAM-C) during a regular data import.

Note that assessments against the principles are conducted at the state scale, not the local scale

2. DPIE need to provide clear guidance on what is considered 'reasonable' avoidance. This would provide a consistent approach for applicants, Council & consultants. There should be a clear message for assessors to first avoid important biodiversity values on site. How do we shift the hierarchy back towards avoid and minimise – developers are going straight to offset for entire sites.

The Biodiversity Offsets Scheme (BOS) establishes a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity. Guidance on reasonable measures to avoid and minimise impacts has been provided within Stage 2 of the [Biodiversity Assessment Method](#) (BAM) and the [BAM Operational Manual – Stage 2](#) (Part 1) . This guidance can be referred to for consideration by proponents, consent authorities and accredited assessors.

The consent authority will consider whether adequate reasonable measures have been taken in determining the outcome of the proposal. Inadequate consideration of avoiding and/or minimising biodiversity impacts can compromise the approval of a development application.

3. When will Serious and Irreversible Impact (SII) thresholds for Threatened Ecological Communities (TECs) be resolved?

The list of entities at risk of SII has recently been updated and can be found on the [SII information webpage](#).

It was proposed in the [recently exhibited version of the BAM](#) that entity-specific thresholds be replaced with stronger impact assessment and reporting requirements. This means assessors

will have to address how a proposed impact will contribute to the extinction risk of the target entity, directly against the Principles. These revisions will help consent authorities to form an opinion on a serious and irreversible impact, because they better align with the Principles as described in clause 6.7 of the [Biodiversity Conservation Regulation 2017](#).

4. Does the operations manual provide guidelines for BSAs on council land for permitted uses for passive recreation activities? i.e. orienteering

The BAM Operational Manual Stage 3 – Improving Biodiversity Values is currently in preparation, in consultation with the Biodiversity Conservation Trust (BCT).

The BSA and Biodiversity Stewardship Site Management Plan must include relevant details associated with permitted uses, including passive recreational activities. Permitted uses do not impact on the biodiversity values of the site. Some areas, such as access roads or tracks, may be required to be excluded for the purpose of credit generation (refer to the [BCT Guideline for BSAs](#)).

Permitted uses should be negotiated with the BCT early when seeking to establish a BSA. Refer to the [BCT website](#) for additional resources and information.

5. Will guidance be provided on how to map species polygons for breeding birds? i.e. buffers on hollows/nests?

DPIE is engaged in ongoing work to provide species-specific guidance. Such guidance will be available in threatened species survey guides (e.g. [‘Species credit’ threatened bats and their habitats](#)). For species without published survey guides, refer to the ‘General Notes’ section within the Threatened Biodiversity Data Collection (TBDC) which may contain information on mapping the species polygon including the buffering of specific habitat features, where relevant.

If guidance is not yet available within the TBDC, please send an enquiry to BAM.support@environment.nsw.gov.au. The Ecosystem Assessment team within DPIE will liaise with species experts to develop this information.

6. Do you need to complete a species polygon for a dual credit species if breeding habitat is not present on the site?

A species polygon is only required for the species credit component of a dual credit species. Where the species credit component is related to breeding, potential breeding habitat must be present and evidence of breeding must be recorded as per relevant published Survey Guides or the ‘General Notes’ section of the TBDC, to generate species credits. Potential breeding habitat is usually described as a habitat constraint. The foraging habitat for a dual credit species is captured through the ecosystem credit component.

7. Where is the market trigger when a species habitat is over cleared? Do the species like-for-like offset rules allow for credits not of the same species to be traded?

In the case of impacts on threatened species that are species credit species, the like-for-like rules require biodiversity credits to represent the same threatened species. Refer to the [Biodiversity Offsets Scheme Rules webpage](#) for further information on like-for-like offset rules and circumstances to which the variation rules may apply.

The performance of the BOS, including ecological, market and planning outcomes, will be monitored over time to ensure the settings remain appropriate to meet objectives.

For example, the BAM must be reviewed every 5 years, in accordance with section 6.9 of the *Biodiversity Conservation Act 2016* (the Act). The Act is required to be reviewed 5 years after commencement to determine whether the policy objectives of the Act remain valid and whether the terms of the Act remain appropriate for securing those objectives.

8. Species can be removed based on geographic constraints. Is this valid given it could limit opportunities to discover species in a new range?

Geographic limitations are one of several 'filters' used to predict the likelihood of occurrence of a threatened species on a site (see Section 6.4 of the [BAM](#)). These data were reviewed by species experts as part of the DPIE threatened species BAM data review project. It is anticipated that outcomes of the review will be up-loaded into BioNet Atlas by the end of 2019. Experts applied a precautionary approach when listing geographic limitations for a species, hence they apply to very few species. Where a species has no geographic limitations listed, this filter will not be available in the BAM Calculator (BAM-C).

Geographic limitation data can be updated as new information around the habitat range of the species is identified.

9. Will there be survey guidelines for other threatened mammals aside from koalas & bats? E.g. threatened gliders, wallabies, wombats, phascogales.

DPIE is working towards a complete suite of survey guides for all threatened species. The survey guides currently in development include those for koalas, reptiles and birds. DPIE are also updating survey guides for bats, amphibians and flora to align them with the BOS.

Refer to section 6.5 of the [BAM](#) 'Undertaking a threatened species survey' for guidance on survey requirements, including where a species guide has not yet been developed.

More information about survey requirements is available in the TBDC, including the optimal month of survey, the unit of measure and other information in the 'General Notes' field. Species specific flora survey information is also available from the homepage of the BAM-C in spreadsheet format.

10. Who do we contact if we have queries about the 'optimal survey times/conditions'?

Information on the optimal species survey times and conditions can be found within the Threatened Biodiversity Data Collection (TBDC). Suitable survey months are presented in the BAM Calculator (BAM-C). There is additional information on survey requirements in the 'General Notes' section of the TBDC for each species and the ['Flora Species with Specific Survey Requirements'](#). Enquiries relating to optimal survey times and conditions can be sent to us via email at BAM.support@environment.nsw.gov.au.

Note that the BAM Operational Manual – Stage 1 provides guidance on when survey times can be varied from those identified in the TBDC/BAM-C. The assessor must provide justification in the BAR using appropriate published or peer-reviewed references and/or data.

11. If the BBAM has been superseded by the BAM, why are clients still requesting quotes for certification under the BBAM?

Please refer clients to the [transitional arrangements webpage](#) for guidance. If you require additional clarification on this matter, please submit your question through the [Biodiversity Offsets Scheme online enquiry form](#).

12. Have any development projects been denied based on the likely impact to threatened species/communities?

DPIE does not hold this information and cannot provide a response to this question.

13. How much of the land protected under bio bank agreements was additional? i.e. secured additional conservation outcomes that would not have happened otherwise.

DPIE is not able to provide a response to this question.

14. Is there going to be an accreditation system for costing TFDs?

No.

15. BAM training is more flora based but applying it involves fauna too. Will there eventually be separate accreditations for flora and fauna? If not, why?

No. Our aim is for a single accreditation that covers both flora and fauna assessment. This reduces complexity for proponents when engaging an assessor. Flora and fauna assessment capabilities are needed to become accredited.

It is worth noting that threatened species survey guides outline those considered to be an 'appropriate surveyor'. An appropriate surveyor does not necessarily need to be an accredited assessor, but is required to demonstrate suitable knowledge, skills and experience applicable to completing the relevant surveys.

16. How can Government Assessors who cannot spend 10 days in the field be accredited?

Assuming this relates to re-accreditation, we are considering this situation. However, we do have an expectation that accredited assessors maintain their field experience. For example, 10 days in the field per year equals one day a month, assuming December and January are excluded. This is less than 5% of work time per annum. There is a reasonable expectation that accredited assessors, who carry out biodiversity assessment using the BAM, have and maintain their field experience. Accreditation is attached to a person, independent of their work organisation.

17. What does DPIE do with conflict of interest declarations? What is expected of consent authorities assessing a development if there is a conflict of interest?

All consent authorities are to follow their own standard processes when a conflict of interest is declared in relation to a development.

For accredited assessors, the specific obligation is “must not act in circumstances where there is actual, perceived or potential conflict of interest.”

In deciding if there is any conflict of interest, the sorts of questions that can be asked are:

- Will I or anyone I am associated with benefit from or be detrimentally affected by me carrying out a project
- Could there be benefits in future that could influence your objectivity - this could include things like earning capacity, future employment, gains to friends or associates
- Do I have debts to any of the parties or associates of the parties/commitments made to parties
- Association could involve a conflict of the interest of one client you have with another client you have.

Any actual, perceived or potential conflict of interest must be disclosed to the clients and consent authorities. It's important to remember, a conflict of interest does not indicate impropriety but it does have to be managed.

There are strategies for managing conflict of interest, for example:

- ‘separation of duties’
- Contract an independent third party to review or complete parts of the work.

Refer to the [Office of Local Government webpage](#) for further examples

18. When is further information on BOS brokers going to be published? Who will qualify for this role?

DPIE cannot provide further information on brokers at present. The provisions for brokers have not been prescribed in the Biodiversity Conservation Regulation 2017.

Refer to the [Offset Scheme Brokers webpage](#) for information.

19. What's happening with accreditation under the EPBC Act?

Update on amendment to the Assessment Bilateral Agreement between NSW and the Commonwealth and Commonwealth endorsement of the NSW Biodiversity Offsets Scheme:

The NSW government is continuing to work collaboratively with the Australian Government to update the Assessment Bilateral Agreement after recent changes to NSW biodiversity legislation. The Australian Government is also seeking to endorse the NSW Biodiversity Offsets Scheme (BOS). This will streamline assessment process for projects applying the BOS which also require approval under the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act).

The proposed changes to the Assessment Bilateral Agreement were exhibited for public consultation earlier this year. The original intent of the assessment bilateral agreement to streamline assessment processes remains and the existing content has been retained wherever possible.

NSW has committed to making minor amendments to the Biodiversity Conservation Regulation 2017 (the Regulation) offset rules to align them with Commonwealth requirements and allow for the Commonwealth to endorse the BOS. The BOS has requirements for retiring like-for-like credits or funding conservation actions that directly benefit the species or community impacted. These meet Commonwealth requirements. However, the NSW offset rules also allow for variation rules to be applied after reasonable steps have been taken to source like-for-like credits and they cannot be found. NSW is considering amendments to the Regulation that would prevent the use of the variation rules for offsets required for EPBC Act purposes for controlled actions. The variation rules would remain available to meet offset requirements for other NSW matters for controlled actions.

For meeting EPBC Act offset requirements under the NSW Biodiversity Offsets Scheme, proponents would retain the ability to:

- Retire biodiversity credits based on the like-for-like rules in the Biodiversity Conservation Regulation
- Fund biodiversity conservation actions that are listed in the Ancillary rules and benefit the threatened entity impacted
- Commit to deliver mine site ecological rehabilitation that creates the same ecological community or threatened species habitat
- Pay into the Biodiversity Conservation Fund, where the Biodiversity Conservation Trust would meet the EPBC Act offset requirement in a like-for-like manner.

20. More financial incentive for resilient vegetation to be conserved under stewardship agreements is needed.

See answer 23 below. Resilient vegetation will have a smaller Total Fund Deposit (TFD), and as such allow for a smaller minimum credit price to be set which would (theoretically) balance out the smaller credit generation.

21. Will reductions in connectivity for stewardship sites through increases in road width (major arterial routes) affect credit value and payment value.

No, credits and payments are based upon values within each site only.

22. What happens if the money in the trust account is not enough to make an annual payment to a landholder or completely runs out?

Management plans and total fund deposits are carefully reviewed, and the discount rate is informed by independent actuarial advice to ensure management funds do not run out. The Biodiversity Conservation Trust's (BCT) prudential policies and risk mitigation strategies are aimed at optimising the net position of the Biodiversity Stewardship Payments Fund (BSPF). The BCT actively monitors the adequacy of the BSPF to ensure ongoing management payments can be made to landholders.

23. There is currently minimal incentive for landowners with intact, resilient vegetation to set up stewardship agreements due to low credit generation.

Fewer credits may be generated on a site with intact, resilient vegetation, however the management costs would also be lower, balancing the equation between credits / management costs compared to sites with higher credits but also higher management costs.

24. Can the Biodiversity Conservation Trust (BCT) construct a more robust financial auditing system to ensure the part A is solely allocated to management works and restoration outcomes rather than managers pocketing any resulting difference in part A and the actual cost of works, due to the competitive nature of bush regen industry?

The BCT audits every site yearly to ensure that the management actions have been undertaken and performance targets specified in the agreement are achieved. The BCT does not audit against part A expenditure. The costing in the TFD may be used to gauge the level of effort required to achieve the performance target but the BCT does not use expenditure as an audit component.

25. What parameters do they use as surrogate of a site achieving a “self-sustaining ecosystem”?

We do not completely understand this question. PCT benchmarks are used to assess the vegetation integrity of a vegetation zone.

26. Has BCT developed a process for assessing BSA’s that have been prepared for land being offset for a project without a credit liability (area-based liability)?

No. Future projects are to have offsets quantified in regards to credits.

The BCT offers Conservation Agreements associated with development where sites meet the requirements outlined in the [‘Guidelines for use of Conservation Agreements as development consent conditions’](#).

The guidelines apply to local development where there are:

- legacy conditions of consent issued before the publication of these guidelines;
- new conditions of consent issued after the publication of these guidelines; or
- conservation agreements that are a pre-requisite of a planning proposal.

The guidelines only apply to major projects where there are legacy conditions of consent issued prior to October 2014, when the Biodiversity Offsets Policy for Major Projects was introduced.

The guidelines can be used for new conditions of consent, projects not captured by the Biodiversity Offsets Scheme or for avoid and minimise measures for projects captured by the Biodiversity Offsets Scheme. The requirements for entering into a conservation agreement associated with development include elements such as size, biodiversity values and configuration.

27. When the BCT seeks land with credits in low supply how does it impact prices of that credit type? Does it accurately reflect availability if one is targeted?

All credit prices are ultimately negotiated between the buyer and seller, noting that the minimum price per credit must cover the total fund deposit for the site. If some credits are in low supply, it may result in sellers being able to negotiate a higher price, however, the BCT and other buyers may explore other options within the boundaries of the legislated offset rules if high prices are offered (e.g. working with other landholders, applying variation rules etc.) All trades are recorded in public registers, which may then influence future transactions.

UPCOMING ECA EVENTS

ECA ANNUAL CONFERENCE

Date: 23-24 July 2020

Theme: TBA

Location: SAGE Hotel Wollongong

PROPOSED FUTURE ECA WORKSHOPS

♦ Orchid Workshop

Date: August 2020

Location: TBA

Register your interest: admin@ecansw.org.au

♦ eDNA Workshop

Date: 2020

Location: TBA

Register your interest: admin@ecansw.org.au

♦ Vegetation Community Workshop—allocating PCT's

Date: 2020

Location: TBA

Register your interest: admin@ecansw.org.au

NON ECA EVENTS

♦ Australasian Bat Society Conference

Date: 8-10 March 2020

Location: The Distinction Hotel, Te Anau,
South Island, New Zealand

Details: <http://ausbats.org.au/2020-conference-agm/4594737709>

ECA Membership Report

In total we have 198 members,:

Full Members

- 143 Practising Members
- 20 Early Career Ecological Consultants

Associate Members

- 21 Associate Government
- 8 Non-practising
- 1 Subscriber
- 5 Student

We currently have 3 applicants and have 12 new members and they are introduced below:

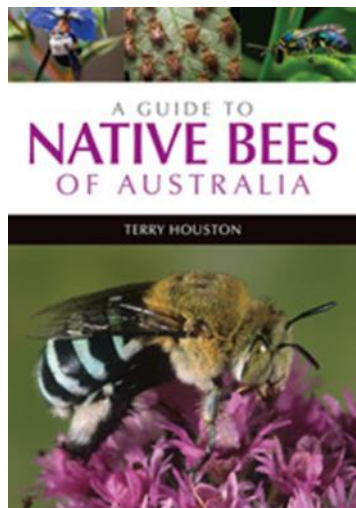
- Jed Field (Early Career Ecological Consultant)
- Diane Callaghan (Early Career Ecological Consultant)
- Dee Ryder (Practising Ecological Consultant)
- Damian Licari (Practising Ecological Consultant)
- Bo Davidson (Practising Ecological Consultant)
- Samuel Des Forges (Practising Ecological Consultant)
- Shelomi Doyle (Practising Ecological Consultant)
- Joe May (Practising Ecological Consultant)
- Mathew Clancy (Associate Non-practicing)
- Kirsten McWhirter (Associate Government)
- Danielle Allen (Associate Government)
- Timothy Maher (Associate Ecological Consultant)

RECENT LITERATURE AND NEW PUBLICATIONS

BOOK REVIEW: A GUIDE TO NATIVE BEES OF AUSTRALIA

Dr Stephen Ambrose

Principal Ornithologist, Ambrose Ecological Services Pty Ltd



Houston, T. (2018).
A Guide to Native Bees of Australia. 272 pp. (CSIRO Publishing, Clayton South). 215 x 148 mm. Softcover. AU \$49.99

Dr

Terry Houston is Australia's foremost authority on Australian native bees, an insect group that he has researched for nearly 50 years. Most of that research was conducted as the Curator of Entomology at the Western Australian Museum in Perth.

His book, *A Guide to Native Bees of Australia*, is, in a way, a synthesis of that research. It illustrates his deep knowledge of Australian bees and his infectious enthusiasm for communicating that knowledge to a broad audience; anyone from natural historians and bee enthusiasts through to professional melittologists (scientists who study bees).

There are an estimated 2000 native bee species across 58 genera and five families in Australia. Despite this richness and diversity, there has not been a user-friendly native bee guide until now. This book is not just a guide to identification, but a broad treatment of Australian native bee biology and taxonomy.

The book assumes that some readers have no or little prior knowledge of Australian bees. Therefore, the first section presents an overview of bees and their biology. Here we learn what a bee is, its form and function, origin and evolution, and the ecological importance of native bees in natural and agricultural environments. There is also a useful discussion of aspects of bee anatomy and morphology that aid in their

identification. But, for me, the most enlightening part of the book is the discussion of native bee ecology, covering lifecycles, sociality, reproduction, foraging behaviour, seasonality, and interactions with other organisms.

The second, much larger, section of the book is for the more serious bee enthusiast and researcher. It provides identification keys to families, subfamilies and genera, together with written and photographic descriptions of bees at each of these levels of classification.

Written accounts of each genus provide information on the pronunciation and meaning of the generic name, the diagnostic characteristics of the genus; the number of Australian species; the distribution of the genus in Australia; and aspects of the ecology and behaviour of selected species.

Very good quality colour photographs accompany each generic account, many are close-up images of preserved specimens, others are of bees in their natural environment. These are supplemented on occasions with line drawings to demonstrate further the diagnostic anatomical features. For instance, photographs on pp. 106 and 107 of the book are close-up images of distinguishing features of the male and female forms of the genus *Leioproctus* (Feathery Leioproctus Bees) within the Family Colletidae (Short-tongued Membrane Bees). The images depict features of the labrum (the hinged flap between the mandibles that protects the retracted proboscis) and antennae that are diagnostic of the genus, as well as interspecific variation in shape and form of female heads, male antennae, and legs.

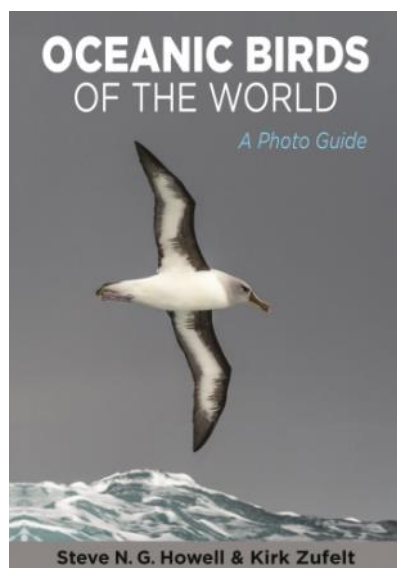
Many photographs in the book not only assist in the identification of bees *in situ*, but provide visual information about their interactions with host plants. A good example of this is on p. 185 of the book where there is a close-up photograph of a *Palaeorhiza disrupta* male (Family Colletidae) displaying on the leaf surface of a plant, along with other close-up photographs of *Palaeorhiza* spp. females feeding on the nectar of flowering plants.

If I was to criticise the book, a few colour plates are a bit small for close scrutiny of bee morphology, a fault of the book's layout rather than the choice of photograph. And, while sexual dimorphism is described in the text for each genus, the photographs do not always show both the male and female adult forms. I hope these minor criticisms will be addressed in a future edition of the book.

In conclusion, this guide is not only a valuable research and educational tool, it will, at the very least, inspire you to look more closely at, and appreciate, the bees that visit your garden, parkland or local patch of bushland. It is also a valuable tool for the more discerning ecological consultant who is interested in documenting insect richness and diversity at a site, understanding the site's ecology, and predicting the potential impacts of habitat clearance on those values. Therefore, it is a worthy addition to an ecological consultant's book shelf.

BOOK REVIEW: OCEANIC BIRDS OF THE WORLD: A PHOTO GUIDE.

*Dr Stephen Ambrose
Principal Ornithologist, Ambrose
Ecological Services Pty Ltd*



Howell, S.N.G and K. Zufelt (2019). Oceanic Birds of the World: A Photo Guide. 360 pp. Princeton University Press, Princeton, New Jersey, USA and Woodstock, Oxfordshire, UK). 215 x 150 mm. Laminated paperback. US \$35.00. <https://press.princeton.edu/titles/14015.html>

If you are an inveterate seabirder or twitcher who frequents pelagic voyages, or even if you are less obsessed with seabirds and just want to identify a species that is skirting the coastline or has reached land, then you probably rely on Harrison (2017 or an earlier edition) to assist with species identification. Howell & Zufelt (2019) is the latest worthy companion book on the market.

The main part of *Oceanic Birds of the World: A Photo Guide* is divided into 12 sections or chapters, each one devoted to a particular bird family. The bird families covered in the book are penguins, alcids (murrelets and allies, puffins and auklets, guillemots and murrelets), petrels (diving-petrels, fulmars and allies, prions and Blue Petrel, gadfly petrels and allies, and shearwaters and allies), albatrosses (short-tailed albatrosses, great albatrosses, mollymawks and sooty albatrosses), storm-petrels (white-rumped, white-bodied and dark

species), tropicbirds, frigatebirds, gannets and boobies, skuas and jaegers, gulls and terns (gulls, typical terns and noddies) and phalaropes. Collectively, the book covers more than 270 species. The taxonomy doesn't align itself with any world bird checklist, in particular, the authors preferring to rely on their own review of the scientific literature, the scientific references cited in the text throughout the book and listed in a lengthy bibliography prior to the species index at the end of the book.

Each section starts with a general overview of the bird family with information on the number of general and species, diagnostic morphological features, global distributions, timing of feather moults, and some basic behaviours. Most family accounts are divided into sub-groups (sub-families) for ease of identification. For instance, the petrels (Procellariidae) are divided into diving-petrels; fulmars and allies; prions and Blue Petrel; gadfly petrels and allies; and shearwaters and allies. The number of genera and species in each sub-group, and example photos of birds in flight or on the water surface from each sub-group, together with page references to more detailed treatment of the sub-group within the book, are provided to assist the reader to identify an oceanic bird to sub-family level. Sub-sections then treat each species individually. The more complex sub-groups have a sub-section which begins with a colour plate of closely-related species in flight and is accompanied with page reference numbers for each species. The Blue Petrel and seven species are prions are shown in one colour plate (p. 81) which informs me that the more detailed account for the Antarctic Prion, for instance, is on pp. 87-88. This is extremely useful because closely-related seabird species are often difficult to tell apart, and to have them all illustrated on the same page assists greatly with species identification.

The photographic images of each species are the main strength of this oceanic bird guide. The back cover of the book states that there are over 2,200 colour photos. Within each species account, all birds except the penguins are depicted in flight and, if appropriate, on or just above the water surface. The penguins are photographed while they are on land and on the surface of the water. Images of two or more closely-related species are often shown on the one page for comparison and most have text labels that identify

diagnostic characters. Some, but not all, species have acknowledged photographs of different age groups (juveniles, sub-adults and adults) and of individuals that are in moult. This is extremely valuable because oceanic birds seen on the high seas outside the breeding season are usually young birds with immature plumage or non-breeding adults in moult, which are spending long periods of time away from land. Most images of birds in flight are superimposed on mid-grey or blue backgrounds to help accentuate the plumage details. However, one minor criticism of the plates is that some photos are reduced in size so much that it is difficult at times to discern the fine plumage details, which can hinder identification. I found this with some of the darker-plumaged shearwaters, in particular. But, generally speaking, the photographic plates are extremely high in quality. Other photographs are of birds in their natural environment (e.g. at breeding colonies, or swimming or resting on the ocean surface).

The written accounts of each species are necessarily brief and do not discuss plumage or morphometrics (except for size measurements), meaning that the reader has to rely solely on the photographic images and their notations for that information. The level of detail in the texts varies considerably between species, for instance quite rudimentary for prions, but very detailed for albatrosses and shearwaters. This probably reflects the level of knowledge there is for each species. All species texts present body length and wingspan measurements, a description of seasonal differences in distribution, timing of breeding and location of major breeding colonies, timing of wing moult and characteristic behaviours at sea which aid in their identification.

Other impressive features of the book include the distribution maps. Bird field guides of any sort often have maps that are so small that it is often difficult to see the detail. However, I am very glad to say that this is not the case with *Oceanic Birds of the World: A Photo Guide*; some of the larger distribution maps are over half a page in size. Each map shows the breeding islands and the oceanic distribution of the species. Seasonal changes in oceanic distributions are shown for migratory or dispersive species, with months of the year when present superimposed alongside their

regional distributions. Some species are lumped together into a single complex e.g. the Wandering Albatross complex (five species) and the Band-rumped Storm-Petrel complex (six species); while the oceanic distributions of each species within a complex are not differentiated in the book, the maps do differentiate between the breeding islands of the species.

There are some additional sources of information throughout the book that aid in oceanic bird identification. For instance, there are photographic comparisons of outstretched wings of the great albatross sub-group showing four different wing moult cycles, complete with notations that identify important characteristics of the moult cycle. Equally impressive is the scoring system for uppertail-covert patterns to assist in the identification of species in the Leach's Storm-Petrel complex.

The book also has an introductory chapter that advises how best to use the book to identify species, and an introduction to types of oceanic birds, their taxonomy, moult patterns, where to find oceanic birds, and their conservation. While this is an identification guide, this chapter is perhaps a bit too brief; many other bird guides have similar chapters that cover similar information in much greater detail.

Oceanic bird taxonomy is very fluid, especially as genetic analyses become more precise. Therefore, a useful appendix discusses, and scientifically-references, recently-described and provisionally-split species that are featured in the species identification section of the book.

A disappointing feature of the book is that it doesn't appear to be physically robust. The first time I opened my copy, the lower part of the first page began to split away from the book's spine. It could be that I was unlucky to be sent a rare defective book, but if it is a more widespread problem, then it's probably not going to survive the rigours normally afforded to bird field guides, especially if used on pelagic voyages. The laminated finish to the book's cover should provide some protection from saltwater spray. The glossy pages enhance the quality of the photos and accompanying graphics, but also risk being glued together if not kept moisture-free. However, the trade-off between print-quality and suitability of use in the

field seems to be a feature of every type of field guide book these days.

Overall, Howell & Zufelt (2019) is a valuable oceanic bird guide from the perspective of its high-quality photographic images and distribution maps, and for the user-friendliness of the book's layout. But for completeness of information, it needs to be used in conjunction with other books such as Harrison (2017) (for more detailed information on sub-specific differences in plumage) and Del Hoyo & Collar (2014) on more detailed taxonomy.

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ROYAL ZOOLOGICAL SOCIETY OF NSW STUDENT CAREERS DAY, 6 JULY 2019

ECA President, Dr Stephen Ambrose was one of six speakers at the Student Careers Day held at the Taronga Conference Centre in Sydney on 6 July 2019. The event was organised by the [Royal Zoological Society of NSW](#) and the speakers from diverse zoology backgrounds spoke about potential career pathways for zoology graduates.

Stephen spoke about zoology careers in ecological consultancy and non-government conservation and research groups, based on his own career experiences. Other speakers were Dr Martin Predavec (NSW Government wildlife researcher), Dr Katherine Dafforn (Macquarie University academic), Dr Alana Burley (NSW Government conservation policy officer), Ellie Downing (Science Communicator, Australian Museum) and Dr Damon Bolton (marine biologist, University of NSW).

About 77 students from universities in Sydney and Newcastle attended the Careers Day. There were enthusiastic discussions between students and speakers during formal Q&A sessions and over lunch at the end of the presentations. Lots of students were interested in pursuing a career in ecological consultancy, indicating that this profession will be in good hands with the next generation of consultants. The Royal Zoological Society of NSW is likely to run this as an annual event.



CODPROMISE

Alan Midgley

In February of 2018 I was starting to get greenfish fever (Murray Cod that is!), having not been west for a fishing trip for quite a while. Recently relocating from Sydney to Port Stephens in 2016, I tried to organise a New England area trip with some mates I knew from Sydney for some cod / kayak camping adventures over the coming weekends. Unfortunately, for various reasons they couldn't make it and so I organised what would become known as the 'Codpromise' trip with my partner over the April long weekend.

The compromise of the trip being that we would stay in a motel, explore the area and of course do a spot of fishing inclusive of a longer day trip down a good-looking stretch of water in the kayaks I had spied on Google Earth.

The week prior was spent mostly organising gear around work commitments and of course keeping an eye on the weather and current river levels, which were looking promising. On a previous planned trip, last minute water releases from a dam had rendered an area near-unfishable coupled with the fish getting 'lockjaw' from the sudden flush of cold dam water.

Eventually, the day had come, leaving early on Good Friday at about 7am. Lucky for us we only had to travel on the Pacific Highway for five minutes or so before our turnoff onto the winding Bucketts Way where very little traffic was travelling. I was lucky enough to be driving the work ute for this trip, which is an automatic and has cruise control. Bucketts Way itself is a bit windy to use cruise control but this would come in handy later in the trip as we would drive into the wide-open plains (also good to have the speed in check because double demerits!)

As anticipated, my partner was asleep after one hour so I just listened to music and casually drove along, observing a few people already camping at the roadside reserves. The drive was pretty easy, stopping for lunch on the roadside along the way. Saw a few free-roaming cows toward the end of the trip, which aren't the smartest of creatures!

Driving through town we spied our motel and carried on exploring a nearby national park where we had a look inside Ashford caves known for threatened roosting microbats. After this we then went to a lookout to a plunge pool. We also had a look at some of the local wildlife and campgrounds I had previously camped at in years past.



It was certainly a lot busier than when I was there last. I had seen emus in this area last time but only a lone bearded dragon would be seen on this drive around.

Using some tracks and waypoints I had on my new GPS, we then carried onto the most important part – the fishing spot! We launched our yaks at a bridge crossing, traversed some stinging nettle and slippery rocks, which eventually led to a larger pool. It's always a good feeling when what you looked at in Google Earth is a reality!



Unfortunately, a lack of flow meant weed and algae was a bit of an issue but we battled on. My lure of choice was a Jackall Doozer in HL Black (basically a big fake artificial fish). Nothing took any interest in our lures for about two hours, when out of the blue – bang! I hooked a fish from an average looking snag. I saw it almost instantly and could see it was a good fish. Like the usual cod it didn't sizzle line off the reel, but rather it just kept its head low and made stubborn, powerful lunges away from the net. Finally got it in the environet and it only just fit – definitely a personal best! I carefully removed the



barbless hooks and took some quick pics before releasing the lip grips. As soon as grips were unlocked he thumped himself / herself loose and returned to the weedy depths – all sweet!

Tried fishing for another hour with no luck and as we got to the other end of the pool the floating and submerged weed mass got worse so we decided to head to the hotel on dusk. We probably only did about half the speed limit to avoid potentially hitting any roos as this place is known for it. The car doesn't have a bull bar so a roo could do some damage. Anyway, back to the motel, shower, then Chinese food for dinner, then back to the motel to crash.

Next morning was a pretty late start due to the big day prior. We leisurely cooked some eggs on toast and sorted our gear for the day trip – snake bandages, EPIRB, food, water, camera, fishing gear etc. By the time we got to the launch site it was 11am. The plan was to do a 9km trip downstream and walk back to the car afterward (about 8kms). Seeing as there were a few caravaners around I thought I might ask if one could follow me down the road, where I would leave my car and get a lift back to the launch spot. Everyone looked pretty established, so I picked the least established looking person (others had washing lines set-up and solar panels around their cars). I approached an old fella named Charles who I got chatting too and he agreed to follow me to the exit point and give me a lift back. Charles was 85, from Adelaide, recovering from bronchial pneumonia and was travelling around with his wife. He joked about being careful because if my partner's shoulders get too strong from kayaking she could overpower me! My theory is as long as I keep paddling I should get stronger too!

Anyway, Charles drove me back and we commenced our kayak trip downstream. Best plan I thought was to paddle / drag a couple kilometres downstream to reach more 'virgin' water and focus our efforts beyond that. The weed in the river system was much less than in the river system fished the day prior. This river stretch is below a large dam and so it experiences periodic flushing when dam water is released. This can be both a blessing and a curse because if you are there when water is released from the bottom of the dam the fish get lockjaw as the cold water shuts them down. Luckily, we were there when everything was in balance.



Once again, fishing was initially tough with nothing to show for our efforts after two hours. I tried a variety of lures, even using crazy giant spinnerbaits. Eventually, I tried a lure change to a large peacock-coloured lure and got almost instant success when tossing it under the shade of a bankside tree where it was engulfed before I could crank the reel. A decent tussle and she was in the landing net. This specimen was a bit smaller than the one the day prior but it was a great fish nonetheless. As my partner was still to get on the board I swapped lures with her and she managed to get onto a little baby cod. Not much, but a cod is still a cod! I managed to get another fish thereafter, not as big as the first two I had caught though.

Along the way I startled a couple of pigs near a cow carcass as I went into retrieve a snagged lure. They darted off quickly. I would see another pig an hour later, but this one was not so skittish, and I soon found out why as six oinking piglets gathered around her in the nearby brush.

Time was getting on and as we had started later in the day we had to paddle past some great looking water to reach our exit point before dark. Still, I managed a couple more cod, nothing massive but I was starting to get them with some consistency. In our paddling travels we also saw some riverside campers as well as a cow that seemed to be stuck in a steep section of the river. I took a GPS mark (no houses for miles around) and later gave the information to the local police who said they would act on it. The cow looked in good health, but I was able to go right up to it and touch it with my paddle. It must have been very tired.

We finally reached our destination at sunset using the GPS as the car is not visible from the river due to the steep banks. With a big full moon rising we packed up our yaks and loaded the gear into the car before a quick hot cross bun and then the drive back. We were tired but satisfied that we had some success as cod can be the fish of a thousand casts!

We drove back to the motel taking it easy as we didn't want a roo strike to ruin this now. Got back into town and got food at the only place still serving, which was a Thai place. Then shower and sleep.

The next morning, we packed up and checked out the local markets, before departing back to Port Stephens after the successful codpromise between compromise and roughing it!



THE BYRON BAY BYPASS: ECOLOGICAL SUSTAINABILITY QUESTIONED BY ECOLOGICAL CONSULTANTS AND THE LOCAL COMMUNITY*

Dr Stephen Ambrose

20 August 2019

* This article is an interpretation of events incorporated in an opinion piece by Dr Stephen Ambrose. It is not an official communiqué from the ECA NSW Council.

In June 2019 Byron Shire resident, Jan Barham, contacted the ECA NSW for support of a request to Byron Shire Council, for a more detailed flora and fauna habitat survey within and adjacent to an approved Byron bypass road corridor. Part of the road corridor passed through disturbed habitat within Cumbebin Swamp, previously a listed wetland under the schedules of the State Environmental Planning Policy No. 14 – Coastal Wetlands, NSW (SEPP 14) and now under the NSW Coastal Management SEPP (2018).

The Byron Bay Bypass has been planned since at least the making of the Byron Local Environment Plan 1988 (Byron LEP). However, it has only been in the last four years that the various planning processes necessary to achieve consent have been undertaken and approved. The Byron Shire Council's proposal for the corridor led to the release of an environmental impact assessment and biobanking report in 2015, and a formal Biobanking Agreement with the NSW Office of Environment and Heritage (OEH) in 2015, with offsetting agreements issued in 2018 to compensate for adverse biodiversity impacts of the development. The Northern Region Joint Regional Panel (Northern Region JRP) approved the development in 2016. The Byron Bay Bypass EIS and supporting documents can be downloaded from the [Byron Shire Council](#) website.

The Butler Street Community Network Inc. (the Applicant) challenged the approval in the NSW Land and Environment Court, over a broad range of environmental and planning issues, and the court hearing was held 15-17 May 2017 (Proceedings No. 227775 of 2016). Among the many issues raised by the Applicant was that a Species Impact Statement was required because of the potentially significant impact of the development on threatened species listed under the schedules of the NSW *Threatened Species Act 1995*. Crucial to their argument was their belief that the Byron Bay Bypass EIS and the Biobanking Assessment were based on insufficient flora and fauna field surveys within and adjacent to the road corridor. Thus, they argued, the ecological impact assessment within the EIS and the size and nature of the biodiversity offset proposed in the Biobanking Report were based on a flawed dataset. Commissioner O'Neill dismissed the Applicant's appeal in the [judgment](#) handed down on 2 June 2017, concluding that the mitigation measures proposed and the Northern Region JRP's conditions of consent adequately address the issues of biodiversity loss.

In correspondence to the ECA NSW, dated 10 June 2019, Ms Barham states:

"Recent focus on the issue by myself (former Councillor and Mayor, Byron Shire Council 1999-2012) and MLC (2011 - 2017), the current Member for Ballina, Tamara Smith and a former MLC, Ian Cohen (1995 -2011) necessitated us engaging the services of Landmark Ecological Services Director, David Milledge. While Mr Milledge was not an accredited BioBanking assessor, he has recently completed his BAM training for accreditation as an assessor under the NSW Biodiversity Offsets Scheme awaiting accreditation from OEH".

"The issue of the bypass approval, including an approval to fill in a State significant wetland by Fisheries and the issuing of a red flag variation under BioBanking by OEH is complicated by the fact that Byron Council has granted a tender to commence work"

"The reviews of the BioBanking process by Milledge highlight a number of failures including the failure to identify a number of significant ecological values that require statutory consideration and could have prevented approval of the project. The reviews also identify a number of inconsistencies, omissions and misrepresentations made during the assessment and approval processes"

"I have been in contact with OEHL for the last month, making available Mr Milledge's reviews and seeking further information from them about the issuing of the Biobanking Statement ID :19 and two Biobanking Agreements, 348 and 352. At this point we have a meeting planned for Monday 17th June with OEHL representatives to discuss Mr Milledge's reports and undertake a site inspection".

"I am aware that the Ecological Consultants Association has recently made representations to OEHL regarding concerns with the BAM scheme and its inappropriate application by some accredited assessors. It would be helpful to know if you have previously made representations regarding the BioBanking Assessment Methodology and the role of assessors in its implementation. It would be appreciated if your organisation was able to have one of its members accredited under BioBanking to review this case to establish in relation to the assessor's role in independently and properly applying the methodology and the rigor applied by OEHL in approving the project. We are also greatly concerned that the legislative basis of BioBanking, essentially carried through to the new scheme, is being undermined by what appears to be a seriously inadequate application of the 'improve and maintain' test".

"I am seeking any information that may assist us in our attempt to have OEHL review their approval of this project under BioBanking in light of the information that has been made available to them."

On 17 June 2019, I responded to Ms Barham's correspondence on behalf of the ECA Council. We stated that the ECA NSW has a policy of not being an advocate for or against individual developments. However, we indicated that the main aim of the ECA NSW is to promote and enhance best practice in ecological assessment, planning and management in accordance with the principles of ecological sustainable development and detailed how this is achieved.

Further correspondence from Ms Barham, dated 8 August 2019, included separate reports from ECA NSW member, David Milledge, and another ecological consultant, Ross Wellington, who had independently walked the road corridor, conducted incidental ecological surveys and subsequently compiled separate reports.

One point of contention is the identity of one of three vegetation communities in an area of Cumbebin Swamp within the road corridor. The Byron Bay Bypass EIS identified all three communities as Paperbark Swamp Forest on the Coastal Lowlands of the North Coast. This was based on a flora survey that was conducted in accordance with the minimum requirements of the NSW Biobanking Scheme's field survey methodology. However, Milledge recorded several rainforest plant species dominating the strata of one of the communities during his site inspection, many of which had not been recorded during the surveys for the EIS. Consequently, he cautioned that the latter ecological community could constitute Lowland Rainforest on Floodplain in the North Coast Bioregion (Lowland Rainforest). This latter community is listed as Endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Critically Endangered (as Lowland Rainforest of Subtropical Australia) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, Milledge recommended an additional flora survey to verify the identity of the rainforest community within and adjacent to the road corridor.

Moreover, the Byron Bay Bypass EIS relied on fauna data that had been collected 15-19 years earlier, rather than conducting more current fauna surveys, especially targeted surveys for threatened fauna species. Milledge saw this as a major deficiency in the EIS and Biobanking Report, and concluded that the biobanking assessment failed to:

- undertake targeted fauna surveys to complement the data from outdated surveys;
- recognise the potential occurrence of Lowland Rainforest in and adjoining the southern section of the bypass footprint and to assess the potential adverse impacts on this community and on the Mitchell's Rainforest Snail (*Thersites mitchellae*). This snail species is listed as Critically Endangered under the EPBC

Act and Endangered under the TSC Act and is strongly associated with Lowland Rainforest. It is known to occur within the Byron Local Government Area, including Cumbebin Swamp and, while the EIS and Biobanking Report acknowledged this, potential habitat for this species within the road corridor was considered to be marginal and that it was unlikely to occur in the road corridor. The marginality of the habitat was considered in retiring credits for the biodiversity offset;

- recognise at least 11 additional threatened fauna species likely to be adversely affected by the construction of the bypass and to include these in the calculation of retirement credits; and
- adequately assess the indirect impacts of construction of the bypass on the Coastal Wetland, together with the direct and indirect impacts on the Lowland Rainforest.

On 3 August 2019, Ross Wellington, found 10 juvenile and immature snail specimens of the genus *Thersites* within and adjacent to the road corridor. Dr John Stanisic of the Queensland Museum examined photographs that Wellington took of the snails *in situ* and confirmed that some specimens were indeed *Thersites mitchellae*.

When the ECA Council received this information from Ms Barham on 8 August 2019, we resumed discussions on whether or not we should formally support the conclusions of one of our members (David Milledge) and request that Byron Shire Council allow an additional flora and fauna habitat survey to be conducted, to enable the impact and biobanking assessment to be reassessed. In doing so, I sought feedback from the consultants who conducted the EIS (none of whom are ECA NSW members, as far as I am aware), Byron Shire Council and OEH. But none responded definitively to that request. Nevertheless, after much soul-searching and debate within the ECA NSW Council, we decided to write a letter in support of the recommendations put forward by Milledge and Wellington. The rationale behind the ECA NSW becoming involved in this case was that one of our members wished to promote and enhance best practice in ecological assessment, planning and management in accordance with the principles of ecologically-sustainable development. The ECA Council supported his call for the need for additional survey and assessment in relation to the Byron Bypass if that objective was to be met. The ECA Council's letter accompanies this article.

While the ECA NSW has not yet received a direct response from Byron Shire Council, Mayor Simon Richardson did respond publicly in [The Byron Echo \(14 August 2019\)](#). He indicated that no further studies were needed and that *"1.4 hectares of impacted Paperbark Swamp Forest would be offset with the management and improvement of over 44 hectares of the exact type of vegetation found within the bypass - a perfect 'like for like' in terms of vegetation, including species found in rainforest and within the bypass footprint."*

In recent days, I have heard an opinion from another independent local ecological consultant that the vegetation community in question is likely to be Paperbark Swamp Forest, but changes to the hydrology of the wetland are drying and changing the chemistry of the soils and allowing more Lowland Rainforest plant species to grow within and adjacent to the road corridor. Therefore, do we have one community transitioning to another over time? In commenting on this, Milledge suggests that this consultant was referring to the two other vegetation communities in the corridor, rather than the third community that could be rainforest.

Clearing of the wetland within the road corridor began on 14 August 2019 ([The Byron Echo, 15 August 2019](#)). However, a last-minute injunction has been imposed on the clearing of the SEPP 14 area of the wetland that is within the corridor while Matters of National Environmental Significance (notably the Mitchell's Rainforest Snail and Lowland Rainforest) are being considered by the Commonwealth Department of Environment and Energy (DEE) under the EPBC Act.

While it is possible that adequate offsetting has occurred, it is my personal opinion that we do not know precisely what biodiversity will be impacted, and the nature and exact significance of those impacts, without additional flora and fauna surveys. Therefore, can we really say that there is accurate documentation of biodiversity loss,

and are the prescribed environmental management plans for the construction phase of the project and the biodiversity offset site the most appropriate ones?

The broader issue is that the flora survey for the EIS met the minimum survey requirements of the biobanking survey methodology. Yet key flora and fauna species present within the corridor, and which help define the ecological community, were not detected and, in relation to this site, places the efficacy of the biobanking methodology into question. While this methodology requires ecological consultants to take into account the suitability of habitat for threatened entities that could be impacted, but not detected or identified within the corridor, subjective reasoning based on experience can come into play. It is my point of view, this was the trigger, rather than the specifics of the case, for the ECA Council to discuss the Byron Bay Bypass. As ecological consultants, we all make a call about the relative importance of habitats for threatened entities or migratory species within or near development footprints; most of the time we get it right, sometimes we get it wrong, but NSW Biobanking, and now the NSW Biodiversity Offset System (BOS), require us to make those calls. If we get it wrong, then it could have disastrous biodiversity consequences, and we may not know they have occurred.

Dr Stephen Ambrose

20 August 2019

ASSESSING THE SUCCESS OF THE NAILTAILNURSERY:

A NOVEL CONSERVATION STRATEGY

Alexandra Ross

ECA Research Grant Winner

Background

Fenced reserves and sanctuaries are a useful strategy for protecting species from introduced predators. However, a prey species removed from predators for an extended period can become habituated and lose predator avoidance strategies. These processes are termed ‘prey naiveté’ and are recognised as one of the leading causes of extinction in vulnerable species.

The bridled nailtail wallaby (*Onychogalea fraenata*) is a medium-sized macropod that has experienced dramatic reduction in range since European settlement and is currently found in only two wild populations with less than 500 individuals in total in the wild. Despite this, its IUCN conservation status was recently downgraded from endangered to vulnerable due to a large free-ranging fenced population at Scotia Sanctuary in western NSW. Though we acknowledge the importance of fenced sanctuaries as a safeguard against extinction, it’s important that we manage our remaining wild populations such that the species can succeed in the wild without creating a population which is both costly to maintain and naïve to feral predators.



Image description: A female bridled nailtail wallaby with pouch young. Bridled nailtail wallabies are easily identified thanks to their distinctive markings, including the ‘bridle’ under their arms, their white cheeks, and their pale grey fur.

To protect vulnerable juveniles a ‘Nailtail Nursery’ which can hold up to 15 individuals was constructed at Avocet Nature Refuge. The nursery is fenced and predator-free and was designed to hold juveniles in the most vulnerable weight range (less than 3kg), until re-release. At 3kg and above, their survival rate increases from 47% to 80% as they become less vulnerable to feral cats. This means the larger population remains wild, while only the vulnerable individuals are fenced, thus lowering overall costs and ensuring the population doesn’t become naïve due to prolonged separation from predators. Construction of the nursery was completed by the non-profit organisation WildMob in 2015.

Image description: Members of the NGO WildMob stand next to the completed Nailtail Nursery, where juvenile wallabies are held to protect them from feral predators like the cat and fox.



The project was lucky to receive a research grant from the Ecological Consultants Association of NSW to determine whether or not the Nailtail Nursery is a successful conservation strategy. If the nursery was successful, we expected juvenile retention to improve. We hypothesised that the total population size would increase following the introduction of the nursery in 2015.

In addition, if nursery-raised wallabies are predator naïve they may be more susceptible to predation post-release, meaning there may be no advantage gained from isolation, even if their juvenile survival improves. We tracked nursery-raised and wild-raised individuals to compare survival and measure anti-predator responses. We hypothesised that nursery-raised individuals would be less wary, but prey naiveté wouldn't affect their survival as they would be above the critical weight threshold (3kg) when they were released from the nursery.

Methods

Bridled nailtail wallabies have been regularly trapped at Avocet Nature Refuge since 2008, using the capture-mark-recapture technique. Unfortunately, bridled nailtail wallabies tend to be either 'trap-shy' or 'trap-happy', i.e. they tend to either be trapped regularly or not at all. This skews the data as the traditional capture-mark-recapture population estimate relies on the assumption that every individual in a population has an equal chance of being caught. For this reason, we used the more robust Jolly-Seber method for estimating populations.

Captured bridled nailtail wallabies in the 3-4kg weight bracket were fitted with identifying eartags (Allflex 28mm) and a VHF transmitter collar (Series M1900, Advanced Telemetry Systems). Wallabies were taken from both the greater wild population, and from the nursery, before re-release back into the wild. Radio-collared wallabies were tracked for the next four months to compare behaviour and survival.



Image description: A VHF radio collar attached to a captured bridled nailtail wallaby. The radio collars are attached with a DIY elasticised weak link, so that collared wallabies can escape the collar if it gets snagged on roots, logs, or fences.

To examine the wariness of nursery-raised and wild-raised bridled nailtail wallabies, radio-collared wallabies were approached at night by an observer wearing night-vision goggles and individual responses will be assessed for:

- SD; Start distance (distance from observer at start of observation)
- AD; Alert distance (distance from observer at moment of wallaby awareness)
- FID; Flight initiation distance (distance from observer when flight responses are initiated)
- FD; Flight distance (distance travelled after flight responses are initiated)

Nursery-raised wallabies are as viable as wild-raised wallabies

Transmitters have been attached to wild-raised and nursery-raised wallabies since November 2017. In total nineteen transmitters have been attached, and five more will be attached by the end of the experiment ($n = 24$ wallabies in total). Of the wallabies currently being tracked, survival data is available for $n = 16$, and no



Image description: A volunteer uses the ‘high point’ of a car to track radio-collared wallabies at sunset, when the species is most active.

difference in survival has been noted between the two treatments (Figure 1). This means that being raised in the nursery does not impact survival after release into the wild.

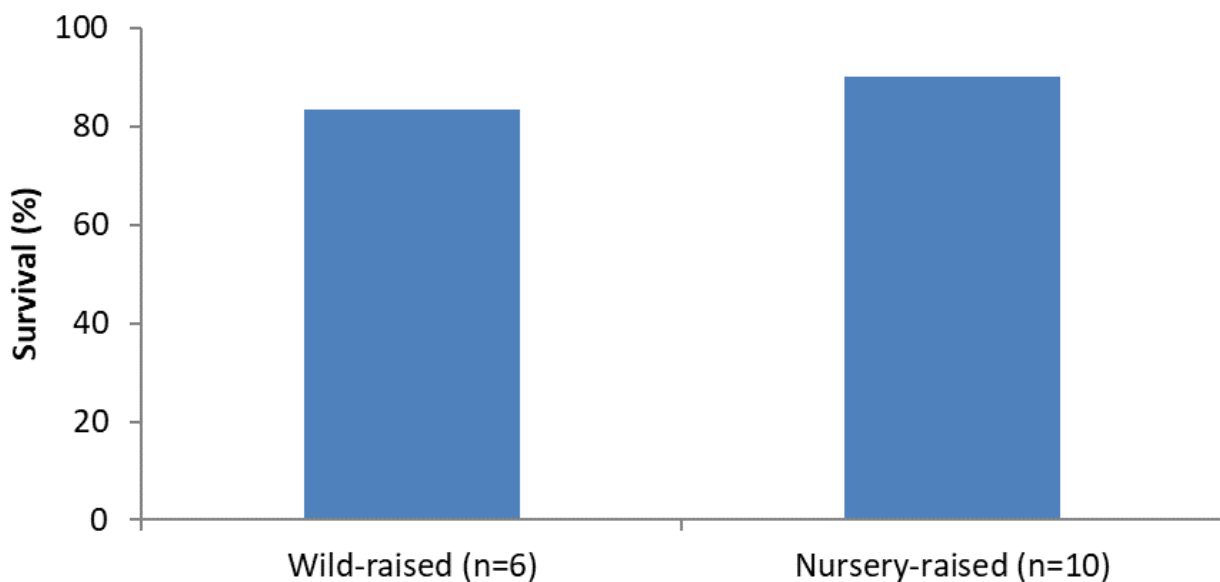


Figure 1. There is no difference in survival between wild-raised and nursery-raised wallabies

The flight initiation distance (FID) of nursery-raised wallabies was collected prior to release into the wild, however the FIDs of wild-raised wallabies was only collected after initial capture, so no pre-collaring data exists.

Nursery-raised wallabies appear to suffer a form of naivet  due to being raised in the nursery, allowing us to get within a few metres of the individual. However, the FID dramatically increases after four weeks in the wild, and after eight weeks there is no discernible difference in the FID of nursery-raised or wild-raised individuals (Figure 2). This suggests that although nursery-raised individuals are impacted by their time spent in the nursery, the impact is not long-term and can be rectified by a return to the wild.

Population estimates based on capture data have been completed for 2011, and every year since 2013. Unfortunately, we do not yet have access to capture data from any intermediate years. Following the introduction of the nailtail nursery in 2015, total population size has steadily increased to an all-time high in July 2018.

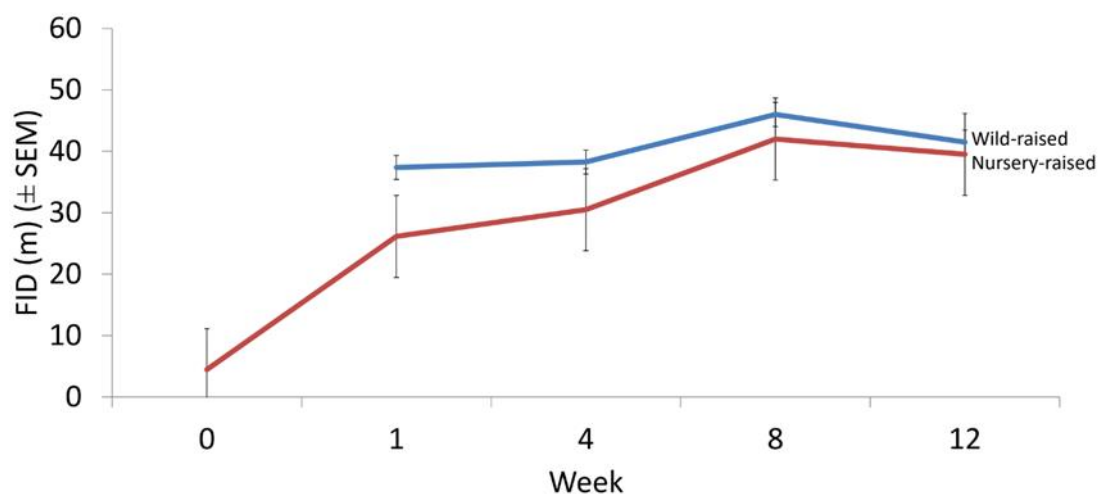


Figure 2. The FID of nursery-raised (red) and wild-raised (blue) wallabies following radio-transmitter attachment.

Population estimates based on capture data have been completed for 2011, and every year since 2013. Unfortunately, we do not yet have access to capture data from any intermediate years. Following the introduction of the nailtail nursery in 2015, total population size has steadily increased to an all-time high in July 2018.

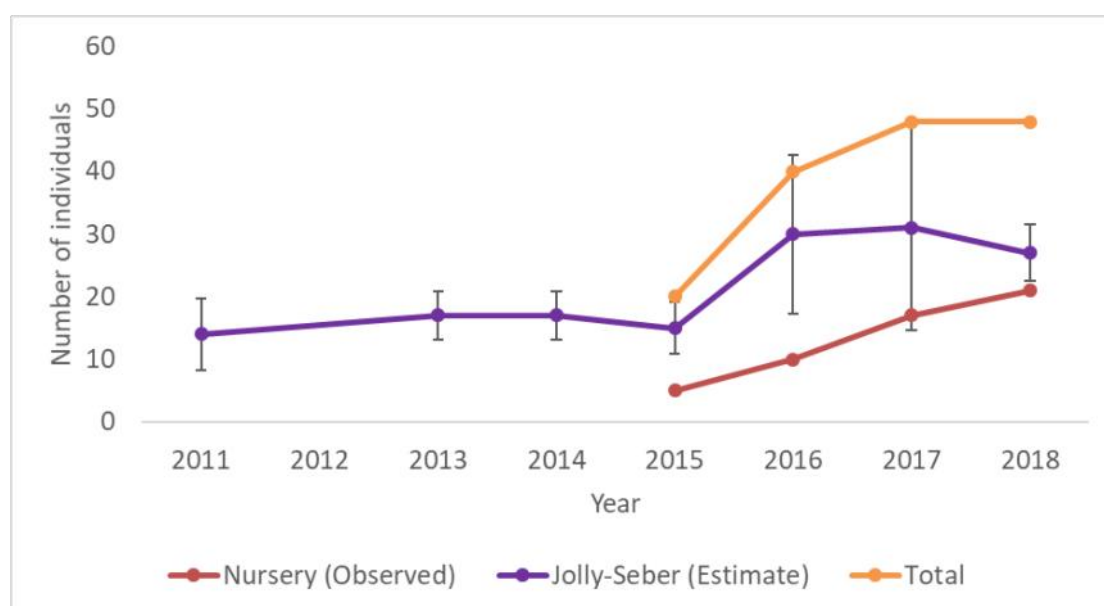


Figure 3. Population size of the Avocet bridled nailtail wallaby population since 2008 using the Jolly-Seber estimate (± 1 SEM) and from actual observations in the nailtail nursery, where exact population size is known.

Conclusions

Since the introduction of the Nailtail Nursery there has been undeniable evidence that the population of bridled nailtail wallabies has increased. In addition, the nursery-raised wallabies do not appear to suffer any long-term effects of prey naiveté as a result of prolonged separation from predators. Though monitoring continues for this species, initial results are promising and could mark the beginning of a new type of conservation strategy for future species at risk of extinction.

WHAT NO TREES?

Martin Denny

Much of inland NSW is considered to be vast open plains. But this was not always the case, as I discovered when undertaking a comparison between the descriptions of the countryside by early explorers and what occurs today (Historical and Ecological Study of the Effects of European Settlement on Inland NSW by Martin Denny. A report by the Nature Conservation Council of NSW to the Heritage Council of NSW, 1992). Two examples are given here:



Major Mitchell described this cropped area near Bogan River as 'open forest land'



View towards Koonenberry Range, north of Broken Hill described by Charles Sturt as 'to the eastward there were distant ranges, but no prominent hill or mountain to be seen. One dense forest lay between us and them...'

The loss of trees is particularly noticeable in the north-western part of the state, in the Tibooburra region.

Many early explorers described the countryside, particularly the sand hills, as being well covered with trees of various species. Here are some examples.

"The sandridges some partially, some thickly, covered with Pine Trees were from 30 to 50 feet high" (Sturt, 1849).

"...to the north of this creek the ground is very sandy, and timbered with pines, acacias and several descriptions of trees with which I am unacquainted." (Wills, 1863) and

"The sand hills are covered with pine and withered acacia, commonly known as mulgar." (Browne, 1945).

Today in the corner region, only two small clumps of pine (*Callitris columellaris*) are known. It has been pointed out that many of the trees commonly seen in the western part of N.S.W. have declined in number since European settlement and that these species will continue to decline as seed stocks are depleted (Kartzaft, 1969). Why have the trees disappeared from the Tibooburra region?

In the past, timber was very important to the settlers:

It was used for fuel and food for stock

"I have scrub cutters in four paddocks and in spite of it, don't expect to save many of the weaners" (Chambers, 1901),

For house building



Local timber used to construct sheds and houses

And, of course, fences.



Bessemer process of producing steel allowed for lighter and stronger wire and fences made of wooden posts and steel wire became part of the Australian scene (Cannon, 1973). A typical fence was described by Chambers in 1901: "Mulga posts 3 1/2" (8.9 cm) at small end, 1'6" (46 cm) in the ground and 3'10" (120 cm) out of the ground." The posts were placed either 15' (4.6 m) apart for an internal fences or 12' (3.7m) apart for a boundary fence.

To see how many posts were used in the Tibooburra region for fences, several fences which were still standing after about 50 years use were measured. These fences contained posts 3.9 m apart, an average of 8.3 cm thick and



Goat cart carrying wood for fuel in Tibooburra

For lining wells and mine shafts



Fences using wire were not used until the 1850's when gold mining drew many men away from properties where they were employed as shepherds. Property owners could no longer rely on free-ranging sheep and had to fence them in. Inland properties could not supply enough material for the traditional "post and rail" fence so wire fences were introduced. The first wire fences used wire 1/4" thick because of its low tensile strength, however, by 1856 the

1.6 m long (including the part in the ground). Some of the tree species used for the fence posts were:

Tree – Common Name	Tree – Scientific Name
Coolabah	<i>Eucalyptus microtheca</i>
River red gum	<i>Eucalyptus camaldulensis</i>
Mulga	<i>Acacia aneura</i>
Gidgee	<i>Acacia cambagei</i>
Whitewood	<i>Atalaya hemiglauca</i>
Bloodwood	<i>Eucalyptus pyrophora</i>
White cypress pine	<i>Callitris columellaris</i>

Using rough calculations, for every kilometre of fence, about 200 posts would be needed. Consulting early pastoral maps (before steel posts were used) it can be estimated that a medium size sheep property would have used about 145 km of fence, i.e. about 30,000 posts.

I had the opportunity back in the 1970s of interviewing some of the ‘old timers’ who were employed by properties as fencers. In this type of country, a fencer estimates that he would obtain only one post from each tree used; this is particularly so where there is an abundance of *Acacia* species. Even if he averages 2 posts per tree, then each property would have used 15,000 trees, to fence an area of about 800 km². As the total area of the corner region is about 15,000 km², then it can be estimated over a quarter of million trees (250,000) were used for fencing alone.

I have been questioned on evidence that tree removal occurred in such an intensity, as present day visitors feel that the open stony plains were also like this. I have to take visitors to places where the stumps from the cut trees are still visible. Two examples are given here.



In cattle country, fencing is not so intensive, thus trees weren't utilized to the same extent, and today more trees are found in south-west Queensland than north western N.S.W. (see Table below) In addition, the Queensland Government issued pamphlets advising graziers how to lop branches from trees and shrubs for feed and not destroying the plant. This advice was not issued in NSW and trees and shrubs were heavily lopped.

Tree density in north-west New South Wales and south-west Queensland (estimated in 1979)

- Mean of three properties in north-west NSW 1,118 trees/km²
- Mean of two properties in south-west Queensland 4,533 trees/km²

Thus an historical approach to many present day problems may provide a different aspect which can prove of valuable assistance in solving such problems.

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Contributions to the Newsletter, Volume 44

Contributions to the next newsletter should be forwarded to the administration assistant Amy Rowles admin@ecansw.org.au by the 30th of January 2020.

- Articles may be emailed in WORD, with photos included or referenced in an attached file as a jpg.
- Please keep file size to a minimum, however there is no limit on article size (within reason)
- Ensure all photos are owned by you, or you have permission from the owner
- Ensure that any data presented is yours and you have permission from your client to refer to a specific site (if not please generalise the location).
- All articles will be reviewed by the editorial committee, and we reserve the right to request amendments to submitted articles or not to publish.
- Please avoid inflammatory comments about specific persons or entity

The following contributions are welcome and encouraged:

- ◇ Relevant articles
- ◇ Anecdotal ecological observations
- ◇ Hints and information
- ◇ Upcoming events
- ◇ Recent literature
- ◇ New publications (including reviews)
- ◇ Photographs

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ECA Photo Gallery



Top Left: Royal National Park. **Top Right:** Hermit Crab, Shark Bay, Bundjalung National Park. **Above Left:** Willie Wagtail hatchling, Ashby NSW. **Above Right:** Christmas Balls, Royal National Park. *Photos Courtesy of Roxanne Zybenko Keane*

Below Left : Brown Tree Snake (*Boiga irregularis*) Sydney, emerging from a honeycomb formation at dusk. **Below Right:** Sand Goanna (*Varanus gouldii*) taking a Spinifex Hopping Mouse (*Notomys alexis*) on the Barkly Tableland, Northern Territory. *Photos courtesy of Gerry Swan.*



ECA Photo Gallery

**Green-thighed Frog.
Devil's Pulpit.** *Photo
courtesy of Veronica
Silver*



Above left: Flying Duck Orchid, Royal National Park.

Above: Pelicans, Sandon River, NSW.

Below Left: Jewel Beetle, Red Rock, NSW.

Below: Monitor Lizard, Woolli, NSW.

Photos courtesy of Roxanne Zybenko Keane

