

AGE AND SEX CHARACTERISTICS OF THE HELMETED HONEYEATER *Lichenostomus melanops cassidix* IN THE HAND

DONALD C. FRANKLIN^{1,2}, IAN J. SMALES³, BRUCE R. QUIN¹ and PETER W. MENKHORST⁴

¹Department of Natural Resources and Environment, Yellingbo Nature Conservation Reserve, Macclesfield Road, Yellingbo, Victoria 3139

²Current address: P.O. Box 987, Nightcliff, Northern Territory 0814. E-mail: monsoon@topend.com.au

³Zoological Parks and Gardens Board of Victoria, P.O. Box 248, Healesville, Victoria 3777

⁴Department of Natural Resources and Environment, Parks, Flora and Fauna Program, P.O. Box 500, East Melbourne, Victoria 3002

Received: 3 February, 2000

There has been a range of opinions about sexual dimorphism in the Helmeted Honeyeater *Lichenostomus melanops cassidix* despite little supporting data, yet these opinions have played an historic role in the definition of the taxon. We demonstrate that males are, on average, larger than females in a range of characters, but there is no absolute morphological distinction. We were unable to identify any consistent or marked differences in plumage between the sexes. There are also few differences between the plumage of young birds and adults, the only categoric difference being in the shape of the tip of the rectrices. However, juveniles have a yellow gape, bill and palate whereas those of adults are black. Gape colour is the more persistent of the three juvenile traits, but its persistence varies greatly between individuals. There are also differences between juveniles and adults in the colour of the legs and eyes. In its age and sex characteristics, the Helmeted Honeyeater closely resembles the inland race of the Yellow-tufted Honeyeater *L. m. meltoni*, notwithstanding large differences in size and the intensity of plumage coloration.

INTRODUCTION

There is marked variation in size and plumage coloration within the Yellow-tufted Honeyeater *Lichenostomus melanops*. This variation is arranged in an unusual and intriguing ring cline centred on the Great Dividing Range in south-eastern Australia (Crome 1973; Schodde and Mason 1999). The extreme forms (large and bright *L. m. cassidix* — the Helmeted Honeyeater, cf small and pale *L. m. meltoni*) both occur in the Yarra Valley in Victoria (Blackney and Menkhorst 1993), and the latter disperse into the former's breeding areas during the winter of drought years (B. Quin, pers. obs.). The pattern of variation and the appropriate subspecific description of the complex have never been fully resolved. Currently, four subspecies are recognized (*meltoni*, *melanops*, *gippslandicus* and *cassidix*; Wakefield 1958; Crome 1973), but Schodde and Mason (1999) have suggested that populations previously attributed to *gippslandicus* should be regarded as intergrades between *cassidix* and *melanops*.

In his formal description of the Helmeted Honeyeater (as *Ptilotis cassidix*), Gould (1867) mentioned variation among his specimens which he suspected was evidence of sexual dimorphism. Wakefield (1958) argued that the Helmeted Honeyeater was markedly sexually dimorphic in both size and plumage, and that these were traits that distinguished it from other populations of the complex. Mack (1933) also believed the Helmeted Honeyeater to be sexually dimorphic in plumage. Cooper (1967) acknowledged the existence of some differences in plumage, but provided colour photographs of a breeding pair in which the sexes could not be distinguished. Crome (1973) provided measurements that demonstrated that the Helmeted Honeyeater was larger than other forms in the complex, but was unable to confirm either plumage or size dimorphism within the Helmeted Honeyeater. Adult male Helmeted Honeyeaters are heavier on average than adult females (Franklin *et al.* 1999).

Morris (1975) and Rogers *et al.* (1990) identified non-categoric size dimorphism, but no difference in plumage, in other populations of the Yellow-tufted Honeyeater.

In this paper, we provide observations and data on the morphometric, plumage and bare part differences between juvenile and adult, and male and female Helmeted Honeyeaters. Compared to some other banding studies of age and sex characteristics of bush bird species (e.g., Rogers *et al.* 1986, 1990), our study is a mix of strengths and weaknesses. The Helmeted Honeyeater is critically endangered, with a population of about 100 individuals (Menkhorst *et al.* 1999), limiting sample sizes for analysis and setting priorities for management other than the collection of morphometric and plumage data. On the other hand, many birds were colour-banded as nestlings, or as juveniles from known nests, with the consequence that the age of many individuals is known with great precision. Furthermore, although we could not identify the sex of young birds, many for which we have data could be sexed on behaviour when they subsequently reached maturity and nested. Identification of age and sex dimorphism for the Helmeted Honeyeater is a potentially useful preliminary step to resolution of the taxonomic status of the Yellow-tufted Honeyeater complex. Such a resolution is currently being attempted using both DNA and morphometric analyses (Hayes 1999, Helmeted Honeyeater Recovery Team in prep.).

METHODS

This study was conducted from 1984 to 1997 at the only remaining set of wild colonies of the Helmeted Honeyeater in the Yellingbo Nature Conservation Reserve (37°50'S, 145°29'E) about 50 km east of Melbourne, Victoria. Helmeted Honeyeaters were captured in mist nets, or rarely, a cage trap. Captured birds were assessed for a range of characters (Table 1) but not all characters were assessed on all occasions. Plumage and leg coloration was not formally assessed; however observations based on extensive field work and backed on occasion by notes, are presented briefly.

TABLE 1

Methods and precision of morphological and plumage character assessments of Helmeted Honeyeaters. See Crome (1969) for additional details of many of the plumage characters.

Character	Method, precision
<i>Bare parts</i>	
bill colour	subjective description
gape colour	subjective description
palate colour	subjective description
eye colour	subjective description
cloaca	categories: male, female, uncertain (see Rogers <i>et al.</i> 1986)
<i>Plumage characters</i>	
crown line	categories: distinct, indistinct (see Results, also Wakefield 1958)
rectrices	categories: pointed, rounded (see Results)
<i>Plumage morphometrics</i>	
tail	length, to 1 mm
white in tail	length of white on tip of an outer rectrice, measured along the rachis, to 0.1 mm (= 'B' in Crome 1973, Fig. 3)
wing	folded wing length, usually the right wing, to 1 mm
helmet	distance from front edge of nostril to forward-most point of feathers folded forwards, to 0.5 mm
forehead feather ear tuft	length of longest feather, to 1 mm from behind the ear-tuft to the tuft tip, to 0.1 mm
<i>Non-plumage morphometrics</i>	
head-bill	length, to 0.1 mm
bill depth	at base, to 0.1 mm
exposed culmen	length, to 0.1 mm
tarsus length	tarsus plus joint, mostly left leg, to 0.1 mm
tarsus depth	diameter in vertical plane, at mid-point, to 0.1 mm

Plumage characters and plumage and non-plumage morphometrics (*sensu* Table 1) are analysed using only assessments made by DF (D. Franklin) and IS (I. Smales) from 1984 to 1992, supplemented with additional measurements by IS from 1993 to 1997 where sample sizes were particularly small. For five characters (Table 2), we compared our measurements using matched samples of six *L. m. gippslandicus* and a variable but small number of Helmeted Honeyeaters. Based on a consideration of both the mean difference and its coefficient of variation, we variously combined our data after standardization, or analysed our data separately. For less replicable measurements, we made no attempt to pool data. Where there are too few data from one assessor to warrant analysis, we present results for the other assessor only. Analysis of bill, gape, palate and eye coloration (Table 1) are based on assessments by DF, IS and BQ (B. Quin) from 1984 to 1997.

Birds measured in the respective moult periods for primaries and rectrices (Franklin *et al.* 1999) have been excluded from analysis of wing and tail length except where suitable fully-grown remiges were definitely present for assessment.

For morphometric comparisons of non-plumage traits, a bird was considered *adult* if it was known to be at least one year old ('2+' *sensu* Rogers 1989). For morphometric comparisons of plumage traits, a Helmeted Honeyeater was considered to be *adult* if it was more than a year old and likely to have completed its first flight moult, which in some individuals is not until the end of the second April after hatching (Franklin *et al.* 1999). Where this strict definition left us with insufficient data for satisfactory analysis, we defined *adult* as any bird not known to be less than one year old and not displaying any known non-adult character. All relevant analyses utilize the former definition unless specifically stated that the 'relaxed definition' was utilized. For a range of comparisons, a bird was considered 'young' if it was known to be less than one year old, but nestlings and fledglings that had not grown fully have been excluded from morphometric analyses. Ages are described either in days (where known and relevant) or using the schema of Rogers (1989).

TABLE 2

A comparison of measurements taken by Ian Smales (IS) and Don Franklin (DF). N is the number of matched samples; M.D. is the mean difference, IS-DF, in millimetres; S.D. is the standard deviation of the difference, in millimetres; *P* is the probability associated with the difference; and C.V. is the coefficient of variation expressed as a percentage. Statistical comparisons are paired-sample *t*-tests, with * = *P* < 0.05; and ** = *P* < 0.01.

Character	N	M.D.	S.D.	<i>P</i>	C.V.	Response
Head-bill	13	-0.24	0.38	*	0.9	take 0.2 from DF; pool
Exposed culmen	7	-0.43	0.72	0.18	5.1	analyze separately
Tarsus length	13	-0.85	0.74	**	2.6	take 0.8 from DF; pool
Tail	8	-1.4	1.6	*	1.6	take 1 from DF; pool
Wing	7	-1.3	0.7	**	0.8	take 1 from DF; pool

We define a 'juvenile' as a bird in its first full pennaceous plumage state. A juvenile feather is any of that original pennaceous set, and a 'juvenile trait' is a bare part that retains the coloration that existed when the bird was a juvenile. Birds that have moulted some, but not all, juvenile feathers may be First Immatures (see Discussion). The more general term 'young bird' is used to describe a bird with any persistent juvenile trait, or in a reproductive context as a bird that has yet to reach sexual maturity.

Sex was attributed to breeding adults on the basis of consistent differences in territorial and nesting behaviour (Franklin *et al.* 1995), the correctness of which has been confirmed by laparoscopic examination of some individuals (D. Middleton pers. comm.) and DNA analysis of others (N. Murray, La Trobe University, pers. comm.). The sex of young and non-breeding birds was determined if and when they subsequently achieved breeding status.

Measurements are compared using *t*-tests and two-way ANOVA. Categorical comparisons are made with Chi-square tests, to which, because there was one degree of freedom, we applied Cochran's continuity correction (Zar 1984). For statistical purposes, repeat assessments of individuals were reduced to one by random selection.

RESULTS

Plumage markings and coloration

We observed no categorical difference in plumage markings or coloration between male and female Helmeted Honeyeaters. The yellow plumage in adult males may be somewhat brighter than in females, but the differences are slight and interpretation is confounded by considerable variation between individuals. The ear tufts and crown are invariably intense yellow, and the throat is usually so. The feathers in these areas are entirely yellow. The chest and belly may be a duller olive-yellow, and in these areas the feathers have yellow tips and grey bases. There was no significant difference between adult males and adult females (relaxed age definition) in the frequency of indistinct crown lines ($n = 40$, $\chi^2 = 0.5$, d.f. = 1, $P = 0.45$).

We also found no categorical difference in plumage markings or coloration between age classes of the Helmeted Honeyeater, with the exception that in birds of up to c. 40 days of age, there may be a sharp transition from yellow on the throat to duller chest coloration which is not evident in older birds. Young birds are a duller yellow than adults, sometimes substantially duller, especially

on the underparts but at times also on the crown, a difference that persists in some cases for up to six months. Sixty-nine per cent of birds aged 1 ($n = 42$) and 30% of birds aged 2+ ($n = 20$) had an indistinct (*cf* distinct) line marking the transition from the bright yellow crown to the somewhat greenish nape feathers, the difference being significant ($n = 62$, $\chi^2 = 7.5$, d.f. = 1, $P < 0.01$).

Bare parts

The bill, gape and palate were yellow in nestlings and fledglings, and entirely black in all birds of greater than 250 days of age, a trend consistent in both sexes. In young birds, yellow on the bill fades to cream and then horn and recedes to the base and tip, being replaced by grey patches which gradually become black. In contrast, the gape and palate were usually clearly either yellow or black although a few individuals were noted in apparent transition. However, there was much variation between individuals in the age at which this occurred (Fig. 1). Gape colour was usually the most persistent juvenile trait of the three, with the majority of individuals retaining the juvenile coloration for more than 180 days. Of 48 young birds in which only one or two of the three characters was entirely black, 44 were consistent with the population sequence, i.e. either only the bill, or only the bill and palate were black, but four individuals displayed a different development sequence.

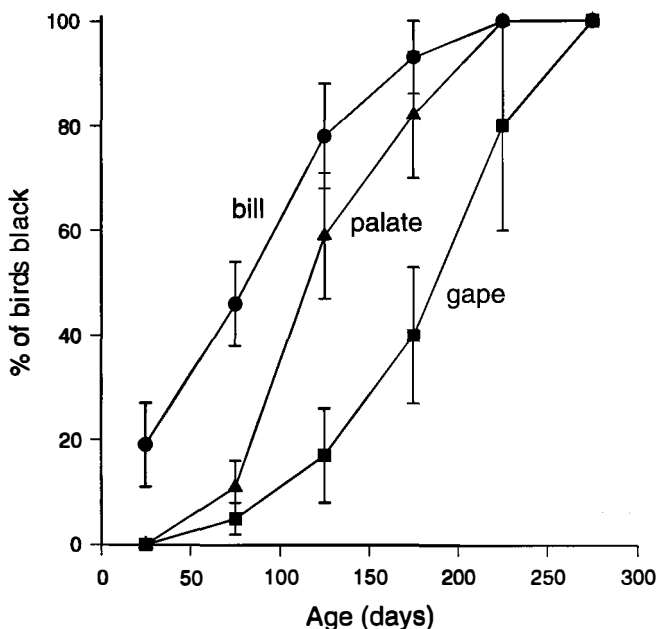


Figure 1. Bill, palate and gape colour development in the Helmeted Honeyeater. Birds have been grouped in 50-day age classes. Vertical bars are standard errors. 'Black' means entirely black.

Fledgling Helmeted Honeyeaters have grey legs strongly tinged with pink, whereas in adults the legs are quite black. We do not have data on the persistence of the juvenile coloration. However, one individual aged 153 days was described as having legs with a 'slight pink tinge', and another aged 189 days had black legs notably duller than those of an adult.

We made 150 assessments of iris colour of Helmeted Honeyeaters of a wide range of known ages (in days), and

a further 32 assessments of individuals known to be more than one year old. Fledgling Helmeted Honeyeaters had dull brown or grey-brown irides, whereas those of adults of both sexes varied from dark chocolate brown to chestnut and brick red. A number of juveniles of less than 50 days of age were described as having 'chocolate', 'dark chocolate' or 'chocolate brown' eyes. The term 'chestnut' was first applied to birds of 107 days of age. However, no bird under 550 days of age was described as having 'brick red' eyes, whereas five birds (four males, one female; two in the breeding season, three outside the breeding season) of 43 assessed and known to be older than 550 days had brick red eyes.

For adults in breeding condition, determination of sex by examination of the cloaca was consistent with our observations of behaviour, but at other times of the year and for other age classes, cloacal sexing was not reliable. Only females develop substantial brood patches (males very rarely incubate — Franklin *et al.* 1995).

Adult morphometrics

There were significant differences between the sexes in all non-plumage characters assessed morphometrically, and also for wing and tail length. Males were larger on average than females but with substantial overlap for all characters (Table 3). The difference between the sexes in tail length was marginally non-significant using the strict definition of adult but very highly significant for the 'relaxed' definition, a result which, given the similarity of the means of the two data sets, appears entirely attributable to the larger sample available for the latter analysis. However, we could find no evidence of differences between the sexes in the two measures of prominence of the helmet (forehead feather, helmet), in the length of the ear tuft, or in the amount of white in the tail (Table 3).

Primaries and rectrices

First-year Helmeted Honeyeaters had shorter folded wing lengths than older birds, and females had shorter wings than males (Table 4, two-way ANOVA, P both < 0.001), but there was no significant interaction between age and sex classes ($P = 0.39$). We are unaware of any independent way of distinguishing a bird's juvenile set of primaries from subsequent sets.

In contrast, rectrices fell into two discrete groups, one with narrow, somewhat pointed tips (hereafter 'pointed') and those with broader, rounded tips (hereafter 'rounded'). Pointed rectrices were found only on birds less than 16 months of age, and not in any bird known or likely to have completed its first moult of the primaries. Pointed rectrices were shorter than rounded rectrices, and females had shorter rectrices than males (Table 5, two-way ANOVA, $P < 0.0001$ and $P = 0.002$ respectively), but there was no significant interaction between rectricial shape and sex ($P = 0.13$). Four individuals assessed as having pointed rectrices on the first occasion and rounded on the second had all passed through a moult period in between, and their tails were 4–12 mm longer respectively on the second occasion.

TABLE 3

Comparison of measurements in adult male and adult female Helmeted Honeyeaters. All measurements are in millimetres. Differences calculated using a two-tailed T test for independent samples. * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$. + indicates the use of the relaxed age definition; see Methods.

Character	Assessor	Sex	N	Mean	S.D.	Range	Difference
Head-bill	is,df	m	30	42.2	1.01	40.0–43.6	
		f	32	40.5	0.69	39.0–42.1	***
Bill depth	df	m	14	5.6	0.23	5.3–6.0	
		f	13	5.3	0.24	5.0–5.7	**
Exposed culmen	is	m	19	15.3	1.18	12.0–17.0	
		f	14	14.3	1.09	12.0–15.5	*
	df	m	14	14.9	1.80	10.3–17.7	
		f	13	13.9	1.32	11.8–16.1	P = 0.13
Tarsus length	is,df	m	36	28.9	0.91	26.0–30.0	
		f	34	28.1	0.66	26.2–29.3	***
Tarsus depth	df	m	9	2.5	0.07	2.4–2.6	
		f	8	2.4	0.10	2.2–2.5	**
Tail	is,df	m	14	103	3.8	98–109	
		f	11	100	2.4	98–105	P = 0.07
Tail +	is,df	m	34	104	4.0	92–111	
		f	30	100	4.3	86–107	***
Wing	is,df	m	21	98	2.5	94–102	
		f	15	93	1.4	91–96	***
Forehead feather	df	m	11	9.4	1.5	7–12	
		f	8	8.9	0.8	8–10	P = 0.45
Forehead feather +	df	m	13	9.4	1.4	7–12	
		f	11	9.0	1.0	8–11	P = 0.45
Helmet +	is	m	13	0	0.8	-2.5–0.5	
		f	12	0	0.4	-0.5–1.0	P = 0.3
Ear tuft +	is	m	19	15.8	1.8	12–18	
		f	16	15.8	1.7	13–18.5	P >> 0.5
White in tail	is	m	19	9.7	2.1	5–13	
		f	16	10.3	1.9	7–14	P = 0.45

TABLE 4

Folded wing lengths of Helmeted Honeyeaters according to age class and sex, in millimetres.

Age class	Sex	Mean	S.D.	Range	N
1	Female	89	4.2	83–93	6
	Male	92	3.4	88–96	6
2+	Female	93	1.6	89–95	13
	Male	97	2.9	93–102	15

TABLE 5

Tail lengths of Helmeted Honeyeaters according to rectricial shape and sex, in millimetres.

Rectricial shape	Sex	Mean	S.D.	Range	N
Pointed	Female	93	4.3	86–101	8
	Male	96	2.7	91–99	8
Rounded	Female	98	4.3	86–101	10
	Male	104	2.3	101–109	9

DISCUSSION

In its pattern of similarities and differences between age and sex classes, the Helmeted Honeyeater closely resembles *L. m. meltoni* (Rogers *et al.* 1990), notwithstanding marked differences between the subspecies in the intensity of coloration and the presence of extended forehead feathers (the helmet) (pers. obs.), and in body size. The Helmeted Honeyeater is larger by *c.* 7–17% in linear dimensions (this paper, *cf.* Rogers *et al.* 1990) and

c. 40–43% in weight (Franklin *et al.* 1999; *cf.* Rogers *et al.* 1990); see also Crome (1973). This resemblance includes the unusual pattern of age- and sex-specific differences in wing and tail measurements described for *L. m. meltoni* by Rogers *et al.* (1990).

Differences between the sexes

Male Helmeted Honeyeaters are larger than females, but in no dimension was the difference absolute, and overlap was mostly extensive. A similar pattern of overlapping dimorphism is evident in body weights, with the additional complication of seasonal variation — spring-early summer means for males being less than winter means for females (Franklin *et al.* 1999). The most discrete characters appear to be folded wing and tail length, although the sample sizes on which we base this suggestion are small. However, interpretation of folded wing and tail lengths are complicated by marked differences between birds that have and have not undertaken their first moult of these feathers, and further because some young birds undertake this first moult in their first year but others in their second year (Franklin *et al.* 1999). In the case of tail length, however, it is possible with care to identify juvenile and adult rectrices by the shape of the feather tip, so this trait may provide the most useful morphometric indication of sex. It may prove possible to identify the sex of individuals using multi-dimensional morphometric analyses, but our data were of inadequate quality and quantity to attempt this. However, alternative methods of identifying the sex of individuals, such as by observing territorial and nesting behaviour (Franklin *et al.* 1995), cloacal sexing of adults

during the breeding season (this paper) and DNA analysis (Neil Murray, pers. comm.) are available and effective.

We were also unable to identify any consistent or clear differences between the sexes in plumage markings or coloration of plumage and bare parts.

Our findings that the Helmeted Honeyeater is non-discretely size dimorphic but not, or perhaps only very slightly dichromatic differ in varying ways from previous assertions and conclusions about sexual dimorphism in the Helmeted Honeyeater. Mack (1933) and Wakefield (1958) reported both size and plumage dimorphism. In contrast, Crome (1973) found evidence of neither. It is unclear why there has been so much ambiguity over the issue. We can only suggest a range of possibilities including the general lack of quantitative or even well-defined qualitative information (see Crome; 1973 for a notable exception), possible confusion between adult females and young birds, the frequent occurrence of anomalous specimens especially in museum collections, and confusion between these anomalous specimens and 'final adult plumage' (see discussion in Crome 1973). It is also possible that, in their eagerness to establish the conservation imperative for the Helmeted Honeyeater, early observers may have inadvertently overstated differences between it and related populations.

The anomalous specimens of Helmeted Honeyeaters comprise large and intensely-pigmented and often dark individuals (Crome 1973; Schodde and Mason 1999). They persisted in the wild at Yellingbo up until the late 1960s (Frank Crome, pers. comm.), but were not evident during the 1980s (IS pers. obs.), although the Yellingbo population retains considerable variation in body size and some variation in plumage coloration. Crome (1973) attributed these specimens to the effect of genetic isolation of very small populations. Given that the population *in toto* of the Helmeted Honeyeater is now much smaller than it was earlier this century, it is curious that they no longer occur. An alternative explanation (Schodde and Mason 1999), that these forms comprise the original Helmeted Honeyeater and have been genetically 'swamped' by other forms of the Yellow-tufted Honeyeater, is plausible given the small distances between populations of the Yellow-tufted Honeyeater in the Yarra Valley north and east of Melbourne (Blackney and Menkhorst 1993). However, microsatellite DNA analyses at five loci suggest that the Yellingbo population is distinct and provide no evidence of recent introgression between it and nearby populations (Hayes 1999).

Differences between age classes

Plumage colour differences between young and adult Helmeted Honeyeaters are relatively slight and not very useful for determining the age of birds, and there is no obvious intermediate plumage state. Juvenile primaries and rectrices are replaced by an adult set at the first moult of these feathers, but in later-hatched individuals this moult is delayed for over a year after hatching (Franklin *et al.* 1999). It is likely that these late-hatched individuals undertake a moult of some other feathers such as body feathers, in their first year, in which case they may then

be described as First Immatures. This is presumably the basis on which Morris (1975) and Rogers *et al.* (1986, 1990) describe an immature form for other *L. melanops* subspecies.

However, such descriptions are best based on observed moult sequences rather than subtle differences in body feather coloration. Feather colour in general, and that of yellow (and red) feathers in particular, is susceptible to variation that is dietary rather than genetic in origin. The carotenoids needed for production of yellow pigments in plumage are all obtained from food (Brush 1990). Although the particular source compounds and the metabolic processes involved for Helmeted Honeyeaters are unknown, variation in diet is strongly implicated in coloration of their plumage. In a number of Helmeted Honeyeaters and *L. m. gippslandicus* raised in captivity, the normal yellow in the plumage was replaced by a grey-white until the diet was altered and the birds moulted. Dietary effects on the intensity of red in the plumage have been reported in other birds (e.g., Linville and Breitwisch 1997). Given that there are differences in use of habitat between non-breeding (generally younger) Helmeted Honeyeaters and established breeding adults, along with differences within and between the sexes in dispersal patterns and foraging behaviour (Runciman *et al.* 1995; Moysey 1997), there is considerable potential for variation in the intensity of plumage coloration between and within age/sex classes to arise as a result of idiosyncratic dietary circumstances.

However, there are clear differences between juveniles and adults in the colour of the gape, palate and bill, with our data showing that gape colour is generally the most persistent and therefore most useful for identifying first-year birds. The colour of these traits changes gradually or rapidly from the juvenile to adult state and at a range of ages in different individuals, with no evidence of either a discrete or intermediate 'immature' state as described for other *L. melanops* populations by Morris (1975) and Rogers *et al.* (1986).

Iris colour also varies with age, with adults having brighter and often redder eyes than young birds. Our assessments may well have been affected by differences between observers and light conditions. However, we are confident that there is considerable variation between adults and that not all adults have red irides, consistent with Rogers *et al.* (1986) but not Morris (1975).

ACKNOWLEDGMENTS

We are indebted to the many people who have assisted with the banding activities of the Helmeted Honeyeater Recovery Program over the years. Walter Boles, Mark Burgman, Michael Clarke, Jamie Matthew, Michael McCarthy, Annie Rogers, Danny Rogers and Ken Rogers commented helpfully on earlier drafts and/or gave useful statistical advice. The Parks and Wildlife Commission of the Northern Territory provided computer facilities for the preparation of the graph.

REFERENCES

- Blackney, J. R. and Menkhorst, P. W. (1993). Distribution of subspecies of the Yellow-tufted Honeyeater in the Yarra Valley region, Victoria. *Emu* 93: 209–213.
- Brush, A. H. (1990). Metabolism of carotenoid pigments in birds. *Federation of Am. So. Exper. Bio. J.* 4: 2969–2977.
- Cooper, R. P. (1967). Is the Helmeted Honeyeater doomed? *Aust. Bird Watcher* 3: 1–14.

- Crome, F. H. J. (1969). A preliminary study of the biology of the Helmeted Honeyeater (*Meliphaga cassidix* (Gould)) and its relationship with the Yellow-tufted Honeyeater (*M. melanops* (Latham)). Unpublished B.Sc. (Hons.) Thesis, Monash University, Victoria.
- Crome, F. H. J. (1973). The relationship of the Helmeted and Yellow-tufted Honeyeaters. *Emu* 73: 12–18.
- Franklin, D. C., Smales, I. J., Miller, M. A. and Menkhorst, P. W. (1995). The reproductive biology of the Helmeted Honeyeater, *Lichenostomus melanops cassidix*. *Wild. Res.* 22: 173–191.
- Franklin, D. C., Smales, I. J., Quin, B. and Menkhorst, P. W. (1999). The annual cycle of the Helmeted Honeyeater *Lichenostomus melanops cassidix*, a sedentary inhabitant of a predictable environment. *Ibis* 141: 256–268.
- Gould, J. (1867). *Ptilotis cassidix* (Jard) *Helmeted Honeyeater*. Supplement to 'Handbook to the Birds of Australia' (1865, private, London.)
- Hayes, V. (1999). *Genetic insights into the taxonomy and conservation of the Helmeted Honeyeater* (*Lichenostomus melanops cassidix*) using *microsatellites*. BSc(hons.) thesis, La Trobe University, Melbourne.
- Linville, S. U. and Breitwisch, R. (1997). Carotenoid availability and plumage coloration in a wild population of Northern Cardinals. *Auk* 114: 796–800.
- Mack, G. (1933). The Helmeted Honeyeater. *Vic. Nat.* 50: 151–156.
- Menkhorst, P., Smales, I. and Quin, B. (1999). *Helmeted Honeyeater Recovery Plan 1999–2003*. Department of Natural Resources and Environment, Victoria.
- Morris, A. K. (1975). Results from banding Yellow-tufted Honeyeaters. *Aust. Bird Bander* 13 (1): 3–8.
- Moysey, E. D. (1997). A study of resource partitioning within the Helmeted Honeyeater *Lichenostomus melanops cassidix* during the non-breeding season. *Emu* 97: 207–219.
- Rogers, K. (1989). Collecting bird banding data. Pp. 6.1–6.33 in *The Australian Bird Bander's Manual* (ed. K. W. Lowe). (Australian National Parks & Wildlife Service, Canberra.)
- Rogers, K., Rogers, A. and Rogers, D. (1986). *Bander's Aid: a guide to ageing and sexing bush birds*. (The authors, St Andrews, Melbourne.)
- Rogers, K., Rogers, A. and Rogers, D. (1990). *Banders Aid Supplement Number One*. (Royal Australasian Ornithologists Union, Moonee Ponds, Melbourne.) (R.A.O.U. Report No. 67.)
- Runciman, D., Franklin, D. C. and Menkhorst, P. W. (1995). Movements of Helmeted Honeyeaters during the non-breeding season. *Emu* 95:111–118.
- Schodde, R. and Mason, I. J. (1999). *The Directory of Australian Birds. A Taxonomic and Zoogeographic Atlas of the Biodiversity of Birds in Australia and its Territories. Passerines*. (CSIRO, Collingwood.)
- Wakefield, N. A. (1958). The Yellow-tufted Honeyeater with a description of a new subspecies. *Emu* 58: 162–194.
- Zar, J. H. (1984). *Biostatistical Analysis. Second edition*. (Prentice-Hall, New Jersey.)

Corella, 2000, 24(3): 35

NOTE ON RECOVERY OF LITTLE TERN *Sterna albifrons* 040–51030 RE-BANDED 041–27635

The recovery of Little Tern *Sterna albifrons* 040–51030, retrapped on nest with one egg at Towra Point, New South Wales, by NSW National Parks and Wildlife Service Seabird Project on 29 Nov. 1995, (Corella 8(1)), is of particular interest. The original band was badly corroded and reading the numbers correctly presented some difficulty. It was therefore sent to the banding office in Canberra for final identification of the band number. Meanwhile replacement 041–27635 was attached to the bird together with colours red/white and pale green/metal. This individual was sighted again at the same place, but not at a nest, on 30 Oct. 1997 (K. Egan, pers. comm.).

On 28 Dec. 1980, on a flat part of the sandy artificial construction site at Port Botany, New South Wales, I banded two Little Tern runners, 040–51030 and 040–51031, which were found together a few metres from their now empty nest. The first bird was noted as [crown] 'honey colour streaks just appearing', and the second bird

as [crown] 'sandy colour streaks just appearing'. Later that day both these runners had reached a high artificial dune approximately 100 metres from the banding place.

On 11 Jan. 1981 the two runners were still together in vegetation on top of the artificial dune. I noted 040–51031 '... in distressed condition with two sticky eyes', and 040–51030 'recovered with sticky eye and released'. The original intention was to take 040–51031 as a specimen for analysis of the bunged-up eye condition, but the problem appeared to be caused by windblown sand and the attention of black ants. It was considered the birds were at least partially blind and had little chance of survival and both birds were left together to let nature take its course (Larkins 1984).

Thus the recovery of 040–51030 over 14 years 11 months after banding, and its reappearance in October 1997 as 041–27635, was a surprise and particularly pleasing.

REFERENCES

- Larkins, D. (1984) Little Tern Breeding Colony on Artificial Site at Port Botany, New South Wales. *Corella* 8: 1–10.

DARIEL LARKINS

225 Kissing Point Road,
Turrumurra, New South Wales 2074