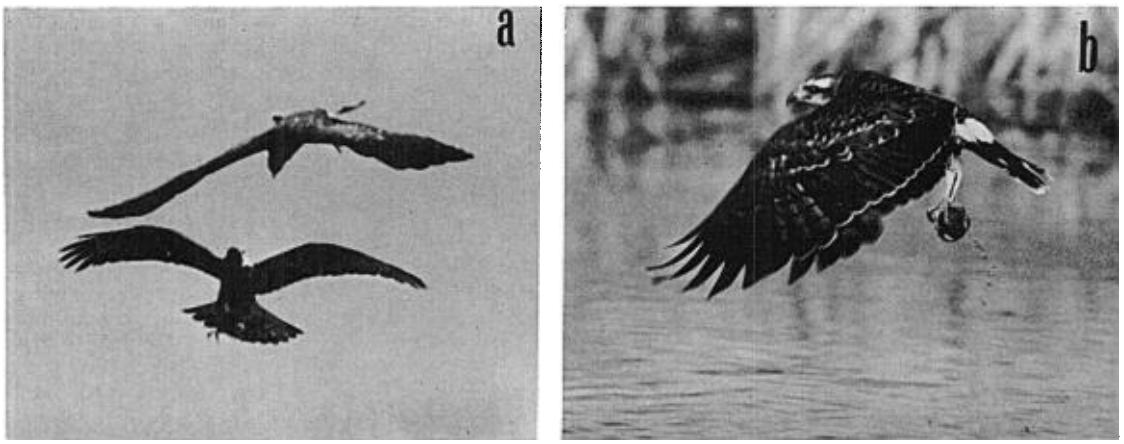

FIGURE 1. a. Territorial interaction between two Everglade Kites. b. Everglade Kite capturing a *Pomacea paludosa* from a canal in the eastern everglades.

this snail in the Everglades. It was common to see as many as three or four adult snails on a single submerged cattail stalk, and it usually took a kite less than a minute (often just a few seconds) to locate and capture a snail on a given hunting foray.

We returned to the same locality on 17 November 1969 and again found brown-plumaged kites feeding in the area. On this date, however, we saw no evidence of territorial defense, and it was clear that several different kites were foraging along the same stretch of canal. Individuals were seen to move great distances in search of food, often flying out of sight as they worked up and down the canal and over adjacent areas of marsh. Snails were much less abundant on this date, as evidenced by our inability to spot them in the water and by the long, frequently unsuccessful, hunting forays of the kites.

It might at first seem paradoxical that defense of feeding areas occurred with superabundance of food, but we suspect that defense is feasible only under such conditions. Under normal conditions of prey abundance the area necessary to supply a kite's needs may well be larger than it is capable of defending effectively, and the expense (of time and energy) of defending a large territory could easily exceed any possible benefit the kite might garner by excluding other kites. However, if snails were superabundant over a relatively large proportion of the range of a kite population, there would seemingly be little to be gained by individuals defending territories. We believe that the area of snail superabundance on 2 November was quite limited although we were unable to check snail abundance in the marshes surrounding the defended areas of canal. In the canal itself we noted high concentrations of snails only in the defended areas.

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MOLTS OF THE VERDIN, *AURIPARUS FLAVICEPS*

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Good descriptive accounts of the Verdin's (*Auriparus flaviceps*) plumages have been written by a number of investigators (Coues 1878; Sennett 1879; Ridgway 1904; Dawson 1923; Bailey 1928); however, published information on the molts of this species is meager. Bent's (1946:432) account of the Verdin's molts is inconclusive: "I have seen no very young verdins, but apparently they are hatched naked, and they probably acquire the juvenal contour plumage before they leave the nest."

Information was obtained on the molts of immature (fledglings that have not completed postjuvenal molt) and adult Verdins while collecting specimens for analysis of their food habits. Particular attention was given to the loss and replacement of the remiges and rectrices.

METHODS

Most of the 43 immature and 18 adult Verdins examined were collected in the desert areas near Mesa and Tempe, Maricopa County, Arizona. A few specimens were taken near the Graham (Pinaleno) Mountains, Graham County, Arizona; Komatke, Maricopa County, Arizona; Sunflower, Maricopa County, Arizona; and Patagonia, Santa Cruz County, Arizona. I collected all Verdins reported herein except those from Komatke, which were obtained and given to me by Mr. Amadeo Rea, and those that were banded on my study plot in Maricopa County.

Verdins were collected primarily in the summer and early autumn of 1965 and 1966. A few individuals, all of which had completed their molt, were collected in the winter of 1965 and spring of 1966. Birds were weighed when possible, and all weights were recorded in grams using an Ohaus Triple Beam Balance. Weighing was accomplished shortly after the birds were obtained. The specimens collected are deposited in the Vertebrate Collection at Arizona State University, Tempe, Arizona.

WEIGHTS

Data on the weights of 34 immature and 15 adult Verdins are reported in table 1. The mean weights of the immatures and adults were 6.9 (SE, 0.085) and 7.2 (SE, 0.127) g, respectively.

PLUMAGES

The Verdin's plumages may be summarized as follows: The juvenal plumage is the first covering of feathers as the young are hatched naked. This plumage is lost

TABLE 1. Weights (g) of immature and adult Verdins.

Age	n	$\bar{x}$	SE	Range
Adults				
Females	7	7.3	0.219	6.2–8.1
Males	8	7.0	0.130	6.4–7.5
Immatures				
Nonprimary molt	16	6.6	0.096	6.0–7.4
Primary molt	18	7.2	0.115	6.6–8.2

in the postjuvenal molt. Recently fledged Verdins lack the yellow head feathers and the chestnut-colored upper lesser wing coverts. These distinguishing characteristics, however, become part of the juvenal plumage of older immatures. The first-year plumage is acquired by the postjuvenal molt. First-year Verdins that had completed the postjuvenal molt could not be distinguished from adults. The adult plumage is renewed each year by a postnuptial molt.

POSTJUVENAL MOLT

Recently fledged Verdins typically show sheathed basal areas on the primaries, secondaries, and rectrices, indicating that growth of the flight feathers is not completed before the birds fledge. Individuals in this condition were being cared for by their parents. The earliest date recorded for an immature undergoing the postjuvenal molt was 4 June. This immature had yellow feathers appearing on the head and was found roosting in the same nest with an adult female. Immatures with the yellow feathers just appearing on the head may still be under the care of adult birds. One immature Verdin banded 28 May and recaptured 17 July had not begun its postjuvenal molt. Another immature collected on 6 August had not begun its postjuvenal molt, although most immatures observed in mid-August and September were in advance stages of molt. Immatures not undergoing the postjuvenal molt in late July and August are probably from late broods since second clutches in this species are not uncommon.

The postjuvenal molt begins with the appearance of the yellow head feathers. The initial growth centers of these feathers are at the base of the tomia, the base of the upper maxilla, and around the eye. Gradually, as the molt progresses posteriorly, more yellow feathers appear in these anterior head regions. Although the yellow head feathers appear before the chestnut-colored lesser wing coverts, the molt of these coverts is complete before the head molt terminates. The first immature showing incoming chestnut-colored wing coverts was collected on 24 July. The primary molt is well advanced when these feathers appear.

No specimens examined had primaries number 1 (innermost), 2, or 3 in molt; therefore, the Verdin's postjuvenal molt must be incomplete (table 2). I do not know any real adaptive significance of retaining these feathers in this nonmigratory species. The amount of yellow on the head of immatures replacing the fourth and fifth primaries varies with the individual.

Secondaries are lost after the primary molt is well advanced. Some specimens beginning the secondary molt had sheathed sixth primaries. Secondary 8 (numbered from distal to proximal) is the initial center of molt (table 3). By the time secondaries 2 and 3 are being replaced, primaries 6 and 7 are molting.

Seven specimens clearly showed the molt of the rectrices begins with the loss of the first (innermost) and terminates with the sixth (outermost) rectrix. The first rectrix is molting about the time that primary 6 and secondary 8 are being replaced, and

TABLE 2. Summary of the molting primaries of immature Verdins.[a] [b]

Date collected	Left wing, primary no.							Right wing, primary no.						
	10	9	8	7	6	5	4	4	5	6	7	8	9	10
8 July	–	–	–	–	–	u	u	u	u	–	–	–	–	–
13 July	–	–	–	–	–	u	12	10	m	–	–	–	–	–
24 July	–	–	–	–	u	26	r	r	24	u	–	–	–	–
24 July	–	–	–	–	m	23	r	r	r	u	–	–	–	–
24 July	–	–	–	–	u	r	r	r	r	3	–	–	–	–
24 July	–	–	–	–	4	23	r	r	r	5	–	–	–	–
1 Aug.	–	–	–	–	–	6	r	r	u	–	–	–	–	–
6 Aug.	–	–	–	–	2	32	r	r	31	1	–	–	–	–
8 Aug.	–	–	–	2	33	r	r	r	r	30	4	–	–	–
28 Aug.	–	–	–	m	14	r	r	r	r	15	m	–	–	–
28 Aug.	–	–	–	–	u	r	r	r	r	u	–	–	–	–
28 Aug.	–	–	u	37	r	r	r	r	r	r	25	u	–	–
28 Aug.	–	–	u	18	r	r	r	r	r	r	17	u	–	–
28 Aug.	–	–	2	33	r	r	r	r	r	r	36	7	–	–
28 Aug.	–	u	7	r	r	r	r	r	r	r	r	4	u	–
18 Sept.	r	31	r	r	r	r	r	r	r	r	r	r	32	r
18 Sept.	13	26	36	r	r	r	r	r	r	r	r	35	25	10
18 Sept.	14	33	r	r	r	r	r	r	r	r	r	r	33	14
18 Sept.	2	12	29	r	r	r	r	r	r	r	r	29	16	2
18 Sept.	r	r	r	r	r	r	r	r	r	r	r	r	r	r
20 Sept.	14	32	38	r	r	r	r	r	r	r	r	r	30	r
9 Oct.	r	r	r	r	r	r	r	r	r	r	r	r	r	r

[a] 21 additional Verdins collected from 25 May to 6 August were in nonmolt.
[b] Dash = old feather present; u = unopened shaft; r = completely replaced feather; m = missing feather; numbers indicate length (mm) of feather growth emerging from shaft.
[c] See text for explanation of primaries 1, 2, and 3.

TABLE 3. Summary of the molting secondaries of immature Verdins.[a] [b]

Date collected	Left wing, secondary no.									Right wing, secondary no.								
	9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9
24 July	–	u	–	–	–	–	–	–	–	–	–	–	–	–	–	–	u	–
24 July	m	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	–
24 July	–	u	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20	u
6 Aug.	9	23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24	13
8 Aug.	–	r	–	–	–	–	–	–	–	–	–	–	–	–	–	–	r	u
28 Aug.	r	r	u	–	–	–	–	–	–	–	–	–	–	–	–	4	r	17
28 Aug.	12	r	m	–	–	–	–	–	–	–	–	–	–	–	–	2	r	8
28 Aug.	r	r	r	–	–	–	r	r	r	r	r	r	–	–	–	11	r	r
28 Aug.	2	14	–	–	–	–	u	r	r	r	r	–	–	–	–	–	r	2
28 Aug.	r	r	r	–	–	–	4	23	r	r	25	2	–	–	–	r	r	r
28 Aug.	–	u	–	–	–	–	–	–	–	–	–	–	–	–	–	–	u	–
18 Sept.	r	r	r	26	r	r	r	r	r	r	r	r	r	r	26	r	r	r
18 Sept.	r	r	29	u	19	32	r	r	r	r	r	r	r	20	u	28	r	r
18 Sept.	r	r	r	21	31	r	r	r	r	r	r	r	r	29	21	r	r	r
18 Sept.	r	r	r	10	31	r	r	r	r	r	r	r	r	32	u	r	r	r
18 Sept.	r	r	r	–	11	25	r	r	r	r	r	r	31	2	–	29	r	r
20 Sept.	r	r	r	–	9	27	r	r	r	r	r	r	r	33	7	r	r	r
9 Oct.	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

[a] 25 additional Verdins collected from 25 May to 6 Aug in nonmolt.
[b] Dash = old feather present; u = unopened shaft; r = completely replaced feather; m = missing feather; numbers indicate length (mm) of feather growth emerging from shaft.

the tail molt appears to be completed as the primary molt is terminated. More variability was noted in the molt of the rectrices than of the remiges. For example, one Verdin had newly-formed shafts of the three outermost rectrices on the right side; the first, second, and third rectrices were old. On the left side, all six tail feathers were old.

The upper greater secondary coverts are molted in sequence from the distal to the proximal portion of the wing. These coverts are not replaced simultaneously with their respective remiges; however, this condition appears to occur with the upper greater primary coverts. The sequence of molt of these primary coverts is proximal to distal. Completion of the growth of the lower greater primary coverts occurs after immature Verdins are fledged. The replacement of these coverts proceeds proximally to distally, and occurs when several primaries have molted.

ANNUAL MOLT

Bent (1946:432) states: "The postnuptial molt of the adult begins before the end of July and may last well through September; I have seen molting adults as early as July 28 and as late as September 29. Probably the postjuvenal molt comes at about the same time." The postnuptial molt evidently begins with the termination of the breeding activities. I found no adult in molt that had eggs or young in the nest. The earliest date recorded for an adult Verdin undergoing the postnuptial molt was 4 June. This female still possessed an incubation patch and was replacing the first three primaries of both wings. She evidently began her molt in May. The

TABLE 4. Summary of the molting primaries of adult Verdins.[a]

Date collected	Left wing, primary no.										Right wing, primary no.									
	10	9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9	10
4 June	–	–	–	–	–	–	–	–	u	10	10	u	–	–	–	–	–	–	–	–
4 June	–	–	–	–	–	–	–	u	27	27	27	26	u	–	–	–	–	–	–	–
18 June	–	–	–	–	–	–	–	–	–	e	e	–	–	–	–	–	–	–	–	–
18 June	–	–	–	–	–	–	–	–	e	e	e	e	–	–	–	–	–	–	–	–
25 June	–	–	–	–	–	–	–	u	5	11	15	10	6	–	–	–	–	–	–	–
26 June	–	–	–	–	–	–	–	–	e	r	r	e	–	–	–	–	–	–	–	–
26 June	–	–	–	–	–	–	2	17	22	r	r	25	20	7	–	–	–	–	–	–
28 June	–	–	–	–	–	–	–	6	23	30	31	30	5	–	–	–	–	–	–	–
3 July	–	–	–	–	–	–	–	–	u	6	1	–	–	–	–	–	–	–	–	–
10 July	–	–	–	–	–	u	12	26	r	s	r	r	27	11	m	–	–	–	–	–
10 July	–	–	–	–	–	–	–	u	20	32	30	24	u	–	–	–	–	–	–	–
10 July	–	–	–	–	–	–	5	r	r	r	r	r	25	6	–	–	–	–	–	–
6 Aug.	–	–	–	m	8	35	r	r	r	23	21	r	r	r	26	4	m	–	–	–
8 Aug.	–	–	3	22	36	r	r	r	r	r	r	r	r	r	r	38	24	3	–	–
8 Aug.	–	–	–	–	–	20	34	r	r	r	r	r	r	33	19	–	–	–	–	–
18 Sept.	r	30	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	28	r
18 Sept.	r	32	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	33	r
9 Oct.	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

[a] Dash = old feather present; u = unopened shaft; r = completely replaced feather; m = missing feather; s = feather shot off; e = feather emerging from shaft, not measured; numbers indicate length (mm) of feather growth emerging from shaft.

latest date I found an adult Verdin still molting was 9 October. Amadeo Rea (pers. comm.) collected an adult female (AMR # 870) at Gila Bend, Maricopa County, Arizona, on 9 October, that was beginning her postnuptial molt.

The postnuptial molt of the adult Verdin is complete. This molt begins with the loss of the first (innermost) primary (table 4). Secondary replacement does not begin until several primaries have molted. Secondary 8 is molted first, followed shortly by loss of 9 and 7. About the same time that secondary 7 is being replaced, secondary 1 (innermost) is lost. Subsequently, the remaining secondaries are replaced in the following order: 2, 3, 4, 5, and 6. Molt of the rectrices typically begins after the secondaries and the primaries have begun their replacement. The sequence of replacement is from the innermost (first) to the outermost (sixth) feather.

Replacement of the upper greater primary coverts progresses with the corresponding remiges. However, the upper greater secondary coverts appear to be replaced, in sequence proceeding distally to proximal, prior to the loss of their respective remiges.

During the breeding season the yellow on the head of adult Verdins, especially males, becomes more intense. This does not appear to result from a prenuptial molt as I never found sheathed feathers during this time. Sennett (1879) implied that the perfection and increase in the yellow on the Verdin's head probably occur with subsequent annual molts. He may be correct in making this assumption since many older Verdins, especially the males, possess much more yellow on their heads than do first-year Verdins. Additional investigation is required to clarify this point. The deep orange spot on the Verdin's forehead is present in both sexes and in first-year birds.

Recent data obtained on the postjuvenal molt of the genus *Parus*, along with the data presented herein on the Verdin, further strengthen the current idea that the Verdin is not a parid. Keith Dixon (pers. comm.), in his studies (unpubl.) on the Mountain Chickadee (*Parus gambeli*) and the Black-capped Chickadee (*P. atricapillus*), found that not more than the four proximal secondaries are replaced, and in most individuals no remiges are dropped. Juvenal rectrices are invariably retained. In an earlier study on the Plain Titmouse (*P. inornatus*), Dixon (1962) found that rarely the outermost primaries and their coverts may be renewed.

SUMMARY

The molts of the Verdin were studied in 1965 and 1966. Most of the 43 immature and 18 adult Verdins examined were collected in the desert areas near Mesa and Tempe, Maricopa County, Arizona. The Verdin's postjuvenal molt is incomplete: no specimen examined showed the first (innermost), second and third primaries in molt. The appearance of the yellow head feathers initiates the postjuvenal molt, and occurs before the appearance of the chestnut-colored lesser wing coverts. However, these wing coverts complete their molt before the head molt is terminated. The postnuptial molt is complete. The sequence of loss and replacement of the remiges and rectrices in both immature and adult Verdins are similar. The postnuptial molt is initiated by loss of the first primary.

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STILL MORE RESPONSES OF THE POOR-WILL TO LOW TEMPERATURES

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Physiological responses of the Poor-will (*Phalaenoptilus nuttallii*) to low environmental temperatures have been studied by numerous workers since Jaeger's (1948) discovery of a torpid individual in southern California (Jaeger 1949; Brauner 1952; Marshall 1955; Bartholomew et al. 1957; Howell and Bartholomew 1959; Bartholomew et al. 1962; Lasiewski and Lasiewski 1967; Lasiewski et al. 1967; Austin and Bradley 1969). Recent studies have shown that the European Nightjar (*Caprimulgus europaeus*) possesses capabilities similar to those described for the Poor-will (Peiponen and Bosley 1964; Peiponen 1965a and b, 1966).

Despite the great interest in the responses of Poor-wills and other caprimulgids to low temperatures, pattern of weight loss over many days has not been investigated. Neither has spontaneous arousal from torpor at body and ambient temperatures below 15°C been demonstrated. These topics are considered in this report.

METHODS

A Poor-will captured on 26 September 1967 near Pocatello, Bannock County, Idaho, weighed 59.1 g. This appears to be the heaviest wild individual recorded (cf. Marshall 1955). This bird soon became tame and thoroughly habituated to its cardboard box container. It could readily be force fed quantities sufficient to cause large depositions of fat. Upon exposure to low ambient temperatures this Poor-