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Rigid Wing-tags for Cockatoos

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Between 1970 and 1975, 1128 Galahs and 685 White-tailed Black-Cockatoos were marked with wing-tags so that the birds could be individually identified without resorting to re-trapping. Tags have been worn by some cockatoos for eight years and do not appear to have interfered with their behaviour or reproductive success. Similar wing-tags have been used on Long-billed Coreellas, Little Coreellas, Red-tailed Black-Cockatoos and Pink Cockatoos.

Introduction

Most studies on the behaviour and social organisation of animals depend upon the observer being able to recognise a sufficient number of individuals for the results of interactions to become meaningful in the long term.

A few mammals such as Zebra, *Equus quagga* (Klingel, 1969), Hunting Dogs, *Lycaon pictus* (van Lawick-Goodall, 1970) and African Elephants, *Loxodonta africana* (Douglas-Hamilton, 1975) have facial or pelage features that enable individuals to be identified reliably by research workers. With birds only the male Ruff, *Philomachus pugnax*, (Hogan-Warburg, 1966) and Bewick's Swan, *Cygnus columbianus bewickii*, (Bateson, 1977) have been shown to have individual differences that can be recognised reliably. For most species, therefore, we need to create individuality in some distinctive way, so that an animal can be recognised at a distance without having to retrap and handle it.

Bird studies have pioneered the field of individual marking techniques. Coloured leg-bands have been used most and have produced information from a wide range of species, but they are of little use for those groups of birds that have very short tarsi or that rarely display their legs to view (i.e. waterbirds, penguins, parrots).

Other ways of marking that have been tried are back-tabs (Blank and Ash, 1956), neck-tags (Craighead and Stockstad, 1956), plastic collars (Braithwaite, 1966), leg streamers (Thompson, 1968), bill-markers (Riggert, 1977), and feather-imping (Wright, 1939), but none of these have been found suitable for parrots whose very strong bills and sharp claws can shred most materials. Only tags fixed to the wings have resisted these attacks and have offered sufficient variety of design and inscription to enable them to rival leg-bands as a means of individually marking large numbers of long-lived birds.

Wing-tags for marking birds were pioneered in the United States (Anderson, 1963; Hester, 1963). Parry used this technique for the first time in Australia when she individually marked a population of Laughing Kookaburras, *Dacelo novaeguineae*, (Parry, 1967). During intensive field studies of parrots at the University of New England, Brereton and co-workers used a modified version of Parry's wing-tags on the Eastern Rosella, *Platycercus eximius* (Brereton and Pidgeon, 1968).

This paper describes the use of rigid wing-tags which have replaced the flexible fabrics of other workers for use on cockatoos.

Materials and Methods

Tag material

The flexible fabric used by other workers (cited previously) was adequate for small parrots such as rosellas even though it did tend to curl up and to be preened in amongst the feathers. When the CSIRO, Division of Wildlife Research began to study cockatoos we found that both Galahs, *Cacatua roseicapilla* and White-tailed Black-Cockatoos, *Calyptorhynchus baudinii* rapidly shredded this material. In the search for alternatives, darvic plastic sheet with its slightly greasy feel (see Coulson, 1963) resisted most chewing by Galahs (<1% of individuals defaced their tags) and allowed six distinct colours to be used (see Results). Black-Cockatoos chewed up darvic and so stainless steel was used to make tags for them. Besides these materials, stainless steel with a baked enamel finish (Figure 1h) and anodised aluminium in a variety of colours have been used (see Table 1).

Size and shape

When adding extra weight to an animal, its own weight needs to be taken into account. As a rough guide we have found that the tags and attachment wires should not exceed 2% of the body weight of the bird (see Table 1). Within this limitation we require a maximum visible

surface shaped so as to minimise aerodynamic interference and to present an edge that is not likely to snag on branches or, particularly, in the hollows where cockatoos nest.

The tag fastened to the wing leaves a visible strip of wire down the middle of the tag. To avoid confusing letters with this wire we initially used rectangular tags (Figures 1a and 1b) to allow a letter to be placed each side of the wire far enough apart to be clearly seen. White-tailed Black-Cockatoos preen the wing coverts over the leading edge of the tag and these rectangles are satisfactory. With Galahs, the coverts are shorter and the hollows they use narrower; we found that several tags were caught and twisted making them hard to read, and so we tried different shapes. Theoretically, the diamond shape should be ideal (Figure 1c) and was satisfactory; however, machines can punch discs more easily (and, therefore, cheaply) and so we settled on discs of aluminium 0.7 millimetres thick and of 32 millimetres diameter (Figure 1d and 1e). These aluminium discs have been used subsequently on Long-billed Corellas, *Cacatua tenuirostris* Little Corellas, *C. sanguinea* Sulphur-crested Cockatoos, *C. galerita* and Pink Cockatoos. *C. leadbeateri* (see Table 2). Plate 18 in Rowley (1975) illustrates some of these tags in colour.

TABLE 1
Dimensions of wing-tags used on cockatoos

Detail of tag					Loading		
1	2	3	4	5	Species (from Table 2)	4 as % of area of one wing	5 as % of body weight
Material	Shape	Dimension (mm)	Surface area (cm ²)	Weight of two tags and two wires (g)			
Darvic	Rectangular	40 x 25 x 0.8	10	4.4	A	2.3	1.4
Stainless steel	Rectangular	42 x 29 x 0.7	12	14.9	A	2.8	4.7
					E	1.5	2.3
Stainless steel	Diamond	26 x 26 x 0.7	7	9.4	A	1.6	2.9
Stainless steel with baked enamel	Rectangular	42 x 28 x 0.8	12	14.2	E	1.4	2.2
					F	1.3	2.1
Anodised aluminium	Rectangular	41 x 29 x 0.9	12	8.0	F	1.3	1.2
Anodised aluminium	Circular	32 x 0.7	8	4.3	A	1.9	1.4
					B	1.9	1.0
					C	1.5	0.9
					D	1.4	0.6
					G	0.8	0.5

Symbols

The individuality of the wing-tag depends upon the symbols that it carries and these can be letters, numbers or shapes. We have found that combinations of two letters or a letter and a number give us an adequate number of unique tags. Initially the entire alphabet was used, each set of tags with a two letter combination. Subsequently we found it advisable to omit certain letters that we found to be confusable in com-

bination, bearing in mind that part of the tag may be obscured by the coverts (Figures 2 and 3). For example, we now find the following 13 letters give us 169 easily identifiable, unique pairs: A, B, C, E, I, M, Q, R, S, U, V, W, X.

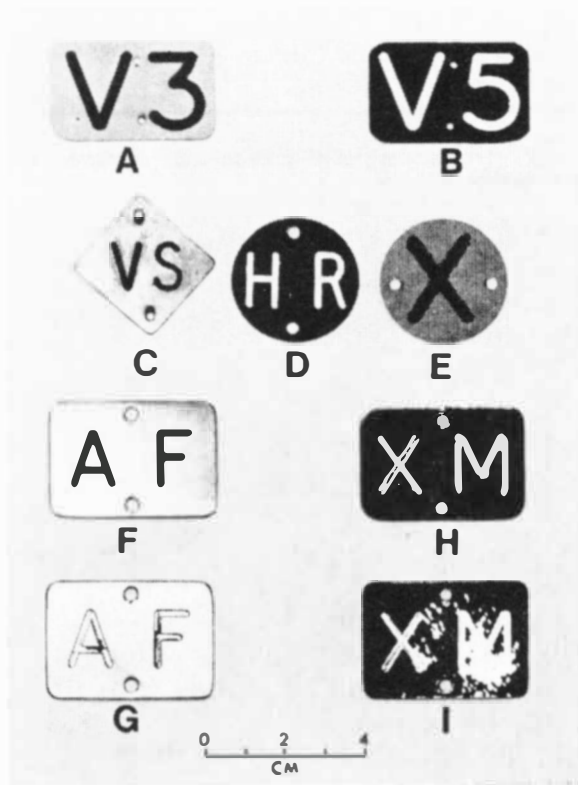


Figure 1. Different wing tags used to mark cockatoos. (a) and (b) are tags of darvic sheet and two different colours are illustrated [a] yellow and [b] blue. (c) Stainless steel (natural finish). (d) and (e) Anodised aluminium. (f) Stainless steel (natural finish). (g) As in (f) showing how paint has been picked out by the bird. Compare with (f) which is the other tag from the same bird. (h) Stainless steel with baked on red enamel finish. (i) As in (h) but bird has picked off some of enamel. Compare with (h) which is the other tag from the same bird. Photo: G. Chapman.



Figure 2. A wing-tagged Galah; note how the large letters are not obscured by the wing coverts. Photo: G. Chapman



Figure 3. White-tailed Black-Cockatoo with stainless steel tag; note how coverts tend to drape over the leading edge of the tag. Photo: L. Moore

TABLE 2

Details of cockatoos that have been wing-tagged.

Species	Average weight of bird [†] , g	Average area of 1 wing [‡] , cm ²	Number tagged including 1978
A* Galah	320	429	1 908
B Pink Cockatoo	417	466	63
C Little Corella	506	521	112
D Long-billed Corella	706	580	261
E White-tailed Black-Cockatoo	660	839	685
F Red-tailed Black-Cockatoo	675	957	226
G Sulphur-crested Cockatoo	812	1 022	15

* letter is used in Table 1 column 6.

[†] data from present studies, unpublished; measurements for equal numbers of males and females combined and averaged. Long-billed and Little Corella data from Dr G. T. Smith.

[‡] from Watters, 1968.

The size of the symbols depends on the space available on the tag; we found that we could use 20 millimetre tall letters on the darvic tags for Galahs, but that 15 millimetres was optimal on the stainless steel and aluminium tags when used on cockatoos with long wing coverts. To achieve long-lasting marks we had the tags professionally engraved and then filled the resulting 2 millimetre wide trench with fast-drying enamel paint. When anodised aluminium (in red, blue, green or black) was used the engraved trench shining in the natural metallic silver has sufficient contrast to enable the symbols to be easily read. Anodised gold tags or plain aluminium ones still need the engraved symbols to be filled with a contrasting paint.

We found that it was important to know what posture the bird was most likely to be in when we were trying to read the tag. This may sound trivial but a perched bird sitting upright presents its wing (and, therefore, the tag) in a different plane to that when the bird is feeding on the ground and this can be confusing.

Fastening

Tags were fastened to each wing by the method used by the New England workers (Brereton and Pidgeon, 1968) — namely a piece of stainless steel wire* passed through the pata-

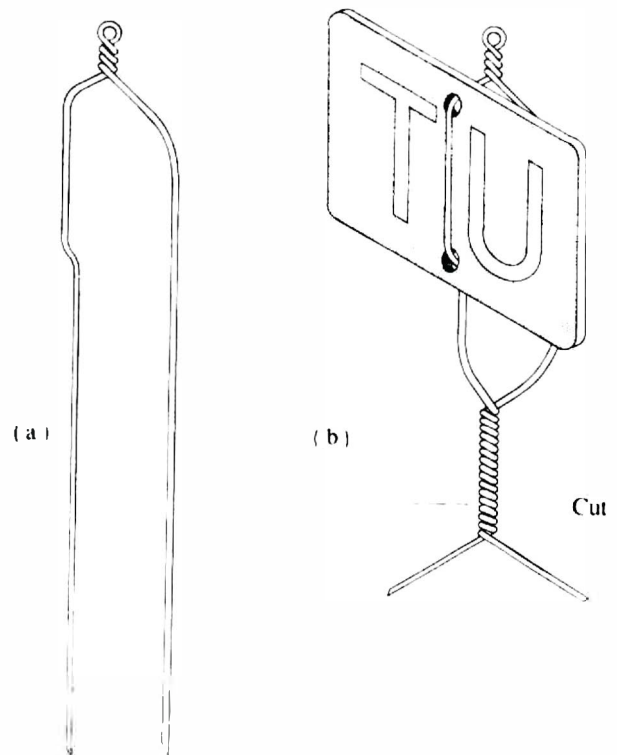


Figure 4. Details of fastening wing-tag.

(a) the fastening wire of stainless steel

(b) fastening wire with tag attached and the ends of the wire twisted shut. Drawing: P. de Rebeira.

* "Spoolarc welding wire". Stainless steel welding wire (0.9 mm diameter) by Chemetron Corp. Pennsylvania, U.S.A.

gium and twisted so as to form a closed loop around the ulna, or forearm of the wing, passing between the third and fourth secondaries (see Figures 4 and 5). The patagium resembles the web of flesh between the human thumb and forefinger; musculature, enervation and blood vessels are minimal and consequently there appears to be little pain or discomfort and virtually no bleeding when it is pierced by the wire. The loop of wire is fastened with two fingers inside the loop so as to leave sufficient freedom; the finished loop is shaped carefully (as in Figures 4 and 5) before the bird is released.

Return of Tags

With both Galahs and White-tailed Black-Cockatoos, numbered stainless steel leg bands supplied by the Australian Bird-banding Scheme, were also placed on the birds. Cockatoos have very short tarsi and consequently bands are seldom noticed by members of the public and so are seldom returned to us. Whilst 5.4% of the wing-tags placed on black-cockatoos have been returned, only 0.6% of the leg bands have been found. With Galahs marked only with leg bands 5.4% were returned after death compared to 12.5% of the wing-tags (Rowley, in prep.).

The high return rate for the wing-tags was due, not only to their increased conspicuousness but also to the message carried on the reverse side of the tag, which was:

Inform CSIRO
Helena Valley
W.A. 6056. Phone
Rev. Chg. 299-6477.

At first small self-adhesive labels were printed and stuck on the back of the tag and sealed there with plastic but latterly we have the words anodised onto the back of the aluminium tag. The only problem has been that our telephone number has been altered twice since we started this labelling! Nevertheless, not only are many people more inclined to pick up the telephone than a pen but we find we establish friendly relationships and many useful contacts this way. Our telephone switchboard is well briefed as to the information we require and the nature of our projects. As a result the percentage of incomplete reports is low, even if research staff are not available when the call comes through.

Two current cockatoo studies do not use leg-bands at all. Red-tailed Black-Cockatoos be-

cause the birds remove or crush the bands and Pink Cockatoos because males require a different band size from females and we cannot always be sure of the sex of the bird we want to tag, especially nestlings.



Figure 5. Detail of fastening wing tag.

(a) upper surface of wing with tag and wire in position and in the process of being twisted shut.
(b) under surface of wing showing how two fingers are inserted in loop to ensure that it is not twisted too tight.

Drawing: P. de Rebeira.

Results

Galahs

Between 1970 and 1976, 1477 Galahs were wing-tagged as either nestlings or juveniles in their first six months of life. Initially we used stainless steel diamonds (Figure 1c) but turned to aluminium discs which were half the weight (Figure 1d) and available anodised in different colours.

Two hundred and seventeen of these birds died (Rowley, in prep.) and their tags were returned to us, giving a return rate of 12.5%. These figures from tag returns plus our regular resighting of tagged individuals remaining in the study area provided data that has been analysed elsewhere (Buckland, 1977) and showed a high mortality rate throughout the first eighteen months of life while the mortality rate of birds eighteen months or older was very much lower.

Of 421 adult Galahs tagged with six different colours of darvic (Figures 1a and 1b), the average for the five years 1970-1974 showed that 73% survived each year. Expressed another way a little over a quarter of the birds died within each 12 months. It was interesting to find that tags of some colours survived better than others. Female birds were tagged red, white or yellow and yellow tagged birds survived significantly better than the others. Male birds were tagged blue, green or black and more blue tagged birds disappeared than either of the other two colours.

In the third year of the study we thought that perhaps the wire loops holding the tags to the wings were too tight and so we made them looser on the nestlings that year. To our horror we found five individuals that caught their tags on the stubs of branches. We nearly abandoned the technique but we decided to tighten the loop again and to pay extreme care to the shaping of the loop before releasing a tagged bird; we have had no further trouble.

White-tailed Black-Cockatoos

Thirty seven of 685 sets of natural finish stainless steel tags (Figure 1f) placed on these birds were returned to us; only ten of these were returned via members of the public — the rest were found by us, mainly in the debris of eagles' eyries (Saunders, 1979). Several of the birds have carried their tags for seven or eight years during which they bred regularly and success-

fully. For example, Female AN was tagged in November, 1970, and has bred successfully every year since. In both 1975 and 1976 she fledged two nestlings which is unusual (one is normal; Saunders (*loc. cit.*)). She was last sighted November, 1978. Some individuals did pick out the enamel paint of the lettering but the letters were still legible (Figure 1g) although they did not stand out as well as the painted letters.

In no instance have we found birds caught up by their tags on branches or in nest hollows.

Red-tailed Black-Cockatoos

Since December, 1974, 96 adult and 130 nestling Red-tailed Black-Cockatoos have been tagged (Saunders, 1977a). To date 13 (5.8%) tags have been returned. When these birds were first marked a stainless steel tag coated with a layer of baked red enamel was used to reduce their conspicuousness (Figure 1h). However, some birds worked at the enamel and managed to spoil the tags (Figure 1i). These damaged tags have been replaced with lighter tags of aluminium anodised matt red and these appear to last well and to remain clearly visible.

Long-billed Corellas

Nestlings have been banded at four locations by each of the authors (Saunders, 1977b; Rowley, unpubl.) and by G. T. Smith (pers. comm.). To date 212 nestlings and 49 adults have been tagged and survival of the tagged birds appears to be excellent:

1. Female MQ was tagged on nestlings on 31 October 1973 and was recorded on three eggs on 20 September 1977.

2. FQ was tagged as a nestling on 22 November 1973 and was shot and the tag returned over four years later in January 1978.

To date 13 (5.0%) tags have been returned to us.

Little Corellas

One hundred and two adults or immatures and ten nestlings have been tagged by G. T. Smith (pers. comm.) in the Murchison Region of Western Australia. Ten (8.9%) tags have been returned so far; the tagged flocks are regularly checked and to date no problems have arisen with the tags.

Pink Cockatoos

These birds have only been tagged for two years so far. The round aluminium discs do not appear to worry the birds at all and the only trouble to date has been with one fledgling that managed to tether itself to a barbed wire fence — a hazard for even untagged fledglings making early, inexperienced landings. Because of the difficulty of approaching close to the adults at some stages of the year we have used tags, with a single letter 20 millimetres tall and 2.5 millimetres wide, for increased clarity (Figure 1c).

Discussion

Rigid wing-tags have been in continuous use on several species of cockatoo for the past nine years and have enabled the behaviour and ecology of these birds to be studied at the individual level.

As has been discussed elsewhere (Saunders, 1979; Rowley in prep.) we found that there was an increased predation of wing-tagged birds and that consequently the data provided by these individuals could not be reliably used for the calculation of population parameters such as mortality rates. We think that this increased risk stems from conspicuousness creating "oddity", rather than for physical debility due to the tag. To minimise oddity we now use matt finish anodised aluminium tags which are half the weight of the earlier stainless steel ones (see Table 1), and do not glitter.

Tags have been worn by some cockatoos for more than eight years and do not appear to have interfered with their behaviour or reproductive success. No other technique would have enabled large numbers of these birds with their hidden tarsi to be recognised individually from a distance over many years.

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