

# AGEING AND SEXING OF THE REGENT HONEYEATER

## *Anthochaera phrygia*

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The Regent Honeyeater has been the subject of intensive study and conservation effort over the past decade and a half. Until now, there has been no guide to accurately age and sex Regent Honeyeaters in the field. Being able to age and sex birds potentially provides data on population structure and dynamics. In particular, it can provide a measure of the recruitment of juveniles into the breeding population. Regent Honeyeaters can be confidently allocated to age classes of J, 1, 2- or 2+ based on plumage and soft part characters and sexed based on wing length and head-bill measurements.

### INTRODUCTION

The Regent Honeyeater *Anthochaera phrygia* is a medium-sized honeyeater (Meliphagidae) that occurs mainly in the box-ironbark open forests of Victoria, New South Wales and south-eastern Queensland. The species has undergone significant range contraction and a decline in numbers, and is listed as *Endangered* (Environment Protection and Biodiversity Conservation Act 1999). As a consequence, the Regent Honeyeater has been the focus of intensive research (Ley and Williams 1992; Ley *et al.* 1996; Geering 1997; Geering and French 1998; Oliver 1998), as part of the ongoing national species recovery plan (Menkhorst 1997; Menkhorst *et al.* 1999; Department of Environment and Conservation 2004). The species displays complex movement patterns over vast areas, largely in response to flowering by a select group of *Eucalyptus* species. This mobility poses great challenges for management. Only during the breeding season, which typically peaks from September through to November, are individuals likely to remain in the same area for extended periods of time.

The species is strikingly marked, being a predominantly black bird, boldly marked with large yellow areas in the wings and tail. The head and neck are black, while the upper parts are black and heavily scalloped with pale yellow. The breast and upper belly are black with very pale yellow to white subterminal chevrons, although the amount of yellow on the lower breast and belly gives the impression that these are largely pale yellow with fine black scalloping. The folded wings are black with varying pale scaling and three yellow panels formed by the primary coverts, secondaries and primaries, while the upper tail is black with a conspicuous yellow edge and tip. The yellow panels of the wings and tail are particularly obvious in flight. Adults have a large patch of bare warty facial skin.

Published morphometrics of Regent Honeyeaters have either been based on small sample sizes (Ley *et al.* 1996) or museum specimens (Schodde *et al.* 1992). Excepting the general notes by Schodde *et al.* (1992), there is no current guide to accurately age and sex Regent Honeyeaters in the field. Such

a guide is desirable given its likely contribution to research and management of the species. For example, accurate allocation of the sex and age class to individuals potentially provides data on population structure and dynamics. In particular, it can provide a measure of the recruitment of juveniles into the breeding population; a less labour intensive method of assessing the relative annual reproductive rate than monitoring the breeding success of a large number of nests.

### METHODS

Regent Honeyeaters were usually captured either immediately before, during or after the breeding season. Playback of Regent Honeyeater calls was often used to lure birds into mist nets while birds were breeding (Geering 1998). From June to August 1997, 91 Regent Honeyeaters were captured in mist nets at a communal night roost in an area of low, dense, eucalypt regrowth. On a few occasions birds were also captured using elevated mist nets adjacent to flowering trees. For all individuals the flattened, straightened wing length and tail length were measured using a butt-ended ruler and head-bill length was measured using Vernier Calipers (Lowe 1989).

Twenty eight birds were captured more than once. Data from these retrapped birds were only included in the analysis if the individual was initially banded as a young bird with unmoulted juvenile primaries and later recaptured as an older age class. Age codes used are those in general usage by the Australian Bird Banding Scheme (Lowe 1989).

The progress of moult was recorded for each bird and the presence of juvenile primaries, primary coverts and tail feathers was noted. The pattern of yellow in the primaries and primary coverts of adult plumaged birds was also recorded. Lastly, the presence or absence of facial warts was recorded for all birds with either unmoulted juvenile feathers or with a less than fully developed warty face.

A histogram of each measurement was analysed to estimate the mean and standard deviation of the two sexes and fit two

normal curves to the data using the programs SHEBA (Rogers 1995) and BIRDSTAT (P. Thomson pers. comm.). Using these fitted curves, two limits can be estimated. The lower value giving the value below which the bird is believed to be of the smaller sex and the higher value, the value above which the bird is believed to be of the larger sex, each with a minimum 95 per cent confidence level.

## RESULTS AND DISCUSSION

A total of 347 Regent Honeyeaters was captured in central-eastern NSW from October 1994 to September 1999. Three hundred and twenty eight of these were captured in the Capertee Valley and the remaining 19 birds in the Mudgee – Gulgong – Merriwa area, 80 to 100 kilometres to the north. Morphometric data from all juveniles ( $n = 20$ ) were excluded from analysis, the remaining 327 birds were all captured at least six months after the previous breeding season.

### Plumage

The typical pattern of yellow on the primaries of adult plumaged Regent Honeyeaters was: primary 10, yellow on the outer vane; primaries 9 to 5 yellow on the outer vane and a large yellow patch on the inner vane; primaries 4 to 1 black, although some inner feathers might be broadly edged pale lemon (Figure 1a). The primary coverts are yellow but often have a black line along part, or all, of the shaft. Some individual variation occurs, particularly in the extent of yellow on the primaries with some birds having yellow patches to at least primary 3 (Figure 1b). Some individuals in full adult plumage have black spots or patches on the primary coverts (Figure 1c). Due to the lack of recapture data, it is not possible to determine whether these variations can be attributed to age.

The juvenile plumage of the Regent Honeyeater is generally plain dusky-brown with a whitish belly. The wings and tail are dark brown with dull yellowish white markings. The primaries have less extensive yellow markings than adults while the primary coverts are broadly edged brown (Figure 2a). No re-capture data are available to accurately determine the commencement of post-juvenile moult. However, two captive-bred juveniles at Taronga Zoo commenced post-juvenile moult five weeks after fledging. Body moult was noted 34 days after fledging with the first adult-like feathers appearing on the back and breast. On day 41 post-fledging adult-like feathers covered approximately 70 per cent of the back and 60 per cent of the breast. On day 42 the first black feathers appeared on the underside of the throat. By day 48 black feathers were evident on the throat and the side of the head through to the scapulars. At this time adult feathers covered 90 per cent of the back and breast. Sixty days after fledging, the back and breast were fully moulted, resembling adult plumage. A band of black feathers extended around the neck with the upper neck, top of head and chin still retaining grey juvenile plumage. By day 63 only the area around the ear coverts were yet to begin moulting while by day 69 after fledging the head was completely black. Once the post-juvenile moult is completed, first year Regent Honeyeaters resemble the adult; however, the age of these individuals can be determined by the unmoulted wing and tail feathers which are duller yellow and browner (Figure 2b).

Unmoulted juvenile primaries and primary coverts were noted on Regent Honeyeaters caught during the period June to December (Tables 1 and 2). While young birds with fully moulted primaries and primary coverts were captured as early as June it is not until September that a considerable proportion of first season birds captured had moulted these juvenile feathers.

Many young Regent Honeyeaters moulted their tail feathers before commencing moult of their wing feathers. Of 87 young birds captured in June to September, 29 had juvenile tail feathers while 28 had already completed their tail moult. No birds captured after September retained any juvenile tail feathers.

Both adult and immature captive-bred Regent Honeyeaters were found to undergo a partial (arrested) moult in autumn (McFadden 2002). Only one of four immature birds moulted its primaries – P 8 to P 10 on one wing and P 7 to P 10 on the other wing. All immature birds had either completely, or almost completely, replaced their tertials but none had moulted any secondaries. Three immature birds had also moulted the inner two to four rectrices prior to the suspension of moult. This is consistent with the pattern of moult observed in wild, first-year birds captured the following spring.

### Facial patch

Juvenile and immature Regent Honeyeaters have an area of smooth, bare, blue-grey facial skin below and behind the eye (Figure 3a). The gape is a fleshy yellow, gradually turning grey or black. The facial patch of adult Regent Honeyeaters comprises bare, warty skin immediately in front of, behind and below the eye. In some individuals the warty skin also extends above the eye (Figure 3b).

The exact timing of the development of facial warts is uncertain due to insufficient recapture data. One hundred and eight Regent Honeyeaters in their first year or early in their second year were captured and information on the facial patch recorded.

Of fourteen young birds captured in June, seven had smooth facial skin with no evidence of warts while seven had warts developing (Table 3). Of the remaining young birds captured in July to December only five, caught in July and August, were noted as having no warts present. Birds classified as having "warts developing" were recorded during the period June to December. The majority of young birds handled in November to January had completely warty faces. As most Regent Honeyeaters are hatched in October and November (Geering and French 1998) the development of the warty face appears to occur at around eight to ten months of age.

It is not known whether facial warts continue to grow slowly throughout the bird's life. The area of the facial warts can vary considerably between adults. Some females are "wartier" than young males while a small number of males have very extensive areas of wart, extending to the area above the eye in some individuals. This may indicate that there could be some age related differences. However, a female and male captured ten years after their initial capture as a fledgling and adult, respectively, appeared no wartier than other individuals handled, suggesting that variation may indeed be individualistic.





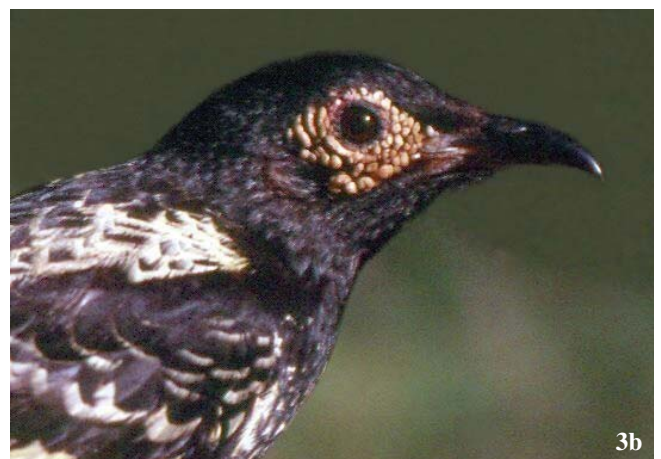
**Figure 1a.** Wing pattern of a typical adult (age code 2+) Regent Honeyeater. **1b.** Wing pattern of adult (age code 2+) Regent Honeyeater with more extensive paneling. **1c.** Wing pattern of adult (age code 2+) Regent Honeyeater with black spots on primary coverts.



**Figure 2a.** Typical wing pattern of a juvenile Regent Honeyeater. **2b.** Immature wing pattern of a Regent Honeyeater (age code 2-) captured in October (note otherwise adult plumage and warty face).



**Figure 3a.** Head of a juvenile Regent Honeyeater.



**Figure 3b.** Head of an adult Regent Honeyeater.

**TABLE 1**

Primary moult status of first season Regent Honeyeaters. Individuals with adult-like characters (warts/primaries/coverts) were aged as first year birds because they either displayed other plumage traits consistent with first year birds or were banded individuals of known age.

	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Juvenile primaries	11 (69%)	22 (76%)	25 (73%)	3 (38%)	0	2 (33%)	1 (20%)	0
Juvenile and adult primaries	1 (6%)	4 (14%)	6 (18%)	0	1 (14%)	0	0	0
Adult primaries	4 (25%)	3 (10%)	3 (9%)	5 (62%)	6 (86%)	4 (67%)	4 (80%)	3 (100%)
<b>No. banded</b>	<b>16</b>	<b>29</b>	<b>34</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>3</b>

**TABLE 2**

Primary covert moult status of first season Regent Honeyeaters. Individuals with adult-like characters (warts/primaries/coverts) were aged as first year birds because they either displayed other plumage traits consistent with first year birds or were banded individuals of known age.

	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Juvenile coverts	14 (87%)	25 (86%)	29 (85%)	3 (38%)	0	0	1 (20%)	0
Juvenile and adult coverts	0	1 (4%)	1 (3%)	0	1 (14%)	0	0	0
Adult coverts	2 (13%)	3 (10%)	4 (12%)	5 (63%)	6 (86%)	6 (100%)	4 (80%)	3 (100%)
<b>No. banded</b>	<b>16</b>	<b>29</b>	<b>34</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>3</b>

**TABLE 3**

Facial wart development of first year Regent Honeyeaters. Individuals with adult-like characters (warts/primaries/coverts) were aged as first year birds because they either displayed other plumage traits consistent with first year birds or were banded individuals of known age.

	June	July	Aug	Sept	Oct	Nov	Dec	Jan
No warts	7 (44%)	1 (3%)	4 (12%)	0	0	0	0	0
Warts developing	7 (44%)	15 (52%)	22 (65%)	7 (77%)	7 (100%)	2 (33%)	1 (20%)	0
Warty	2 (12%)	13 (45%)	8 (23%)	1 (13%)	0	4 (67%)	4 (80%)	3 (100%)
<b>No. banded</b>	<b>16</b>	<b>29</b>	<b>34</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>3</b>

**TABLE 4**

Ageing criteria for Regent Honeyeaters (age codes as per Lowe (1989))

Age	Age Code	Feature description
Juvenile	J	Plumage grey-brown
Immature	1	As adult, retaining juvenile primaries (dusky brown with dull yellowish white markings), primary coverts (dull yellowish broadly edged brown) and tail. Facial warts absent or developing.
	2-	As adult, juvenile primaries or primary coverts, facial warts developed.
Adult	2+	Primaries black with yellow on, usually, P10 to P5. Primary coverts yellow, with or without black shaft, very occasionally with black spots. Facial patch warty.

**TABLE 5**

Wing length and head-bill length of Regent Honeyeaters

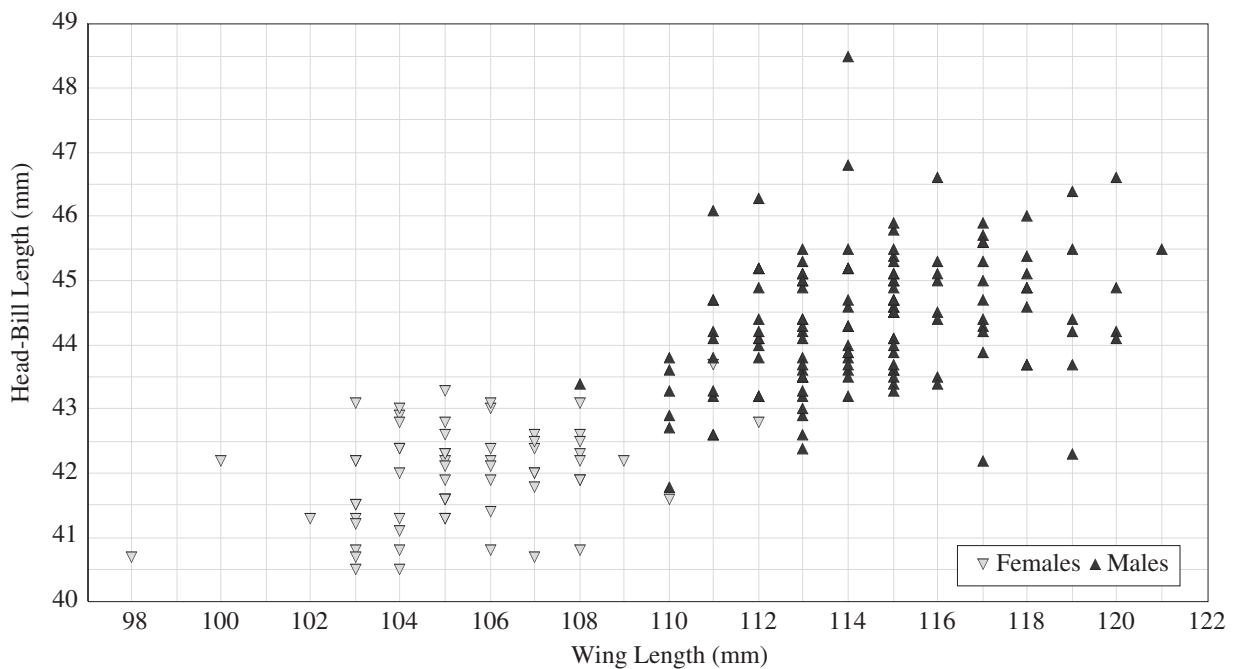
**Wing length**

Age	No.	Mean ♀	Mean ♂	Upper limit ♀	Lower limit ♂	% right	% don't know	% wrong
1	65	102.4 ± 2.14	110.0 ± 2.30	103	109	63.81	36.07	0.11
1*	41	104.1 ± 2.52	111.3 ± 2.69	104	112	44.18	55.6	0.22
2+	224	105.1 ± 2.26	114.3 ± 2.66	107	112	80.24	19.08	0.21

\* 1st year birds with freshly moulted adult primaries

**Head-bill length**

Age	No.	Mean ♀	Mean ♂	Upper limit ♀	Lower limit ♂	% right	% don't know	% wrong
1	108	42.3 ± 0.92	45.1 ± 0.77	43.1	44.6	78.41	21.08	0.5
2+	197	42.0 ± 0.84	44.3 ± 1.06	41.6	44.1	43.61	55.78	0.61



**Figure 4.** Bivariate plot of wing and head-bill lengths from Regent Honeyeaters aged 2+.

## Ageing

The development of a warty face appears to commence at about nine months of age, at which time most young birds also commence moulting their juvenile wing and tail feathers. Very few Regent Honeyeaters were observed with fully moulted primaries and primary coverts before warts had developed; however, it was not uncommon for young birds to have juvenile primary and primary coverts in combination with well developed warty faces.

It is possible that young from late nests may develop warty faces but retain worn juvenile tail and primary feathers until after the following breeding season while those from early nests undergo a moult prior to the following breeding season. It is therefore possible to confidently assign age to classes 1 or 2- for most Regent Honeyeaters that were hatched in the previous breeding season as detailed in Table 4.

## Sexing

Male and female Regent Honeyeaters have similar plumage patterns. Males, however, tend to have more heavily marked underparts with broader black fringes to the feathers of the breast and belly giving the bird a darker appearance. As a general rule, males also tend to have a greater area of warty facial skin.

The main difference between the sexes is size. In many mated pairs the birds can be confidently sexed in the field using a combination of the differences in plumage and soft-part characters (see above) and an often-noticeable size difference. In the hand, wing length and head-bill measurements can be used to sex most birds, males being larger than females (Schodde *et al.* 1992). The sex of most birds can be determined using univariate data for wing length or head bill; however, the reliability of these measurements for sexing is dependent on age (Table 5). Excluding juveniles, birds of the previous breeding season, i.e. aged 1 or 2-, with a wing length of less than 104 millimetres can be assigned as female while those greater than 109 millimetres as male. For adult (2+) birds, females have a reliable upper limit of 107 millimetres and males a lower limit of 112 millimetres. Using bivariate data for these two measurements provides a greater degree of certainty in determining the sex of an individual (Table 6; Figure 4).

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TABLE 6

Bivariate sexing criteria at 95 per cent confidence for Regent Honeyeaters aged 2+. Limits of head-bill for given wing length.

Wing	Age 1 Head-bill		Age 2+ Head-bill		
	Upper limit for female	Lower limit for male	Upper limit for female	Lower limit for male	
94	44.2	48.3	–	–	
95	44.1	48.0	–	–	
96	44.0	47.8	–	–	
97	43.9	47.6	46.9	–	
98	43.8	47.3	46.6	–	
99	43.6	47.0	46.3	–	
100	43.5	46.7	46.1	–	
101	43.3	46.4	45.8	–	
102	43.1	46.1	45.4	–	
103	42.9	45.7	45.1	49.0	
104	42.6	45.3	44.7	48.6	
105	42.2	44.8	44.3	48.1	
106	41.6	44.4	43.8	47.6	
107	40.8	43.9	43.4	47.0	
108	39.8	43.6	42.8	46.4	
109	39.0	43.4	41.9	45.7	
110	38.6	43.1	40.6	44.9	
111	–	42.9	39.0	44.0	
112	–	42.6	38.4	43.2	
113	–	42.3	38.4	42.6	
114	–	42.1	38.4	42.0	
115	–	41.6	38.4	41.2	
116	–	41.3	38.4	40.2	
117	–	40.9	38.4	39.1	
118	–	40.5	38.4	38.4	
	Right	Don't know	Wrong	Right	Don't know
	89.5%	10.3%	0.2%	89.0%	10.9%



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