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POSTJUVENAL MOLT AND DETERMINATION OF AGE OF THE CARDINAL

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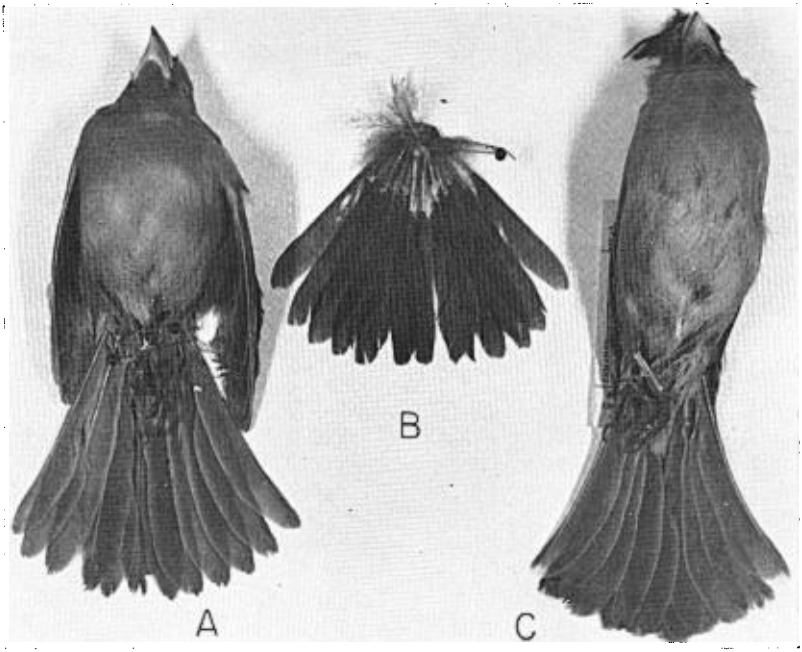
In the winter of 1957 I began banding Cardinals, *Richmondena cardinalis*, on the campus of the University of Western Ontario, London, Ontario, Canada. At that time I sought some method which would enable me to discriminate between adults (more than one-year-old) and birds in their first winter (hereafter referred to as immature). I attempted to use the method proposed by Miller (1946) for determining the age of live passerines, but it was unsatisfactory. The crest of the Cardinal made difficult a quick, clear view of the skull. By winter the unossified portions of the skull were very small in some birds and consequently were difficult to find. Finally, in the extreme cold prevailing at the time of banding, it seemed unwise to subject birds to any additional stress which might be caused by minor surgery and by the time required for the examination. So, I sought other means of age determination.

In December and, to a lesser degree, in January some birds retain obvious marks of immaturity, such as a dark culmen and dark spots on the mandible dorsal to the angle of the gonys. In

Fig. 1. Two immature ♀ Cardinals and tail of a juvenal bird showing variation in the shape of the tips of the rectrices. Collection data: A, 23 Dec 1961 skull n. oss.; B, 17 Sept 1959; C, 14 Dec 1959 skull n. oss.



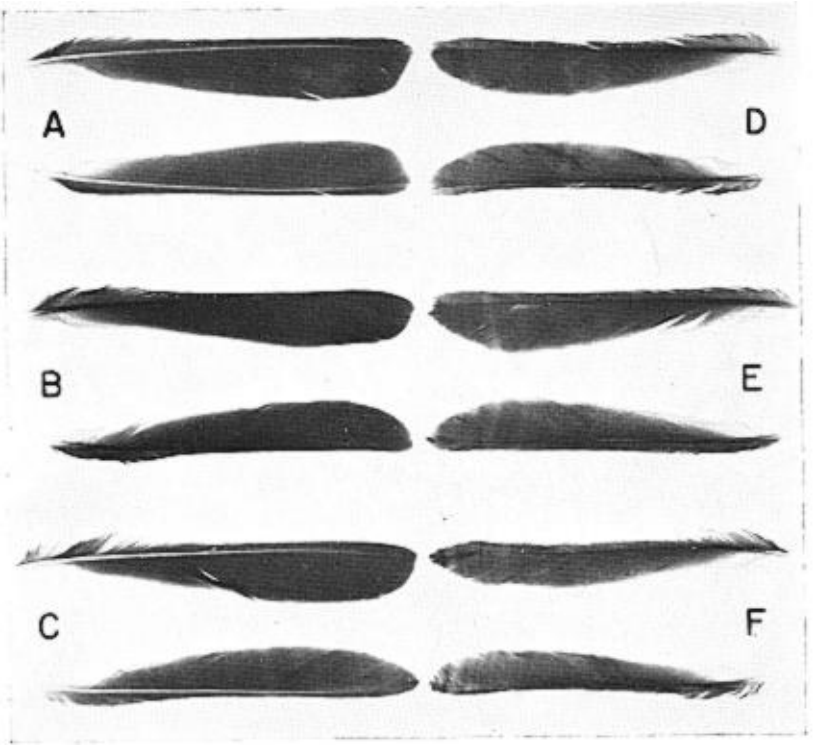
many males, moreover, buff or brown feathers on the breast or flanks indicate immaturity. In the absence of these characters, the ages of many birds, particularly females, could not be certainly determined. Meanwhile, I had observed that the shapes of the tips of the rectrices varied greatly from bird to bird. In some birds the tips were pointed (Fig. 1A and Fig. 2E), in some blunt (Fig. 1C and Fig. 2A). Some of the former but none of the latter birds were obviously immature. Accordingly, it seemed that the two types of rectrices might distinguish adult from immature birds, as was the case in a Californian race of the Rufous-sided Towhee, *Pipilo erythrophthalmus megalonyx*, (Davis, 1957).

The purpose of this paper is twofold: to show (1) that Cardinals can be divided into two age-groups by an examination of the rectrices, and (2) that, contrary to the opinion of Dwight (1900), many Cardinals do not have a complete postjuvenal molt. Details concerning the postjuvenal molt will be published later.

METHODS

When a bird was first trapped, I clipped off with scissors about 3 cm from one rectrix 5 and one rectrix 6 (usually the left and right respectively) and stored the clippings in a small coin envelope. On

Fig. 2. Variation in the shapes of rectrices 5 and 6 in 6 pairs of rectrices from ♀ Cardinals trapped in December. In each pair, rectrix 5 is uppermost. Rectrices of pairs A and C are mounted with ventral surface uppermost.



this I recorded the banding data and notes on the plumage and on the coloration of the bill. Later, when I realized that the pointed rectrices were usually shorter and narrower than the blunt rectrices, I plucked the appropriate rectrices, a procedure which apparently caused little distress to the bird. Thus, in several winters from December 1957 to December 1965, I collected 260 pairs of rectrices from 144 different males and 190 different females, some of which returned in several successive winters. Included in these totals are 21 known immature birds, 20 banded as nestlings and one banded as a juvenile in July, which returned in the following winter, and 31 males and 34 females known to be adults when they returned.

The length of each plucked rectrix was measured to the nearest millimeter. The rectrices were weighed on a Mettler Type H_6T balance. As I believed that humidity might affect the weights of the feathers, all weighings were made on two consecutive days. Thus, although the weights herein recorded are not dry weights, the relative weights should nevertheless be trustworthy.

I supplemented the preceding material by collecting 151 Cardinals in the vicinity of London between September and January of various years. Estimation of the ages of these specimens was based on the degree of cranial ossification and on the presence of a bursa Fabricii.

CLASSIFICATION OF RECTRICES

The tips of several rectrices are contrasted in Fig. 2. The two upper pairs (A and D) represent common types. Differences in the shape, not only of the tips, but of the entire feathers are obvious. Rectrices 5 and 6 of pair A are broader than their counterparts of pair D. The tips show the greatest contrast. In each rectrix of pair A the posterior medial border is almost straight and makes an angle of about 70° with the rachis. At the medial end of the straight border, the edge of the feather curves abruptly. Rectrices of this type were called *blunt*. In contrast, each rectrix in pair D lacks a blunt tip, the posterior medial margin of the feather curving continuously until the widest point of the rectrix is reached. These rectrices were classified as *pointed*. Pairs B and E represent uncommon blunt and pointed types. Rectrix 5 of pair B is a typical blunt-rectrix but rectrix 6 is only slightly blunt and its shape is scarcely distinguishable from that of the pointed type. The rectrices of pair E have pointed tips but are unusually broad. Finally, pairs C and F represent unusual occurrences. The rectrices of pair C differ obviously in shape; rectrix 5 is clearly blunt, but rectrix 6 is equally clearly pointed. The rectrices of pair F are exceptionally narrow feathers of the pointed type.

Each rectrix was examined without reference to sex or field notes and classified as pointed or blunt. The procedure was repeated for each rectrix and, if the second determination disagreed with the first, repeated again. About 5% of the first two determinations disagreed. Some of this disagreement resulted from poor preservation of the rectrices following their removal and some from the intermediate shapes of the tips of some rectrices. Thus, it was not always possible to classify rectrices solely on shape. But other characteristics were present in blunt and pointed rectrices which were useful when the shape was indecisive. (1) typical pointed-rectrices were obviously paler than typical blunt-rectrices. This can be barely discerned in Fig. 2. (2) pointed feathers were often much worn; blunt feathers were rarely so. It should be emphasized that circular reasoning is not involved here: pointed feathers do not derive their shape from blunt feathers as a result of wear. (3) when one rectrix of a pair, as for example pair B in Fig. 2, was obviously a particular type but the other disagreed in some aspect of shape while agreeing in color and degree of wear, then the latter was assigned to the same type as the former. Thus, rectrix 6 of pair B, while agreeing closely in the shape of its tip to the pointed type, was notwithstanding assigned to the blunt category because it compared well in color, wear, and general shape with the typical blunt-rectrix 5 of this pair. Further confusion was provided by 14 pairs of rectrices in which one member of a pair was pointed but

TABLE 1. MEAN LENGTHS (MM) AND WEIGHTS (MG) OF POINTED AND BLUNT RECTRICES 5 AND 6 IN WINTER OF CARDINALS AT LONDON, ONTARIO

			Pointed			Blunt				
			N	Mean S.E.	Range	N	Mean S.E.	Range	d	P
♂♂	Rectrix 5	Length	49	101.7±0.42	96-107	49	107.3±0.38	100-113	5.6	<.001
		Weight	51	23.3±0.24	20-28	51	27.8±0.24	24-31	4.5	<.001
	Rectrix 6	Length	47	95.1±0.39	89-101	52	100.3±0.36	92-105	5.2	<.001
		Weight	50	23.3±0.24	20-28	55	27.0±0.27	21-31	3.7	<.001
♀♀	Rectrix 5	Length	55	97.7±0.47	88-104	68	103.3±0.35	96-110	5.6	<.001
		Weight	61	21.5±0.23	18-25	65	25.9±0.21	22-30	4.4	<.001
	Rectrix 6	Length	54	91.6±0.45	84-98	64	96.5±0.35	91-103	4.9	<.001
		Weight	58	21.4±0.22	18-25	63	25.6±0.23	22-30	4.2	<.001

the other was blunt (Fig. 2C); usually (10 cases) rectrix 5 was blunt. As will be elucidated later, pointed rectrices occur only in immature or first-year birds but blunt rectrices occur in adult and in some immature birds. Thus, only pointed rectrices permit certain age-determination. Accordingly, each bird bearing disparate rectrices 5 and 6 was assigned to the pointed group.

The length and weights of the two types of rectrices provide a quantitative measure of the difference between the types (Table 1). In each sex, the mean lengths and mean weights of blunt rectrices 5 and 6 were significantly greater than those of pointed rectrices ($P < .001$ in each of 8 comparisons using Student's t test). The overlap in ranges in both length and weight of the two categories was sufficiently great to preclude the use of either measurement in classifying the rectrices.

TABLE 2. MEAN WEIGHTS (MG) OF TWO TYPES OF RECTRIX 5 OF THE SAME LENGTH FROM FEMALE CARDINALS.

	Pointed				Blunt				Difference
Length	Mean Length	N	Range	Mean	Mean Length	N	Range	Mean	
98-99 mm	98.6	11	20–23	22.2	98.5	6	22–25	23.8	1.6
100-100 mm	100.2	9	21–24	22.4	100.6	11	23–28	24.9	2.5
102-103 mm	102.5	6	22–25	23.3	102.5	15	23–28	25.2	2.2

The difference in weight between blunt and pointed rectrices does not result entirely from the difference in length. Rather, it reflects the difference in the shape of the feathers. Table 2 shows that blunt rectrices are about 10% heavier than pointed rectrices of comparable lengths.

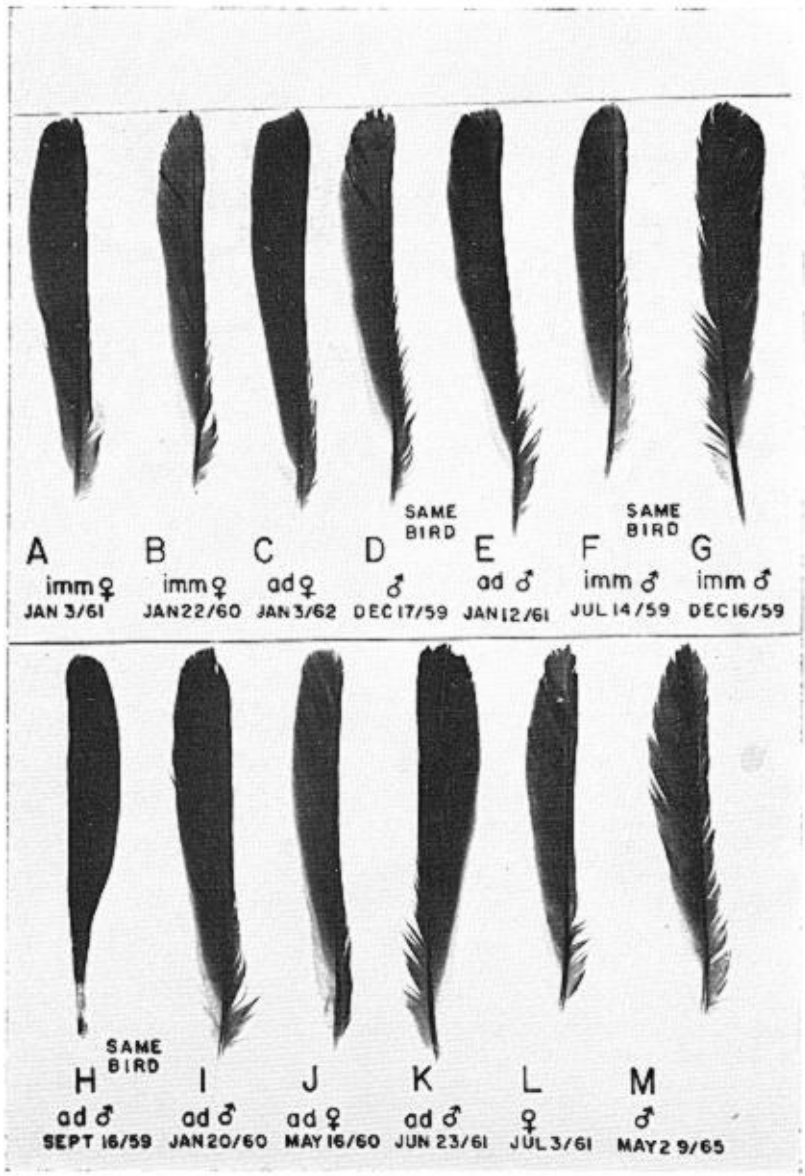
I conclude that the two types of rectrices are essentially discontinuous and are not merely the upper and lower ends of a continuous series. What then, is the basis of this variation?

TYPE OF RECTRIX AND AGE

Several lines of evidence suggest that pointed rectrices are indicative of immaturity:

1. All known adult birds (31 ♂♂, 34 ♀♀) had blunt rectrices in the winter;
2. Ten birds (4 ♂♂, 6 ♀♀) banded as nestlings had pointed rectrices in the winter following their birth (Fig. 3B);
3. Four birds, shot in September and judged to be less than 30 days old, had incompletely grown pointed rectrices (Fig. 1B);
4. All birds (13 ♂♂, 12 ♀♀) with pointed rectrices, collected in November, December, or January, had incompletely ossified skulls (Table 3). But all birds with fully ossified

Fig. 3. Silhouettes of rectrix 5 from 10 Cardinals to illustrate variation in shape related to age and to the season. The immature or adult status of birds so designated was known from banding records.



skulls had blunt rectrices. In both groups of birds, molt of the flight feathers had apparently ceased;

5. All birds (4 ♂♂, 5 ♀♀) with pointed rectrices when first captured and which returned in a later winter had blunt rectrices when recaptured (Fig. 3D and E). This observation by itself shows only that feather shape changes with age, but if taken in conjunction with the preceding observations, it is consistent with the idea that pointed feathers occur only in immature birds.

I conclude, therefore, that Cardinals with pointed rectrices in the winter are immature birds. But it does not follow from this that all Cardinals possessing blunt rectrices are more than one-year-old. Indeed, as Table 3 shows, many immature birds have blunt rectrices in the winter. Thus, there are two groups of immature birds in winter: one with pointed rectrices and the other with blunt. As, judged from birds which returned in successive winters, all Cardinals eventually acquire blunt rectrices, the presence of two types of rectrices in immature birds requires explanation.

TABLE 3. TYPES OF RECTRICES RELATED TO CRANIAL OSSIFICATION IN 53 CARDINALS, COLLECTED IN NOVEMBER, DECEMBER, OR JANUARY, IN WHICH MOLT OF FLIGHT FEATHERS HAD CEASED.

	Skull fully ossified		Skull not fully ossified		Total
	Pointed	Blunt	Pointed	Blunt	
♂♂	0	9	13	6	28
♀♀	0	7	12	6	25

All juvenal birds, as judged by their size, by their association with parents, or by their blackish bill, examined by me had pointed rectrices (Fig. 1B). Nevertheless, 10 birds (6 ♂♂, 4 ♀♀) banded as nestlings had blunt rectrices when recaptured in the following winter (Fig. 3A). Furthermore, one bird banded as an independent juvenile in July had at that time pointed rectrices (Fig. 3F), but in December the opposite rectrices (i.e. not replacements for those plucked) were blunt (Fig. 3G). In juvenal birds collected when they were molting rectrices, the new rectrices were blunt but the old were pointed. I conclude then that the pointed rectrices in birds which otherwise appear to be adults are juvenal feathers; blunt rectrices represent a second and postjuvenal generation of feathers found not only in all adults but also in many immature birds. It may be argued that the pale, pointed rectrices present in winter are not juvenal feathers but are faded and excessively worn blunt rectrices. All the evidence opposes this idea. Compare for example the fresh right rectrix 5 (Fig. 3H) taken on 16 September 1959 with the left rectrix 5 (Fig. 3I) from the same bird four months later on 20 January 1960. Despite some damage incurred when mounting the latter feather preparatory to photographing it, its

essential bluntness remains apparent. Moreover, even in summer when wear should show its greatest effect, rectrices from known adults are still blunt (Fig. 3J and K). Note the difference in shape between these rectrices and those shown by Fig. 3L and M. The latter were taken from birds judged from their behavior, and in case of the male from his pale coloration, to have been first-year birds in their first breeding season. Wear, then, does not obscure the essential differences between pointed and blunt rectrices. Thus, the presence of two types of rectrices in immature birds must result from individual differences in the extent of the postjuvenal molt.

Additional evidence of an incomplete postjuvenal molt is shown in Tables 4 and 5. Table 4 shows that the molt of flight feathers had largely terminated by November and had terminated in all birds collected in December and January. This confirms my more hurried observation that all birds banded by me in the winter had ceased molting of flight feathers. Now, consider only those birds in which the molt had terminated (Table 5). About half of the

TABLE 4. PROGRESS OF MOLT OF FLIGHT FEATHERS OF 143 CARDINALS IN RELATION TO THE SEASON. AGE DETERMINED ON BASIS OF CRANIAL OSSIFICATION AND PRESENCE OF A BURSA. SEXES ARE GROUPED.

Age	Stage of molt	Sept.*	Oct.	Nov.	Dec.	Jan.
Adult	proceeding	7	13	3	0	0
	terminated	0	7	5	5	2
Immature	proceeding	18	38	5	0	0
	terminated	0	2	19	16	3

*one adult ♀, one juvenal ♂, one juvenal ♀ and five dependent juveniles of undetermined sex, all collected in September, are excluded because molt of flight feathers had not begun.

sample had pointed rectrices; all these birds were certainly immature. Additionally, 17 of these 25 birds possessed either some primaries or secondaries which were also juvenal. The few birds with old primaries invariably had some old secondaries; the converse did not apply. No bird with blunt rectrices, regardless of the degree of cranial ossification, had any old remiges. Assuming that all those birds with fully ossified skulls were adult, then about 68% of the immature Cardinals failed to undergo a complete postjuvenal molt.

Failure to molt juvenal rectrices is clearly related to the time of hatching (Table 6). Birds hatched before the fourth week in July underwent a complete molt of all flight feathers and by winter were almost indistinguishable from adults. The bills of some of this group still retained a darkish hue but in others the bill appeared completely adult. Birds hatched later than the fourth week in July retained at least juvenal rectrices 5 and 6 and, occasionally, some juvenal remiges. Respecting these, information on four birds

TABLE 5. RETENTION OF OLD REMIGES RELATED TO TYPES OF RECTRICES IN 53 CARDINALS COLLECTED IN NOVEMBER, DECEMBER, OR JANUARY, IN WHICH MOLT OF FLIGHT FEATHERS HAD CEASED.

	Skull fully ossified		Skull not fully ossified			
	Blunt		Pointed		Blunt	
	♂	♀	♂	♀	♂	♀
	N = 16		N = 25		N = 12	
Remiges all new	9	7	5	3	6	6
Some old primaries	0	0	2*	3*	0	0
Some old secondaries	0	0	8	9	0	0

*These birds are included in numbers of birds with some old secondaries.

indicates that the retention of remiges is also influenced by the hatching date. Two birds, hatched on 26 July and 3 August, had all new remiges; of two siblings hatched on 8 August, one had juvenal secondaries 1 to 6 in each wing while the other had juvenal secondaries 2 to 6.

The members of each of four sets of siblings agreed exactly with each other in the degree of molt of the rectrices.

The data of Tables 5 and 6 imply that a majority of Cardinals must be produced from eggs which hatch after the fourth week in July. This is indeed the case. I have found locally that about 55% of Cardinals (based on fledging dates for 126 nestlings) fledge between the last week of July and the end of the nesting season in mid-September. Thus, there is ample late season production of young birds to account for the large number of immature birds which do not undergo a complete postjuvenal molt.

USEFULNESS OF THE METHOD

The usefulness of the proposed method rests upon the proportion of birds which can be definitely classified. Here, as has been noted, about 68% of known immature Cardinals did not undergo a com-

TABLE 6. TYPE OF RECTRIX 6 IN WINTER OF 21 IMMATURE CARDINALS RELATED TO THE DATE OF HATCHING. SEXES ARE COMBINED. DATES OF SIBLINGS ARE IN PARENTHESES.

	Type of rectrix	
	Blunt	Pointed
Date of hatching	May 19, 26 June 1 (ca.) 7, 8, (8, 8), 18, July (15, 15), 19.	July (25, 25), 26, 30, Aug. 3, (8, 8, 8), 15, 29.

plete molt of the rectrices. Thus, a substantial number of birds can be designated certainly as immature in banding reports; many of these birds and particularly females might otherwise be reported as being of adult or unknown status. By way of illustration, my catches in the winters of 1959-60 and 1960-61 are summarized in Table 7. Slightly more than 20% were known adults banded in

TABLE 7. NUMBERS OF CARDINALS WITH POINTED OR BLUNT RECTRIX 6 IN BIRDS TRAPPED AT LONDON, ONTARIO, IN THE WINTERS OF 1959-60 AND 1960-61. SEXES ARE COMBINED.

	Known adults		Unknown age		Percent	
	59/60	60/61	59/60	60/61	59/60	60/61
Blunt	27	21	39	27	52	57
Pointed	0	0	62	36	48	43

earlier years. Of the remainder, 61% (62) in 1959-60 and 57% (36) in 1960-61 were classified as immature birds because they possessed juvenal rectrices. Assuming that a few of the birds of uncertain age were adults then the percentages of incompletely molted birds would approximate to the value of 68% derived from my museum specimens. Thus, using the method herein described, it was possible to designate accurately in the banding reports 62 birds of a total of 128 as immature in the winter of 1959-60, and 36 of 84 birds as immature in the following winter. Contrast those values with the following. Using recovery records of Cardinals on file with the U. S. Fish and Wildlife Service, I summarized the ages, as reported at the time of banding, of about 500 Cardinals which had been banded in North America in December, January, or February and which had been subsequently found dead. In this sample only 12 of 495 birds were reported as immatures; of the remainder, 359 were reported as adults. The disparity between the proportional representation of immatures in that sample and that in mine is highly significant (chi square, $P < .001$). One obvious explanation is that many of the so-called adults in the larger sample were really immature birds which had attained adult plumage.

Certain aspects of avian population dynamics, notably dispersal and mortality, vary with age (Lack, 1954). As much of our knowledge of these topics is derived from banding data, it seems desirable to increase the accuracy of estimates of age wherever possible. With respect to the Cardinal, therefore, I recommend to bird banders that they attempt to apply the proposed method and to record Cardinals in the winter as being either immature or of unknown age. In the winter, unless the breeding history of an unbanded bird is known, it seems unwarranted to attribute adult status to any Cardinal. In banding reports for this species, and for many others, the category of adult in the non-breeding season may be the source of more confusion than clarification.

The method outlined here is easy to use. It is not necessary to collect or to clip rectrices (though it would be wise for anyone who bands many Cardinals to retain one rectrix six from each bird until the observer appreciates the nature of the variation involved). When a bird is in the hand it is a simple matter to spread the tail and inspect the lateral rectrices. The contrast in color and shape between blunt and pointed rectrices is ordinarily striking and permits rapid classification. If conditions permit, estimation of the age of birds with blunt rectrices could be attempted using either the method of Miller (1946) or its modification (Norris, 1961).

The method has even greater value during the breeding season when there is too little variation in the color of the bill to permit determination of age. Some males at this time are much less intensely colored than known adults and often have buff-colored feathers on the breast, feathers which I have never seen in a known adult. Presumably these birds are first-year males entering their first breeding season. Table 8 shows the frequency of pointed and

TABLE 8. FREQUENCY OF POINTED ABD BLUNT RECTRIX 6 IN ADULT CARDINALS IN BREEDING SEASON, MAY TO JUNE, 1965.

	♀			♂			
	Caught	Inferred	Total	Caught	Inferred	Total	Grand Total
Pointed	4	0	4	15	0	15	19
Blunt	9	5	14	27	11	38	52
Total	13	5	18	42	11	53	71

blunt rectrices in 71 Cardinals breeding here in 1965. Rectrices were recovered from 55 birds. In addition, there were 16 known old adults which were not caught but were presumed to have blunt rectrices. Nineteen birds had pointed rectrices. Locally, I have found that about 35% of breeding birds are missing from the study area by the following breeding season. If this value approximates closely to the annual mortality rate of birds once they have bred, then in a stable population (as the local one seems to be), of 71 breeding birds, 25 should be replacements bird breeding for the first time. Since about 68% of known immatures in winter had pointed rectrices, and assuming no change in this percentage between winter and late spring, one would expect that $\frac{68 \times 25}{100} = 17$ birds in the breeding sample would have pointed rectrices. This value agrees closely enough with the observed value of 19 to warrant the inference that there is little, if any, molt of juvenal rectrices between winter and late spring. I conclude, therefore, that the proposed method of determining age can be validly used in the breeding season. Admittedly, rectrices will show much more wear in the spring and summer than in the winter. It is my impression, however, that pointed juvenal rectrices show excessive wear in

summer more often than blunt rectrices. Consequently a rectrix whose shape in the summer is doubtful because of wear is likely a juvenal rectrix.

DISCUSSION

Passerines often retain some juvenal rectrices following termination of a partial postjuvenal molt (Miller, 1928 and 1933; Emlen, 1936; Michener and Michener, 1940; Pitelka, 1945 and 1958; Davis, 1951 and 1957; Mewaldt, 1958). This characteristic has been used as an index of age of the American Crow, *Corvus brachyrhynchos*, (Emlen, 1936), of Clark's Nutcracker, *Nucifraga columbiana*, Mewaldt (1958), and of towhees of the genus *Pipilo* (Davis, 1951 and 1957). In these species, as in the Cardinal, the tips of the juvenal rectrices are pointed or rounded, but adult rectrices have blunt or truncate tips.

Geographic and seasonal intraspecific variation in the extent of the postjuvenal molt have been noted. Davis (1957) pointed out that juveniles of a Californian race of the Rufous-sided Towhee, unlike the nominate race in New York (Dwight, 1900), did not invariably molt their rectrices during the postjuvenal molt. Miller (1933) found that members of desert populations of the *Phainopepla nitens lipida* had a complete postjuvenal molt more commonly than did individuals of coastal populations of the same race. As the times of hatching differed in the two areas, the contrast in the extent of the postjuvenal molt cannot be definitely attributed to geographic variation. An excellent example of seasonal effects on the postjuvenal molt is provided by the observations of Michener and Michener (1940) on the House Finch, *Carpodacus mexicanus grinnelli*. They noted that the first-hatched young of the season underwent a complete postjuvenal molt but, as the season advanced, the young of progressively later broods retained more and more juvenal remiges. The Cardinal is similar in this respect to the House Finch and this seasonal variation may be at the root of the contradiction between my conclusion that all young Cardinals do not have a complete postjuvenal molt and the contrary conclusions of Dwight (1900) and Sutton (1935a). These workers stated neither the number nor the time of hatching of the young Cardinals which formed the bases of their observations. Possibly they dealt with Cardinals which hatched early in the season and would, therefore, have had a complete postjuvenal molt. Sutton (1935b) did, however, describe a breeding male Cardinal in terms which suggest that it was a first-year bird which had retained some juvenal feathers. I have no information on geographic variation in the postjuvenal molt of the Cardinal. As New York State and Michigan, where Dwight and Sutton worked, are close to here, it is improbable that geographic variation could account for the contradictory observations.

In the species cited above, when the postjuvenal molt is partial, some juvenal remiges are retained more frequently than juvenal rectrices. The Cardinal differs in that the rectrices are the juvenal flight feathers more commonly retained.

The adaptive significance of intraspecific variation in the extent of the postjuvenal molt does not seem to have been investigated. As the Cardinal spends much time foraging on the ground, much wear to the rectrices probably results. It would, therefore, be advantageous for early-hatched birds to replace juvenal rectrices at the postjuvenal molt. Otherwise, these feathers would be retained until the first postnuptial molt in the August or September of the following year, up to 15 months after hatching. Why should late-hatched juveniles not molt similarly? These individuals begin to molt in September and possibly even in early October when the temperature is dropping rapidly (at London mean monthly temperatures are: August, 20.2C; September, 15.8; October, 9.8; November, 2.8). Several authors, cited by King and Farner (1961), have found that the standard metabolic rate rises considerably during the molt. If this is true also for the Cardinal, then it would occur in late-hatched juveniles when demands upon energy for thermoregulation are presumably also increasing. I suggest therefore that the retention of some juvenal feathers may be an adaptive response to the changing demands upon energy in the fall. But in view of the paucity of data bearing on molt and energy requirements, it is idle to speculate further.

SUMMARY

Rectrices 5 and 6 of 234 Cardinals banded in the winter and of 151 Cardinals collected from September to January near London, Ontario, were divided into two groups: *pointed* and *blunt*, based on the shape of their tips. Blunt rectrices were longer, heavier, broader and darker than pointed rectrices. The differences between the means of the mensural characters were highly significant ($P < .001$).

All known adults (65) had blunt rectrices. Thirty-five of 58 known immature birds in which the postjuvenal molt had terminated had retained pointed (juvenal) rectrices; the remainder had blunt rectrices. Therefore, Cardinals with pointed rectrices are immature.

The degree of completion of the postjuvenal molt is related to the time of hatching. Eleven individuals hatched before 20 July had blunt rectrices 5 and 6, but 10 birds hatched after 24 July had pointed rectrices 5 and 6, in the following winter.

The two types of rectrices provide a means of assigning Cardinals to one of two age-groups: (1) immature, and (2) unknown age. As about 45% of 212 birds caught in winter had pointed rectrices and could thus be definitely considered immature, the method has a practical application. In the breeding season, when other criteria of age applicable in the winter are no longer useful, the proposed method is still valid.

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