Molt Limits in North American Passerines

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ABSTRACT

"Molt limits," or the boundaries between replaced and retained wing feathers and rectrices during partial or incomplete molts, were investigated in 288 species of North American passerines through the examination of over 16,000 specimens. Thirty-six species showed evidence of complete first prebasic molts, including 27 species that did not have extensive prealternate molts (those including at least some greater coverts) and nine species that did have extensive prealternate molts. Of the remaining 252 species, 183 did not have extensive prealternate molts and 69 species did. Fifty-four species showed evidence of partial or incomplete replacement of primaries, during the first prebasic molt, the prealternate molt, or both, in at least a proportion of the populations. The replacement pattern of primaries was either "eccentric" (proceeding distally from the center of the primaries; 46 species), or "typical" (proceeding distally from the innermost primary; 8 species). In six species that showed an eccentric replacement pattern, a small proportion of individuals also showed the typical replacement pattern. Data on variation in the extent of greater-covert, secondary, rectrix, primary, and primary-covert replacement for each partial or incomplete molt in each species, references to previous detailed studies on molt, and notes on geographic variation, discrepancies between the results of this study and that of previous work, and other interesting cases, are presented.

INTRODUCTION

In most North American passerines, the first prebasic molt is "partial" or "incomplete," some but not all feathers being replaced (Pyle et al. 1987, Mulvihill 1993). Recently, Jenni and Winkler (1994) have illustrated the utility of "molt limits," the boundaries between replaced and retained feathers that result from partial molts, in ageing such passerines. Retained juvenal wing coverts and flight feathers are relatively worn and often show more subdued color patterns than adjacent, supplemental or first-basic feathers. Because adult (definitive) prebasic molts in virtually all North American passerines are complete (Pyle et al. 1987), the presence of molt limits indicates HY/SY (first-year) birds, at least until the prealternate molt, and often until the second prebasic molt (Mulvihill 1993, Jenni and Winkler 1994). Thus, molt limits can be especially useful for ageing North American passerines in winter and spring, after first-year birds have typically completed skull pneumatization. Patterns of replacement among the wing feathers vary substantially both among species and among individuals of the same species. This variation is very poorly documented for most North American species (see Mulvihill 1993). Additionally, some species undergo partial or incomplete prealternate molts in both HY/SY and AHY/ASY (adult) birds (Pyle et al. 1987, Mulvihill 1993). To use molt limits effectively, therefore, variation in the extent of replacement during the first prebasic molt, and the occurrence and extent of prealternate molts (especially in AHY/ASYs), must be known. To assess variation in the location of molt limits resulting from partial and incomplete, presupplemental, first prebasic, first prealternate, and adult prealternate molts of North American passerines, I examined over 16,000 specimens of 288 species. The results of this examination are presented here.

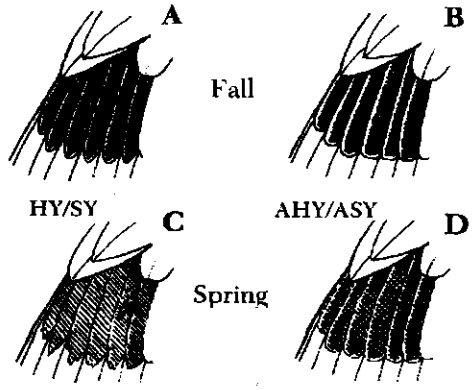
METHODS

Specimens examined for this study were located at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), Point Reyes Bird Observatory (PRBO), Natural History Museum of Los Angeles County (LACM), San Diego Natural History Museum (SDNHM), Moore Laboratory of Zoology (MLZ), and Western Foundation of Vertebrate Zoology (WFVZ). On

each specimen the wing coverts and flight feathers were studied carefully for evidence of partial or incomplete molts. The number of replaced wing coverts and flight feathers were recorded on all birds showing evidence of incomplete feather replacement, after active molting had ceased. Both wings were examined on each specimen to ensure that results were based on incomplete molts rather than adventitious replacement; specific data were taken from the right wing.

The age of each bird when it was collected was determined by information on the specimen labels, the presence of molt limits (assuming that adult prebasic molts are complete), and the color and amount of wear to the primary coverts (Figure 1), which typically are retained, at least in part, by birds undergoing incomplete molts (see below). Other plumage criteria (Pyle et al. 1987) were used where appropriate. Age terminology follows that of the Bird Banding Laboratory (Canadian Wildlife Service and U.S. Fish and Wildlife Service 1991). Terminology of molt, plumages, and feather generations follows Humphrey and Parkes (1959; see also Thompson and Leu 1994). Plumage characters, along with date and location of collection, were used to determine whether observed molt limits resulted from the presupplemental molt "PS" (Thompson and Leu 1994), the prebasic molt "PB", or the prealternate molt "PA".

Fig 1. Shape and relative condition of the primary coverts in HY/SY and AHY/ASY passerines, in fresh (fall) and worn (spring) condition. The contrast between these feathers and replaced greater coverts is very useful in ageing many species. Note that the edging on these feathers is often present but thinner in HY birds than in AHY birds in the fall, and it is often absent in SY birds but still present in ASY birds in the spring.



An attempt was made to sample at least 15-20 specimens for each molt within a species, from as wide a geographic range (within North America) as specimen material allowed. Although all collections were located in California, a significant proportion of specimens were collected from other localities throughout North America. Larger samples of specimens were examined for species showing wide geographic variation or complex incomplete molts, and smaller samples indicate fewer available specimens. Ranges in the number of feathers replaced, within each tract, are presented as mean ± twice the standard deviation. These ranges estimate what would be expected for 95% of the population, assuming a normal distribution to replacement patterns (Pyle 1997).

When the results of this examination contradicted those of other published or unpublished information (see the Tables for other references discussing molt in North American passerines), specimens were reexamined to either confirm or correct the original data of this study, before they were tabulated.

RESULTS AND DISCUSSION

Molt patterns in the 288 North American species examined could be categorized into several groups. In 27 species (9.4%), data indicated that replacement of wing coverts and flight feathers during both the first and adult prebasic molts was typically complete, and that the prealternate molts were either absent or limited, including no greater coverts or flight feathers. These species were: Northern Beardless-Tyrannulet (*Camptostoma imberbe*), the two species of wood-pewees, Alder Flycatcher (*Empidonax alnorum*), Horned Lark (*Eremophila alpestris*), the eight species of martins and swallows, Bushtit (*Psaltriparus minimus*), Wrentit (*Chamaea fasciata*), Grasshopper Sparrow (*Ammodramus savannarum*), nine species of blackbirds, grackles, and cowbirds (all North American species except Yellow-headed Blackbird), and the two species of meadowlarks. These species are not considered further in this paper. The other 261 species are listed in Table 1, along with data on the replacement of greater coverts, tertials/secondaries, and rectrices.

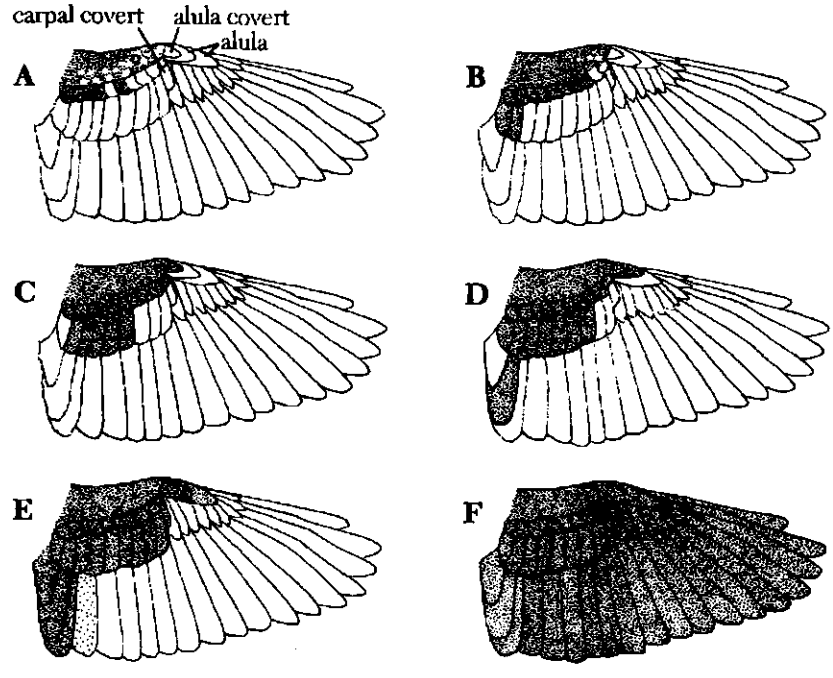
In nine species of passerines (the four species of *Myiarchus* flycatchers; Sulphur-bellied Flycatcher; Eastern Kingbird; and Bachman's, Botteri's and Cassin's sparrows), the first prebasic molt was complete or nearly so, and the first and adult prealternate molts included some flight feathers and/or greater coverts in at least some birds. In four of these species (the kingbird and the three sparrows), age of the bird subsequent to completion of the prebasic molt could not be determined, so data on the extent of the prealternate molt (in both age groups pooled) is given in Table 1. In Sulphur-bellied Flycatcher and the four species of *Myiarchus*, most or all juvenal primary coverts were retained through the second prebasic molt, allowing ageing of birds collected in spring and summer. For these, the extents of both the first and the adult prealternate molts are given (Table 1).

The remaining 252 species have partial or incomplete first prebasic molts. The extent of these varied from no greater coverts or flight feathers replaced (17 species) to most or all greater coverts, a variable number of secondaries and rectrices, and one or more primaries replaced in at least some birds (51 species; Table 2).

Of these 252 species, data indicated that 183 species (72.6%) either lack a prealternate molt or have a limited prealternate molt that does not include greater coverts or flight feathers in any birds. Just the extent of the first prebasic molt is summarized for these 183 species (Table 1). The remaining 69 species (27.4%) showed evidence of prealternate molts that included one or more greater coverts or flight feathers in at least some birds. For these species, the extent of the first prebasic molt (1st PB), the first prealternate molt (1st PA), and the adult prealternate molt (adult PA) are summarized (Table 1).

Finally, the extent of the presupplemental molts (PS) of six species could be determined, those in which this molt does not overlap in timing or location, at the populations level, with the first prebasic molt (Thompson and Leu 1994). In four other species that have presupplemental molts (Northern Cardinal, Pyrrhuloxia, Yellow-breasted Chat, and Lark Sparrow) (Thompson and Leu 1994, Pyle unpublished data), the period in which greater coverts or flight feathers were replaced could not be determined, and these two molts are combined in Table 1 (as "PS/PB").

Fig. 2. Variation in the extent of wing covert and tertial replacement during partial molts. HY/SYs of many North American passerines will show molt limits similar to those in illustrations **A** to **E**, although exceptions to this pattern of replacement are to be expected. Most AHY/ASY passerines show uniform replacement (**F**), at least until the prealternate molt, when some AHY/ASYs undergo a partial molt resulting in molt limits as in **A-E** (see Table 1).



Molt limits resulting from partial or incomplete, first prebasic molts - The sequence and extent of wing-covert and tertial replacement generally follow similar patterns among North American passerines, although numerous exceptions, both within and among species, can be expected. Molt of the wing coverts typically begins with the proximal lesser coverts, and proceeds distally and toward the greater coverts (Jenni and Winkler 1994, Figure 2). Thus, it usually commences with the inner lesser and median coverts (Figure 2A). Often, when about half of the lesser coverts have been replaced, molt of the median coverts commences (Figure 2A); when about half of the median coverts have been replaced, molt of the greater coverts commences (Figure 2B); and when about half of the greater coverts have been replaced, molt of the tertials commences (Figure 2D); however, the relative timing of feather replacement in these feather tracts can vary substantially.

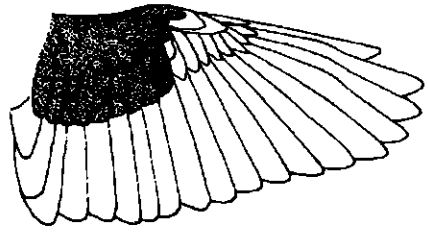
Replacement of the greater coverts usually proceeds proximally (Figure 2B-E), although irregular sequences and skipped feathers, particularly involving the innermost covert (Figure 2C) often are encountered (Jenni and Winkler 1994).The alula covert is often replaced when molt of the median coverts has been completed, and the carpal covert and alula feathers often are not replaced until molt of the greater coverts has been completed (Figure 2C-E). Partial wing feather molts can suspend at any point during this replacement process, and variation in the point of suspension, sometimes substantial, occurs within each species (Table 1). In a few birds of some species, s6 and occasionally s5 can be replaced after all three tertials have been renewed (Figure 2E).

In many species, the central rectrices can be replaced if and when the tertials are replaced. In a few species, the central rectrices are replaced but the tertials are retained. In some species additional rectrices can be renewed during incomplete molts. These often are replaced from the central pair outwards, although in many individuals the outermost pair may be replaced immediately following the central pair. In many species of passerines, particularly among the vireos, warblers, and sparrows, all lesser, median, and greater coverts but no tertials, rectrices, or other flight feathers are replaced (Figure 3).

Note that the primary coverts are retained in all of these examples of partial molt (Figures 2 and 3).

By comparing the typical replacement sequences and extents of Figure 2 with information on variation in the extent of the first prebasic molts of each species in Table 1, molt limits can be looked for and used to age many HY/SY birds through at least the prealternate molt. Individuals of all North American passerines in fall and winter (except for a few species which may suspend the adult prebasic molt for migration, such as Red-eyed Vireo; see Mulvihill & Rimmer 1997), not in active molt, that show molt limits (Figure 2A-E and Figure 3) are HY/SYs. AHY/ASYs typically show wing coverts which are uniform in color, wear, and size (Figure 2F), at least until the prealternate molt.

Fig. 3. Many vireos, warblers, and sparrows show a slight variation to the general pattern of replacement shown in Fig. 2, replacing all wing coverts but no (sometimes 1-2) alula feathers or flight feathers (see Table 1).

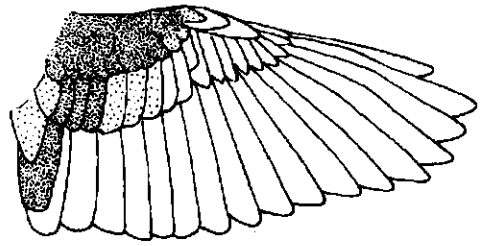


In some species "pseudolimits" occur (See Table 1 and Notes 2 and 3, following the tables). These are natural contrasts in color pattern between adjacent feathers, that can simulate molt limits. In *Zonotrichia* sparrows, for instance, the innermost two or three greater coverts and the tertials are a darker or richer brown than adjacent, distal feathers, in both HY/SYs and AHY/ASYs. With these species, care must be taken to distinguish between pseudolimits and true molt limits; it is best to carefully examine the extent of wear to the tips of these feathers to determine if one or more generation of feathers is involved. Jenni and Winkler (1994) provide more information, accompanied by numerous illustrations, on pseudolimits and the process of ageing passerines using molt limits.

Molt limits resulting from partial or incomplete, prealternate molts - Most North American passerines do not have prealternate molts that include greater coverts or tertials, but in those that do, the feather replacement sequence typically is similar to that of prebasic molts, as illustrated in Figure 2. In most species, partial prealternate molts occur in both SYs and ASYs, although the extent of this molt in ASYs usually is less than that of SYs (Table 1). In 14 of the 75 species listed in Table 1 with first and adult prealternate molts, no ASY specimens were found with replaced greater coverts or flight feathers. These included species with extensive first prealternate molts (several flycatcher species), and species in which the first prealternate molt included only a few inner greater coverts at most (several warbler species). One species, the Bobolink, showed complete or nearly complete prealternate molts in both SYs and ASYs. In some species, the tertials and/or central rectrices could be replaced during prealternate molts, that otherwise included few if any wing coverts (see Table 1).

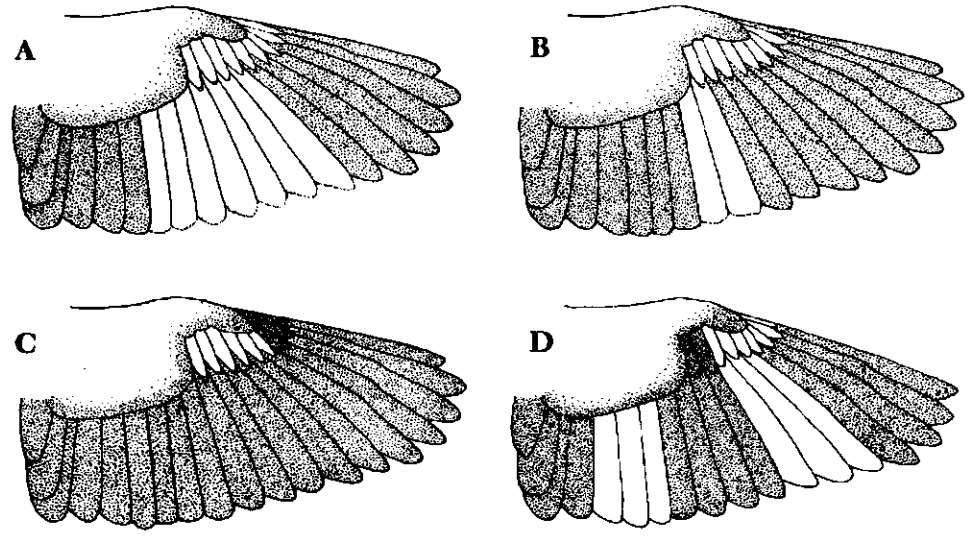
Care must be taken when ageing these species in spring and summer, as both SYs and ASYs can show molt limits. Many SYs of certain species (those with more extensive first prebasic than first prealternate molts) can show three generations of feathers in the wing or tail: juvenal feathers, first-basic feathers, and first-alternate feathers (Figure 4). These individuals can be aged SY. Otherwise, the relative contrast between retained and replaced feathers is the best means of distinguishing the age groups, this contrast being much greater between juvenal and first-alternate feathers than between adult-basic and adult-alternate feathers (see Mulvihill 1993, Jenni and Winkler 1994). Contrasts involving the juvenal primary coverts, which are retained completely or partially by most HY/SY North American passerines (see below), often provide the best means of distinguishing SYs and ASYs in the spring and summer (Figure 1).

Fig. 4. An example of an SY bird with three generations of feathers, juvenal (white), first basic (lightly stippled), and first alternate (dark) feathers, after partial first prebasic and first prealternate molts. ASY birds that have partial prealternate molts will show only two generations of feathers, as in Fig.2.



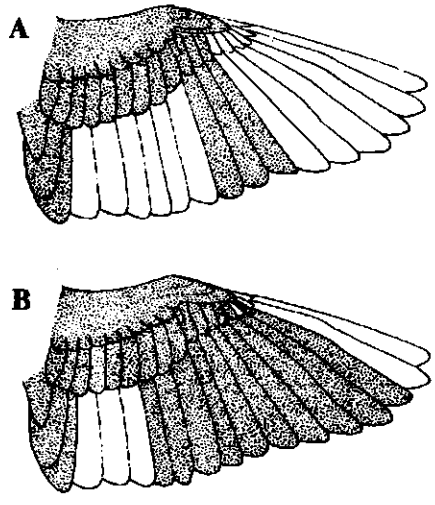
Species that replace at least some primaries during incomplete molts - Fifty-four species of North American passerines were found in which at least a proportion of individuals regularly replaced some but not all primaries during incomplete molts (Table 2). Several replacement strategies were noted among these species. The majority (46 species, or 88.5%) showed "eccentric" replacement patterns (Figure 5), in which the outer primaries, inner secondaries and, sometimes, the outermost primary coverts are replaced (Jenni and Winkler 1994, Pyle in review). In 38 species, eccentric patterns were observed during the first prebasic molt only. In two species (Yellow-bellied and Willow flycatchers) it occurred only during the first prealternate molt; and in four species of kingbirds, replacement of primaries began during the first prebasic molt, suspended over winter, and resumed during the first prealternate molt (along with a second replacement of body feathers; see Pyle in review). In one species (Nelson's Sharp-tailed Sparrow), eccentric replacement patterns were observed during both the first and the adult prealternate molts but not during the first prebasic molt. Interestingly, no replaced primaries were found in spring or summer Saltmarsh Sharp-tailed Sparrows (Table 1), which have recently been split from Nelson's (American Ornithologist's Union 1995). Finally, in one species (Lesser Goldfinch; see Notes following the tables), eccentric replacement patterns were noted during the first prebasic molt of all forms, and during the first and the adult prealternate molts of the "black-backed" form but not the "green-backed" form. Other examples of geographic variation in molt extent are discussed in the notes following the tables. If not specifically noted, species did not show marked geographic variation in molt extent.

Fig. 5. Eccentric molt patterns in North American passerines. Most species show a pattern similar to that of illustration **A**, although some flycatchers can show more extensive eccentric replacement, as in illustrations **B** and **C**. A few species can show both an eccentric and a typical pattern, as in illustration **D** (see Table 2).



Eight species showed primary and secondary replacement in "typical" sequence (Figure 6), the primaries commencing from the innermost and proceeding distally, and the secondaries (after replacement of the tertials) commencing with the outermost and proceeding proximally. In these cases, primary coverts typically were replaced with their corresponding primaries, although one or two coverts often were retained despite the replacement of the adjacent primary (Figure 6B). The typical remex replacement sequence was observed during the first prebasic molt only.

Fig. 6. Examples of flight feather replacement in typical sequence (as in complete molts), found during incomplete molts in eight species of North American passerines (see Table 2).



Six species that showed eccentric molt patterns also replaced up to three inner primaries and three outer secondaries, in typical sequence (Figure 5D). In these species (Table 2), only small proportions of birds (5-16%) showing eccentric replacement also had replaced feathers in typical sequence. Finally, one species (Green Jay) showed an irregular sequence, replacement of the secondaries proceeding distally from the tertials, followed by replacement of the primaries, proceeding distally from the innermost feather.

Table 2 summarizes the type of replacement pattern and extent of molts in species which showed incomplete replacement of the primaries and primary coverts. As with molt limits among wing coverts, the limits among the flight feathers of these species are helpful in distinguishing HY/SYs from HY/ASYs (Mulvihill 1993, Jenni and Winkler 1994), in most cases through the second prebasic molt.

A call to banders: more study is needed - The information presented in Tables 1 and 2 should be used as a starting point toward a more complete understanding of molt limits and their use in ageing North American passerines. Detection of molt limits on specimens often is difficult (see Note 1 following the tables), in part because the wings cannot be examined freely without risking damage to the specimens. For instance, in several species, the original results of this study contradicted that of

other detailed examinations based on either specimens or live birds (see the notes following the tables). In a few of these examples, reexamination indicated that the initial results of this study were in error. Certainly, other errors exist within Tables 1 and 2 which will need to be corrected by future workers. In addition, replacement patterns of the carpal covert, alula covert, and greater and lesser alula feathers (see Figure 2), not covered specifically by this study, should be examined more fully (Mulvihill 1993).

Molt limits are much easier to detect on live birds in the hand than they are on specimens. The ability to open a bird's wing to examine the feathers, and the fact that the feathers are in better relative shape on live birds than on specimens, should allow banders to readily detect molt limits in most species. (A few species, such as House Wren and Common Yellowthroat, will always present difficulties, even on live birds in the hand). I strongly urge banders to start looking for molt limits when ageing North American passerines and to publish their information, whether it substantiates or contradicts the results of this study.

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Table 1. Range of variation in numbers of greater coverts, tertials, secondaries, and rectrices replaced during partial molts in North American passerines. Molting periods include the presupplemental molt (PS), the first prebasic molt (1st PB) and the prealternate molt (PA), the latter in both first-year birds and adults. Percentages (e.g., "%0") represent the percentage of the sample (n) that replaced that many feathers (0) during partial molts. Ranges represent mean ± twice the standard deviation rather than true ranges, to exclude anomalous individuals and to estimate the range encompassing 95% of the population. The sequence of replacement of greater coverts and tertials/inner secondaries generally follows that illustrated in Figures 2 and 3, and replacement of the rectrices follows the sequence outlined in the text. When more than four tertials and secondaries are replaced the sequence follows that of one of several replacement patterns (see text), as noted in Table 2. A number in the "Notes" column refers to detailed, published information (as numbered in the Literature Cited and References section) that discuss molt in North American passerines. Other references under "Notes" refer to information presented in the section following the Tables.

			Greater coverts			Tertials & Secondaries		Rectrices			
Species	Molt	n	%0	range	%10	%0	range	%0	range	%12	Notes
OLIVE-SIDED FLYCATCHER	1st PB	16	0	8-10	88	0	3-6	0	12-12	100	53
Contopus borealis											See Table 2
GREATER PEWEE	1st PB	9	56	0-7	0	100	0-0	100	0-0	0	53
Contopus pertinax											
YELLOW-BELLIED FLYCATCHER	1st PB	9	22	0-7	0	11	0-3	100	0-0	0	21, 26, 53
Empidonax flaviventris	1st PA	12	0	10-10	100	0	3-9	0	12-12	100	See Table 2
	ad PA	13	0	2-7	0	0	1-3	100	0-0	0	
ACADIAN FLYCATCHER	1st PB	17	100	0-0	0	100	0-0	100	0-0	0	21, 26, 71
Empidonax virescens	1st PA	18	22	0-7	0	17	0-4	100	0-0	0	
	ad PA	22	73	0-2	0	72	0-3	100	0-0	0	
WILLOW FLYCATCHER	1st PB	10	100	0-0	0	100	0-0	100	0-0	0	53
Empidonax traillii	1st PA	37	0	10-10	100	0	3-9	0	12-12	100	See Table 2
	ad PA	15	100	0-0	0	100	0-0	100	0-0	0	
LEAST FLYCATCHER	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	19, 21
Empidonax minimus	1st PA	27	0	3-9	0	7	0-4	44	0-12	11	
	ad PA	11	0	2-10	8	0	1-3	78	0-2	0	
HAMMOND'S FLYCATCHER	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	21
Empidonax hammondii	1st PA	26	23	0-5	0	81	0-2	100	0-0	0	
	ad PA	15	7	0-7	0	27	0-3	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
DUSKY FLYCATCHER	1st PB	18	15	0-5	0	23	0-3	100	0-0	0	21
Empidonax oberholseri	1st PA	30	10	0-6	0	17	0-3	93	0-2	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
GRAY FLYCATCHER	1st PB	12	0	3-7	0	8	0-3	83	0-2	0	21
Empidonax wrightii	1st PA	22	9	0-6	0	5	0-4	64	0-2	0	
	ad PA	16	63	0-5	0	50	0-4	100	0-0	0	
PACIFIC-SLOPE FLYCATCHER	1st PB	49	40	0-5	0	72	0-4	100	0-0	0	22
Empidonax difficilis	1st PA	20	40	0-5	0	20	0-2	0	0-0	0	
	ad PA	20	65	0-3	0	65	0-3	100	0-0	0	
CORDILLERAN FLYCATCHER	1st PB	14	7	0-8	0	7	0-5	100	0-0	0	22
Empidonax occidentalis	1st PA	14	50	0-7	0	42	0-3	14	0-2	0	
	ad PA	20	75	0-3	0	75	0-3	100	0-0	0	
BUFF-BREASTED FLYCATCHER	1st PB	9	44	0-3	0	100	0-0	100	0-0	0	
Empidonax fulvifrons											
BLACK PHEOBE	1st PB	22	0	4-10	14	14	0-3	46	0-5	0	
Sayornis nigricans											
EASTERN PHOEBE	1st PB	17	0	4-10	18	18	0-3	36	0-2	0	See Notes
Sayornis phoebe											
SAY'S PHOEBE	1st PB	24	0	5-10	4	33	0-3	100	0-0	0	
Sayornis saya											
VERMILION FLYCATCHER	1st PB	82	0	10-10	100	0	3-9	0	12-12	100	53
Pyrocephalus rubinus											See Table 2
DUSKY-CAPPED FLYCATCHER	1st PA	12	100	0-0	0	67	0-2	100	0-0	0	See text
Myiarchus tuberculifer	ad PA	18	100	0-0	0	94	0-1	100	0-0	0	
ASH-THROATED FLYCATCHER	1st PA	24	67	0-3	0	42	0-3	100	0-0	0	See text
Myiarchus cinerascens	ad PA	26	77	0-3	0	77	0-2	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
GREAT CRESTED FLYCATCHER	1st PA	14	35	0-3	0	0	2-3	100	0-0	0	See text
Myiarchus crinitus	ad PA	22	35	0-4	0	0	1-3	100	0-0	0	
BROWN-CRESTED FLYCATCHER	1st PA	17	82	0-4	0	35	0-4	100	0-0	0	See text
Myiarchus tyrannulus	ad PA	18	33	0-5	0	100	0-0	100	0-0	0	
GREAT KISKADEE	1st PB	18	61	0-3	0	100	0-0	100	0-0	0	
Pitangus sulphuratus		20								0	
		20								0	
SULPHUR-BELLIED FLYCATCHER	1st PA	12	100	0-0	0	50	0-3	100	0-0	0	See text
Myiodynastes luteiventris	ad PA	14	100	0-0	0	100	0-0	100	0-0	0	
TROPICAL KINGBIRD	1st PB	12	0	3-10	25	0	1-6	0	1-4	0	53
Tyrannus melancholicus	1st PA	13	23	0-6	0	0	4-7	0	4-12	17	See Table 2
	ad PA	14	28	0-4	0	86	0-2	100	0-0	0	See Notes
COUCH'S KINGBIRD	1st PB	8	0	2-5	0	0	2-4	37	0-2	0	
Tyrannus couchii	1st PA	6	33	0-4	0	17	0-4	33	0-2	0	
	ad PA	7	43	0-2	0	86	0-1	100	0-0	0	
CASSIN'S KINGBIRD	1st PB	15	27	0-4	0	33	0-3	80	0-2	0	53
Tyrannus vociferans	1st PA	18	39	0-5	0	22	0-5	94	0-2	0	See Table 2
	ad PA	15	27	0-4	0	53	0-2	100	0-0	0	
THICK-BILLED KINGBIRD	1st PB	17	29	1-6	0	53	0-3	94	0-2	0	53
Tyrannus crassirostris	1st PA	8	13	0-4	0	0	1-4	87	0-2	0	
	ad PA	12	67	0-2	0	67	0-1	100	0-0	0	
WESTERN KINGBIRD	1st PB	27	0	8-10	85	0	1-4	30	0-5	0	53
Tyrannus verticalis	1st PA	48	25	0-4	0	0	1-6	42	0-2	0	See Table 2
	ad PA	39	39	0-3	0	28	0-2	100	0-0	0	
EASTERN KINGBIRD	PA	20	25	0-4	0	15	0-3	100	0-0	0	See text
Tyrannus tyrannus											

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
SCISSOR-TAILED FLYCATCHER	1st PB	21	0	2-10	27	5	0-5	73	0-4	0	53
Tyrannus forficatus	1st PA	17	18	0-7	0	0	1-4	41	0-4	0	See Table 2
	ad PA	32	50	0-3	0	35	0-2	100	0-0	0	
ROSE-THROATED BECARD	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	
Pachyramphus aglaiae	1st PA	18	56	0-2	0	87	0-4	87	0-2	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
GRAY JAY	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	See Note 1
Perisoreus canadensis											
STELLER'S JAY	1st PB	39	8	0-9	0	82	0-2	90	0-2	0	50
Cyanocitta stelleri											
BLUE JAY	1st PB	20	0	4-10	20	10	0-4	50	0-2	0	2, 82
Cyanocitta cristata											
GREEN JAY	1st PB	10	0	7-10	90	30	0-9	10	0-5	0	See Table 2
Cyanocorax yncas											
BROWN JAY	1st PB	13	15	0-4	0	100	0-0	100	0-0	0	
Cyanocorax morio											
FLORIDA SCRUB-JAY	1st PB	6	0	9-10	67	0	2-3	0	2-2	0	2, 49
Aphelocoma coerulescens											
ISLAND SCRUB-JAY	1st PB	13	0	7-10	8	100	0-0	100	0-0	0	49
Aphelocoma insularis											
WESTERN SCRUB-JAY	1st PB	42	0	3-9	0	93	0-2	100	0-0	0	49
Aphelocoma californica											
MEXICAN JAY	1st PB	21	0	2-9	0	95	0-1	100	0-0	0	49
Aphelocoma ultramarina											
PINYON JAY	1st PB	19	32	0-8	0	89	0-2	100	0-0	0	24
Gymnorhinus cyanocephalus											

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
CLARK'S NUTCRACKER *Nucifraga columbiana*	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	27
BLACK-BILLED MAGPIE *Pica pica*	1st PB	20	0	5-10	40	80	0-2	100	0-0	0	
YELLOW-BILLED MAGPIE *Pica nuttalli*	1st PB	22	0	5-10	45	73	0-2	91	0-1	0	
AMERICAN CROW *Corvus brachyrhynchos*	1st PB	34	24	0-3	0	100	0-0	100	0-0	0	13
NORTHWESTERN CROW *Corvus caurinus*	1st PB	9	67	0-2	0	100	0-0	100	0-0	0	
FISH CROW *Corvus ossifragus*	1st PB	6	17	0-3	0	100	0-0	100	0-0	0	
CHIHUAHUAN RAVEN *Corvus cryptoleucus*	1st PB	6	0	1-3	0	100	0-0	100	0-0	0	
COMMON RAVEN *Corvus corax*	1st PB	13	54	0-2	0	100	0-0	100	0-0	0	
BLACK-CAPPED CHICKADEE *Parus atricapillus*	1st PB	26	0	6-10	54	92	0-2	100	0-0	0	
CAROLINA CHICKADEE *Parus carolinensis*	1st PB	18	0	6-10	67	78	0-2	72	0-4	0	
MEXICAN CHICKADEE *Parus sclateri*	1st PB	11	72	0-3	0	100	0-0	100	0-0	0	
MOUNTAIN CHICKADEE *Parus gambeli*	1st PB	28	0	4-10	36	96	0-2	93	0-2	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
SIBERIAN TIT *Parus cinctus*	1st PB	6	0	4-8	0	100	0-0	100	0-0	0	
BOREAL CHICKADEE *Parus hudsonicus*	1st PB	13	0	7-10	31	100	0-0	100	0-0	0	6
CHESTNUT-BACKED CHICKADEE *Parus rufescens*	1st PB	49	0	6-10	22	100	0-0	100	0-0	0	
BRIDLED TITMOUSE *Parus wollweberi*	1st PB	18	0	4-10	50	44	0-3	50	0-12	6	
PLAIN TITMOUSE *Parus inornatus*	1st PB	19	0	8-10	84	11	0-5	11	0-12	89	12; See Notes See Table 2
TUFTED TITMOUSE *Parus bicolor*	1st PB	16	0	8-10	75	25	0-4	0	12-12	100	See Table 2 See Notes
VERDIN *Auriparus flaviceps*	1st PB	20	0	10-10	100	0	4-6	0	12-12	100	66; See Notes See Table 2
RED-BREASTED NUTHATCH *Sitta canadensis*	1st PB	33	100	0-0	0	100	0-0	100	0-0	0	51
WHITE-BREASTED NUTHATCH *Sitta carolinensis*	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	See Note 3
PYGMY NUTHATCH *Sitta pygmaea*	1st PB	28	100	0-0	0	100	0-0	100	0-0	0	43
BROWN-HEADED NUTHATCH *Sitta pusilla*	1st PB	30	67	0-3	0	57	0-3	100	0-0	0	43
BROWN CREEPER *Certhia americana*	1st PB	25	100	0-0	0	100	0-0	0	12-12	100	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
CACTUS WREN	1st PB	23	0	7-10	87	8	0-8	0	2-12	83	63
Campylorhynchus brunneicapillus											See Table 2
ROCK WREN	1st PB	53	0	8-10	62	4	0-7	83	0-2	0	See Table 2
Salpinctes obsoletus											See Note 3
											See Notes
CANYON WREN	1st PB	24	0	2-10	8	8	0-3	100	0-0	0	
Catherpes mexicanus											
CAROLINA WREN	1st PB	15	0	4-10	47	13	0-5	53	0-12	40	See Table 2
Thryothorus ludovicianus											See Notes
BEWICK'S WREN	1st PB	32	0	6-10	91	0	1-6	13	0-12	28	See Table 2
Thryomanes bewickii											See Note 1
											See Notes
HOUSE WREN	1st PB	30	0	3-10	7	7	0-4	80	0-2	0	See Table 2
Troglodytes aedon											See Note 1
											See Notes
WINTER WREN	1st PB	24	0	4-10	13	8	0-4	8	0-2	0	See Note 1
Troglodytes troglodytes											
SEDGE WREN	1st PB	13	0	7-10	85	8	0-6	58	0-12	8	See Table 2
Cistothorus platensis	1st PA	12	0	2-8	0	0	1-3	33	0-12	8	See Note 3
	ad PA	11	0	3-9	0	0	2-4	9	0-12	27	See Notes
MARSH WREN	1st PB	34	0	5-10	15	0	1-6	0	12-12	100	23, 73; See Notes
Cistothorus palustris	1st PA	20	0	4-10	15	5	0-3	40	0-12	15	See Table 2
	ad PA	27	0	5-10	30	0	1-4	9	0-12	45	See Note 3
AMERICAN DIPPER	1st PB	24	0	2-6	0	79	0-2	100	0-0	0	See Notes
Cinclus mexicanus											
GOLDEN-CROWNED KINGLET	1st PB	22	59	0-4	0	100	0-0	100	0-0	0	
Regulus satrapa											

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
RUBY-CROWNED KINGLET *Regulus calendula*	1st PB	17	88	0-3	0	100	0-0	100	0-0	0	
BLUE-GRAY GNATCATCHER	1st PB	28	0	5-10	71	18	0-4	86	0-12	7	56
Polioptila caerulea	1st PA	19	89	0-3	0	47	0-4	79	0-4	0	See Notes
	ad PA	18	61	0-3	0	39	0-2	100	0-0	0	
CALIFORNIA GNATCATCHER	1st PB	20	0	8-10	75	5	0-5	40	0-12	15	56
Polioptila californica	1st PA	20	75	0-3	0	35	0-4	80	0-2	0	See Notes
	ad PA	16	50	0-3	0	50	0-2	100	0-0	0	
BLACK-TAILED GNATCATCHER	1st PB	16	0	10-10	100	0	1-5	13	0-12	13	56
Polioptila melanura	1st PA	11	100	0-0	0	64	0-2	82	0-2	0	See Notes
	ad PA	12	58	0-3	0	75	0-3	100	0-0	0	
EASTERN BLUEBIRD *Sialia sialis*	1st PB	26	0	3-10	27	50	0-5	50	0-12	31	
WESTERN BLUEBIRD *Sialia mexicana*	1st PB	30	0	2-10	10	83	0-4	77	0-12	10	
MOUNTAIN BLUEBIRD *Sialia currucoides*	1st PB	28	0	1-8	0	100	0-0	96	0-2	0	
TOWNSEND'S SOLITAIRE *Myadestes townsendi*	1st PB	29	31	0-8	0	97	0-1	93	0-4	0	See Note 1
VEERY *Catharus fuscescens*	1st PB	21	10	0-5	0	100	0-0	100	0-0	0	8 See Notes
GRAY-CHEEKED THRUSH *Catharus minimus*	1st PB	19	11	0-5	0	100	0-0	100	0-0	0	8 See Notes
BICKNELL'S THRUSH *Catharus bicknelli*	1st PB	8	13	0-4	0	100	0-0	100	0-0	0	8 See Notes

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
SWAINSON'S THRUSH *Catharus ustulatus*	1st PB	24	4	0-5	0	100	0-0	100	0-0	0	5, 8 See Notes
HERMIT THRUSH *Catharus guttatus*	1st PB	53	28	0-4	0	100	0-0	100	0-0	0	8 See Notes
WOOD THRUSH *Hylocichla mustelina*	1st PB	16	50	0-4	0	100	0-0	100	0-0	0	8, 44
CLAY-COLORED ROBIN *Turdus grayi*	1st PB	17	0	2-10	6	94	0-2	100	0-0	0	
AMERICAN ROBIN *Turdus migratorius*	1st PB	34	12	0-9	0	76	0-2	100	0-0	0	8
VARIED THRUSH *Ixoreus naevius*	1st PB	30	7	0-5	0	93	0-1	100	0-0	0	8
GRAY CATBIRD *Dumetella carolinensis*	1st PB	26	4	0-10	12	19	0-2	90	0-2	0	8
NORTHERN MOCKINGBIRD *Mimus polyglottos*	1st PB	26	0	8-10	77	4	0-8	46	0-12	27	32 See Table 2
SAGE THRASHER *Oreoscoptes montanus*	1st PB	20	0	1-7	0	65	0-3	95	0-2	0	See Note 1
BROWN THRASHER *Toxostoma rufum*	1st PB	18	0	2-9	0	22	0-3	100	0-0	0	8; See Notes See Note 2
LONG-BILLED THRASHER *Toxostoma longirostre*	1st PB	6	0	6-10	33	33	0-4	100	0-0	0	See Note 2 See Notes
BENDIRE'S THRASHER *Toxostoma bendirei*	1st PB	8	0	2-10	38	25	0-6	75	0-12	25	See Table 2 See Note 1

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
CURVE-BILLED THRASHER *Toxostoma curvirostre*	1st PB	16	0	3-10	63	25	0-5	19	0-12	50	See Table 2 See Notes
CALIFORNIA THRASHER *Toxostoma redivivum*	1st PB	21	0	4-10	19	33	0-3	71	0-8	0	See Note 1 See Note 2
CRISSAL THRASHER *Toxostoma crissale*	1st PB	13	0	9-10	92	0	2-7	15	0-12	85	See Table 2
LE CONTE'S THRASHER *Toxostoma lecontei*	1st PB	18	0	8-10	61	0	1-5	77	0-12	11	See Table 2
AMERICAN PIPIT	1st PB	20	55	0-4	0	100	1-2	100	0-0	0	
Anthus rubescens	1st PA	13	23	0-4	0	15	0-3	38	0-2	0	
	ad PA	15	13	0-4	0	0	1-3	27	0-2	0	
SPRAGUE'S PIPIT	1st PB	5	0	5-10	20	20	0-4	100	0-0	0	
Anthus spragueii	1st PA	4	25	0-3-	0	25	0-3	75	0-2	0	
	ad PA	6	0	3-5	0	0	2-3	33	0-2	0	
BOHEMIAN WAXWING *Bombycilla garrulus*	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	See Note 1
CEDAR WAXWING *Bombycilla cedrorum*	1st PB	20	100	0-0	0	100	0-0	100	0-0	0	See Note 1
PHAINOPEPLA	PS	14	64	0-3	0	100	0-0	100	0-0	0	35, 69
Phainopepla nitens	1st PB	30	0	2-10	57	17	0-9	23	0-12	40	See Table 2 See Note 4
NORTHERN SHRIKE *Lanius excubitor*	1st PB	24	8	0-10	29	83	0-3	100	0-0	0	
LOGGERHEAD SHRIKE *Lanius ludovicianus*	1st PB	30	0	7-10	77	7	0-5	13	0-12	73	34 See Table 2

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
WHITE-EYED VIREO *Vireo griseus*	1st PB	12	0	8-10	75	0	1-5	33	0-12	67	16, 25, 67 See Table 2
BELL'S VIREO *Vireo bellii*	1st PB	26	0	8-10	85	19	0-5	54	0-12	38	See Table 2
BLACK-CAPPED VIREO *Vireo atricapillus*	1st PB	6	0	9-10	83	0	1-4	100	0-0	0	
	1st PA	7	71	0-2	0	0	1-3	86	0-2	0	
	ad PA	4	25	0-5	0	25	0-3	75	0-2	0	
GRAY VIREO *Vireo vicinior*	1st PB	4	0	4-10	50	0	1-4	50	0-12	50	
	1st PA	15	33	0-3	0	27	0-2	87	0-2	0	
	ad PA	4	100	0-0	0	100	0-0	100	0-0	0	
SOLITARY VIREO *Vireo solitarius*	1st PB	27	0	9-10	93	100	0-0	100	0-0	0	
	1st PA	31	84	0-2	0	58	0-3	100	0-0	0	
	ad PA	39	90	0-2	0	62	0-2	100	0-0	0	
YELLOW-THROATED VIREO *Vireo flavifrons*	1st PB	20	0	9-10	95	100	0-0	100	0-0	0	9
	1st PA	15	40	0-4	0	0	2-3	100	0-0	0	
	ad PA	14	64	0-3	0	36	0-3	100	0-0	0	
HUTTON'S VIREO *Vireo huttoni*	1st PB	30	0	7-10	40	87	0-1	100	0-0	0	
WARBLING VIREO *Vireo gilvus*	1st PB	30	0	9-10	93	100	0-0	100	0-0	0	
PHILADELPHIA VIREO *Vireo philadelphicus*	1st PB	12	0	10-10	100	100	0-0	100	0-0	0	9
RED-EYED VIREO *Vireo olivaceus*	1st PB	14	0	8-10	93	100	0-0	100	0-0	0	9, 39 See Notes
BACHMAN'S WARBLER *Vermivora bachmanii*	1st PB	9	0	8-10	67	100	0-0	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
BLUE-WINGED WARBLER *Vermivora pinus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
GOLDEN-WINGED WARBLER *Vermivora chrysoptera*	1st PB	17	0	10-10	100	100	0-0	100	0-0	0	10
TENNESSEE WARBLER *Vermivora peregrina*	1st PB	19	0	10-10	100	100	0-0	100	0-0	0	10
ORANGE-CROWNED WARBLER *Vermivora celata*	1st PB	20	0	10-10	100	95	0-2	90	0-2	0	15 See Notes
NASHVILLE WARBLER *Vermivora ruficapilla*	1st PB	20	0	7-10	95	90	0-2	85	0-2	0	
VIRGINIA'S WARBLER *Vermivora virginiae*	1st PB	22	0	9-10	91	86	0-3	86	0-2	0	
COLIMA WARBLER *Vermivora crissalis*	1st PB	3	0	10-10	100	100	0-0	100	0-0	0	
LUCY'S WARBLER *Vermivora luciae*	1st PB	20	0	10-10	100	80	0-3	80	0-2	0	
NORTHERN PARULA *Parula americana*	1st PB	24	0	9-10	92	96	0-1	100	0-0	0	10
TROPICAL PARULA *Parula pitiayumi*	1st PB	17	0	10-10	100	100	0-0	100	0-0	0	
YELLOW WARBLER	1st PB	35	0	3-10	89	23	0-3	100	0-0	0	10
Dendroica petechia	1st PA	23	0	3-10	22	13	0-5	100	0-0	0	
	ad PA	25	0	8-10	88	0	2-3	100	0-0	0	
CHESTNUT-SIDED WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10
Dendroica pensylvanica	1st PA	17	0	3-10	18	94	0-1	100	0-0	0	
	ad PA	19	0	5-10	37	84	0-1	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
MAGNOLIA WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica magnolia	1st PA	18	0	3-9	0	94	0-1	100	0-0	0	
	ad PA	20	0	4-10	25	80	0-1	100	0-0	0	
CAPE MAY WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10
Dendroica tigrina											See Notes
BLACK-THROATED BLUE WARBLER	1st PB	31	0	8-10	90	97	0-2	100	0-0	0	10
Dendroica caerulescens											
YELLOW-RUMPED WARBLER	1st PB	50	0	7-10	96	100	0-0	100	0-0	0	10, 17
Dendroica coronata	1st PA	50	8	0-9	0	100	0-0	100	0-0	0	
	ad PA	50	6	0-10	18	100	0-0	100	0-0	0	
BLACK-THROATED GRAY WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica nigrescens											
TOWNSEND'S WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica townsendi											
HERMIT WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica occidentalis											
BLACK-THROATED GREEN WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica virens											
GOLDEN-CHEEKED WARBLER	1st PB	12	0	10-10	100	100	0-0	100	0-0	0	
Dendroica chrysoparia											
BLACKBURNIAN WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10
Dendroica fusca	1st PA	18	0	6-10	61	78	0-2	100	0-0	0	
	ad PA	20	0	9-10	90	70	0-2	100	0-0	0	
YELLOW-THROATED WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica dominica											

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
GRACE'S WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica graciae											
PINE WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	42
Dendroica pinus											See Notes
KIRTLAND'S WARBLER	1st PB	6	0	10-10	100	100	0-0	100	0-0	0	
Dendroica kirtlandii											
PRAIRIE WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica discolor											
PALM WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 1
Dendroica palmarum											
BAY-BREASTED WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Dendroica castanea	1st PA	14	0	3-10	29	100	0-0	100	0-0	0	
	ad PA	19	0	8-10	89	100	0-0	100	0-0	0	
BLACKPOLL WARBLER	1st PB	20	0	10-10	100	75	0-3	100	0-0	0	10
Dendroica striata	1st PA	16	0	5-10	19	0	1-3	100	0-0	0	
	ad PA	15	0	5-10	33	0	2-3	100	0-0	0	
CERULEAN WARBLER	1st PB	7	0	10-10	100	100	0-0	100	0-0	0	
Dendroica cerulea	1st PA	18	100	0-0	0	33	0-3	89	0-2	0	
	ad PA	29	100	0-0	0	48	0-2	97	0-2	0	
BLACK-AND-WHITE WARBLER	1st PB	26	0	10-10	100	100	0-0	100	0-0	0	10
Mniotilta varia	1st PA	22	100	0-0	0	23	0-3	78	0-2	0	See Note 3
	ad PA	18	100	0-0	0	6	0-3	78	0-2	0	
AMERICAN REDSTART	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10, 59
Setophaga ruticilla	1st PA	19	89	0-3	0	100	0-0	100	0-0	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
PROTHONOTARY WARBLER *Protonotaria citrea*	1st PB	20	0	10-10	0	100	0-0	100	0-0	0	
WORM-EATING WARBLER *Helmitheros vermivorus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 1
SWAINSON'S WARBLER *Limnothlypis swainsonii*	1st PB	12	0	10-10	100	100	0-0	100	0-0	0	See Note 1
OVENBIRD *Seiurus aurocapillus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10 See Notes
NORTHERN WATERTHRUSH *Seiurus noveboracensis*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10; See Notes See Note 1
LOUISIANA WATERTHRUSH *Seiurus motacilla*	1st PB	11	0	10-10	100	100	0-0	100	0-0	0	See Note 1 See Notes
KENTUCKY WARBLER *Oporornis formosus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
CONNECTICUT WARBLER *Oporornis agilis*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
MOURNING WARBLER	1st PB	16	0	10-10	100	100	0-0	100	0-0	0	
Oporornis philadelphia	1st PA	13	62	0-3	0	100	0-0	100	0-0	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
MACGILLIVRAY'S WARBLER	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
Oporornis tolmiei	1st PA	20	60	0-3	0	100	0-0	100	0-0	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
COMMON YELLOWTHROAT	1st PB	70	0	10-10	100	63	1-5	64	0-12	17	10, 14
Geothlypis trichas	1st PA	21	52	0-3	0	100	0-0	100	0-0	0	See Table 2
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	See Note 1

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
GRAY-CROWNED YELLOWTHROAT *Geothlypis poliocephala*	1st PB	13	0	10-10	100	100	0-0	100	0-0	0	
HOODED WARBLER *Wilsonia citrina*	1st PB	26	0	9-10	96	100	0-0	100	0-0	0	10, 72 See Notes
WILSON'S WARBLER *Wilsonia pusilla*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10
CANADA WARBLER *Wilsonia canadensis*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 1
	1st PA	20	70	0-3	0	100	0-0	100	0-0	0	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
RED-FACED WARBLER *Cardellina rubrifrons*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 1
PAINTED REDSTART *Myioborus pictus*	1st PB	24	0	10-10	100	100	0-0	100	0-0	0	59 See Notes 1 & 3
RUFOUS-CAPPED WARBLER *Basileuterus rufifrons*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	
YELLOW-BREASTED CHAT *Icteria virens*	PS/PB	20	0	10-10	100	0	3-6	90	0-2	0	48, 69 See Table 2
OLIVE WARBLER *Peucedramus taeniatus*	1st PB	22	100	0-0	0	100	0-0	100	0-0	0	
HEPATIC TANAGER *Piranga flava*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 1
SUMMER TANAGER *Piranga rubra*	1st PB	20	0	8-10	95	65	0-2	100	0-0	0	10, 46
	1st PA	14	21	0-4	0	36	0-5	50	0-12	21	
	ad PA	23	78	0-3	0	83	0-2	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
SCARLET TANAGER	1st PB	21	5	0-10	29	100	0-0	100	0-0	0	10
Piranga olivacea	1st PA	25	0	7-10	60	0	1-4	0	3-12	84	
	ad PA	20	0	8-10	80	95	0-1	95	0-2	0	
WESTERN TANAGER	1st PB	25	88	0-1	0	100	0-0	100	0-0	0	
Piranga ludoviciana	1st PA	20	5	0-10	25	25	0-2	85	0-6	0	
	ad PA	25	88	0-3	0	100	0-0	100	0-0	0	
NORTHERN CARDINAL	PS/PB	36	0	10-10	100	53	0-8	28	0-12	25	57, 61, 65, 69, 77
Cardinalis cardinalis											See Table 2
											See Note 4
PYRRHULOXIA	PS/PB	29	0	9-10	97	38	0-6	48	0-12	28	See Table 2
Cardinalis sinuatus											
ROSE-BREASTED GROSBEAK	1st PB	26	15	0-10	8	92	0-1	92	0-2	0	4, 10
Pheucticus ludovicianus	1st PA	34	0	8-10	91	0	1-3	12	0-12	35	
	ad PA	26	100	0-0	0	100	0-0	100	0-0	0	
BLACK-HEADED GROSBEAK	1st PB	22	86	0-2	0	100	0-0	100	0-0	0	
Pheucticus melanocephalus	1st PA	26	0	10-10	100	87	0-3	15	0-12	12	
	ad PA	70	100	0-0	0	100	0-0	100	0-0	0	
BLUE GROSBEAK	PS	18	11	0-5	0	100	0-0	100	0-0	0	10, 69
Guiraca caerulea	1st PB	27	0	3-10	67	0	3-8	11	0-12	70	See Table 2
	1st PA	21	81	0-2	0	100	0-0	100	0-0	0	See Note 4
	ad PA	44	100	0-0	0	100	0-0	100	0-0	0	See Notes
LAZULI BUNTING	PS	18	100	0-0	0	100	0-0	100	0-0	0	10, 69, 80
Passerina amoena	1st PB	16	0	10-10	100	0	3-8	0	12-12	100	See Table 2
											See Notes
INDIGO BUNTING	PS	17	99	0-1	0	100	0-0	100	0-0	0	10, 58, 69
Passerina cyanea	1st PB	21	0	8-10	95	0	2-5	0	12-12	100	See Table 2
	1st PA	16	13	0-9	0	50	0-3	100	0-0	0	
	ad PA	27	0	5-10	41	41	0-3	89	0-4	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
VARIED BUNTING	PS	5	60	0-3	0	100	0-0	100	0-0	0	See Table 2
Passerina versicolor	1st PB	17	0	10-10	100	0	3-6	0	12-12	100	
PAINTED BUNTING	PS	10	100	0-0	0	100	0-0	100	0-0	0	68, 69
Passerina ciris	1st PB	18	0	10-10	100	0	2-5	0	12-12	100	See Table 2
	1st PA	10	30	0-7	0	70	0-2	100	0-0	0	
	ad PA	27	0	6-10	56	70	0-3	100	0-0	0	
DICKCISSEL	1st PB	20	0	10-10	100	65	0-3	90	0-2	0	10
Spiza americana											See Notes
OLIVE SPARROW	1st PB	9	0	10-10	100	100	0-0	100	0-0	0	
Arremonops rufivirgatus											
GREEN-TAILED TOWHEE	1st PB	23	0	9-10	91	100	0-0	100	0-0	0	
Pipilo chlorurus											
EASTERN TOWHEE	1st PB	20	0	9-10	95	35	0-3	65	0-12	15	10
Pipilo erythrophthalmus											See Notes
SPOTTED TOWHEE	1st PB	22	0	9-10	91	22	0-3	63	0-12	27	
Pipilo maculatus											
CALIFORNIA TOWHEE	1st PB	17	0	10-10	100	71	0-3	79	0-12	6	See Note 1
Pipilo crissalis											
CANYON TOWHEE	1st PB	18	0	10-10	100	83	0-2	83	0-4	0	See Note 1
Pipilo fuscus											
ABERT'S TOWHEE	1st PB	26	0	10-10	100	85	0-2	100	0-0	0	See Note 1
Pipilo aberti											See Notes
WHITE-COLLARED SEEDEATER	1st PB	10	10	0-10	20	30	0-3	30	0-12	70	
Sporophila torqueola											
BACHMAN'S SPARROW	PA	17	100	0-0	100	59	0-3	100	0-0	0	74, 78
Aimophila aestivalis											See text

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
BOTTERI'S SPARROW *Aimophila botterii*	PA	19	100	0-0	0	63	0-3	89	0-2	0	78 See text
CASSIN'S SPARROW *Aimophila cassinii*	PA	26	100	0-0	0	83	0-3	92	0-2	0	74, 78 See text
RUFOUS-WINGED SPARROW	1st PB	10	0	8-10	90	0	2-4	40	0-12	10	47
Aimophila carpalis	1st PA	16	13	0-10	13	0	1-5	0	2-12	38	See Notes
	ad PA	12	0	2-9	0	0	2-3	0	2-12	25	
RUFOUS-CROWNED SPARROW *Aimophila ruficeps*	1st PB	17	0	10-10	100	0	2-5	35	0-12	41	78 See Table 2
AMERICAN TREE SPARROW *Spizella arborea*	1st PB	22	0	10-10	100	0	1-3	64	0-2	0	See Notes
CHIPPING SPARROW *Spizella passerina*	1st PB	51	0	10-10	100	6	0-4	73	0-2	0	75, 76 See Notes
CLAY-COLORED SPARROW	1st PB	22	0	10-10	100	32	0-3	27	0-2	0	76
Spizella pallida	1st PA	13	23	0-5	0	15	0-3	69	0-2	0	
	ad PA	12	33	0-4	0	17	0-3	75	0-2	0	
BREWER'S SPARROW	1st PB	20	0	10-10	100	10	0-3	80	0-2	0	76
Spizella breweri	1st PA	20	30	0-5	0	10	0-4	100	0-0	0	
	ad PA	20	50	0-4	0	25	0-3	100	0-0	0	
FIELD SPARROW *Spizella pusilla*	1st PB	19	0	10-10	100	0	2-7	21	0-12	42	75, 76; See Notes See Table 2
BLACK-CHINNED SPARROW	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	76
Spizella atrogularis	1st PA	24	46	0-5	0	71	0-3	92	0-2	0	See Notes
	ad PA	20	60	0-4	0	90	0-2	100	0-0	0	
VESPER SPARROW *Pooecetes gramineus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	See Note 3 See Notes

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
LARK SPARROW *Chondestes grammacus*	PS/PB	32	0	10-10	100	13	0-9	19	0-12	66	See Table 2
BLACK-THROATED SPARROW *Amphispiza bilineata*	1st PB	17	0	10-10	100	0	2-5	0	12-12	100	See Table 2
SAGE SPARROW *Amphispiza belli*	1st PB	21	0	10-10	100	0	2-5	100	0-0	0	
FIVE-STRIPED SPARROW *Amphispiza quinquestriata*	1st PB	6	0	9-10	83	0	2-4	33	0-12	33	See Notes
LARK BUNTING	1st PB	19	100	0-0	0	0	1-6	0	12-12	100	See Table 2
Calamospiza melanocorys	1st PA	20	0	10-10	100	0	1-3	75	0-2	0	
	ad PA	20	100	0-0	0	0	1-4	70	0-2	0	
SAVANNAH SPARROW	1st PB	64	0	10-10	100	22	0-3	100	0-0	0	10
Passerculus sandwichensis	1st PA	30	100	0-0	0	60	0-3	60	0-4	0	See Note 3
	ad PA	32	100	0-0	0	56	0-3	56	0-2	0	
BAIRD'S SPARROW	1st PB	9	0	10-10	100	0	2-3	22	0-2	0	See Note 3
Ammodramus bairdii	1st PA	7	43	0-4	0	71	0-2	86	0-2	0	
	ad PA	19	42	0-5	0	69	0-3	79	0-2	0	
HENSLOW'S SPARROW *Ammodramus henslowii*	1st PB	18	0	10-10	100	0	2-5	28	0-12	22	See Table 2 See Note 3 See Notes
LE CONTE'S SPARROW	1st PB	13	0	10-10	100	0	2-4	100	0-0	0	55, 70
Ammodramus leconteii	1st PA	10	0	1-5	0	0	2-3	70	0-2	0	See Note 3
	ad PA	12	0	3-10	8	0	2-3	33	0-2	0	
SALTMARSH SHARP-T. SPARROW	1st PB	14	0	10-10	100	0	2-4	57	0-12	14	See text
Ammodramus caudacutus	1st PA	10	0	4-9	0	0	2-4	0	12-12	100	See Notes
	ad PA	18	0	5-10	22	0	2-4	0	12-12	100	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
NELSON'S SHARP-TAILED SPARROW	1st PB	13	0	10-10	100	0	1-3	100	0-0	0	See text
Ammodramus nelsoni	1st PA	14	0	6-10	57	0	3-6	0	12-12	100	See Table 2
	ad PA	16	0	6-10	50	0	3-6	0	12-12	100	See Notes
SEASIDE SPARROW	1st PB	24	0	10-10	100	0	2-6	0	12-12	100	See Table 2
Ammodramus maritimus	1st PA	12	50	0-5	0	33	0-3	100	0-0	0	See Notes
	ad PA	13	38	0-5	0	38	0-3	100	0-0	0	
FOX SPARROW	1st PB	40	0	8-10	97	100	0-0	100	0-0	0	See Note 1
Passerella iliaca											
SONG SPARROW	1st PB	94	0	10-10	100	0	1-6	16	0-12	74	10
Melospiza melodia											See Table 2
											See Notes
LINCOLN'S SPARROW	1st PB	20	0	10-10	100	95	0-2	70	0-2	0	See Note 1
Melospiza lincolnii	1st PA	22	100	0-0	0	91	0-2	100	0-0	0	
	ad PA	20	100	0-0	0	95	0-1	100	0-0	0	
SWAMP SPARROW	1st PB	24	0	10-10	100	46	0-3	92	0-2	0	See Notes 2 & 3
Melospiza georgiana											See Notes
WHITE-THROATED SPARROW	1st PB	23	0	9-10	96	100	0-0	100	0-0	0	10; See Notes
Zonotrichia albicollis											See Notes 2 & 3
GOLDEN-CROWNED SPARROW	1st PB	34	0	10-10	100	97	0-2	100	0-0	0	See Notes 2 & 3
Zonotrichia atricapilla	1st PA	18	0	2-6	0	0	2-3	44	0-2	0	
	ad PA	15	0	2-5	0	0	1-3	80	0-2	0	
WHITE-CROWNED SPARROW	1st PB	65	0	10-10	100	66	0-3	70	0-2	0	28, 29, 31, 36, 37
Zonotrichia leucophrys	1st PA	35	20	0-7	0	8	0-3	43	0-2	0	See Notes 2 & 3
	ad PA	36	31	0-8	0	11	0-3	44	0-2	0	See Notes
HARRIS' SPARROW	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	11, 41, 79
Zonotrichia querula	1st PA	15	80	0-2	0	0	2-3	13	0-2	0	See Notes 2 & 3
	ad PA	15	80	0-2	0	0	3-3	0	2-2	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
DARK-EYED JUNCO *Junco hyemalis*	1st PB	96	0	3-10	69	79	0-2	94	0-2	0	10, 40, 81
YELLOW-EYED JUNCO *Junco phaeonotus*	1st PB	19	0	10-10	100	47	0-3	100	0-0	0	See Notes
McCOWN'S LONGSPUR *Calcarius mccownii*	1st PB	15	0	10-10	100	100	0-0	100	0-0	0	
LAPLAND LONGSPUR *Calcarius lapponicus*	1st PB	18	94	0-2	0	100	0-0	100	0-0	0	
SMITH'S LONGSPUR	1st PB	11	100	0-0	0	100	0-0	100	0-0	0	
Calcarius pictus	1st PA	11	82	0-2	0	100	0-0	100	0-0	0	
	ad PA	17	6	0-2	0	100	0-0	100	0-0	0	
CHESTNUT-COLLARED LONGSPUR *Calcarius ornatus*	1st PB	18	100	0-0	0	100	0-0	100	0-0	0	
SNOW BUNTING *Plectrophenax nivalis*	1st PB	15	0	10-10	100	100	0-0	100	0-0	0	See Notes
MCKAY'S BUNTING *Plectrophenax hyperboreus*	1st PB	16	0	10-10	100	100	0-0	100	0-0	0	
BOBOLINK	1st PB	19	0	8-10	89	95	0-2	100	0-0	0	10, 45
Dolichonyx oryzivorus	PA	59	0	10-10	100	0	7-9	0	12-12	100	See text
YELLOW-HEADED BLACKBIRD *Xanthocephalus xanthocephalus*	1st PB	20	0	10-10	100	100	0-0	100	0-0	0	10
ORCHARD ORIOLE *Icterus spurius*	1st PB	32	0	10-10	100	0	3-7	16	0-12	47	See Table 2
HOODED ORIOLE *Icterus cucullatus*	1st PB	29	0	10-10	100	0	3-5	79	0-12	3	See Table 2 See Notes

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
STREAK-BACKED ORIOLE *Icterus pustulatus*	1st PB	17	0	7-10	82	35	0-2	71	0-6	0	See Table 2
ALTAMIRA ORIOLE *Icterus gularis*	1st PB	6	0	10-10	100	0	1-3	33	0-12	17	
AUDUBON'S ORIOLE *Icterus graduacauda*	1st PB	16	0	5-10	50	50	0-3	56	0-8	0	
BALTIMORE ORIOLE *Icterus galbula*	1st PB	11	55	0-3	0	100	0-0	100	0-0	0	10, 60, 62
	1st PA	21	5	0-10	24	19	0-2	29	0-12	29	
	ad PA	20	100	0-0	0	100	0-0	100	0-0	0	
BULLOCK'S ORIOLE *Icterus bullockii*	1st PB	35	0	8-10	80	17	0-5	11	0-12	46	60
SCOTT'S ORIOLE *Icterus parisorum*	1st PB	21	0	5-10	71	14	0-5	57	0-12	19	See Table 2
GRAY-CROWNED ROSY-FINCH *Leucosticte tephrocotis*	1st PB	37	43	0-9	0	100	0-0	100	0-0	0	See Notes
BLACK ROSY-FINCH *Leucosticte atrata*	1st PB	19	100	0-0	0	100	0-0	100	0-0	0	
BROWN-CAPPED ROSY-FINCH *Leucosticte australis*	1st PB	24	87	0-3	0	100	0-0	100	0-0	0	
PINE GROSBEAK *Pinicola enucleator*	1st PB	31	23	0-10	3	100	0-0	100	0-0	0	
PURPLE FINCH *Carpodacus purpureus*	1st PB	35	0	3-10	49	100	0-0	100	0-0	0	
CASSIN'S FINCH *Carpodacus cassinii*	1st PB	24	0	4-10	50	100	0-0	100	0-0	0	

Table 1 (cont.)

Species	Molt	n	Greater coverts %0	Greater coverts range	Greater coverts %10	Tertials & Secondaries %0	Tertials & Secondaries range	Rectrices %0	Rectrices range	Rectrices %12	Notes
HOUSE FINCH	1st PB	52	0	8-10	98	4	0-7	8	0-12	54	30, 64; See Notes
Carpodacus mexicanus											See Table 2
											See Note 4
RED CROSSBILL	1st PB	46	15	0-10	30	78	0-3	87	0-2	0	10, 20
Loxia curvirostra											See Notes
WHITE-WINGED CROSSBILL	1st PB	31	0	2-10	26	74	0-4	81	0-12	3	10, 20
Loxia leucoptera											See Table 2
COMMON REDPOLL	1st PB	49	8	0-10	4	98	0-1	98	0-2	0	10, 20
Carduelis flammea											See Note 1
HOARY REDPOLL	1st PB	27	40	0-5	0	100	0-0	100	0-0	0	10, 20
Carduelis hornemanni											See Note 1
PINE SISKIN	1st PB	28	11	0-10	18	64	0-3	93	0-2	0	See Notes
Carduelis pinus											
LESSER GOLDFINCH	1st PB	31	3	0-10	77	0	1-6	23	0-12	58	See Table 2
Carduelis psaltria											See Notes
Green-backed forms	1st PA	14	86	0-2	0	100	0-0	100	0-0	0	
	ad PA	21	71	0-5	0	95	0-2	95	0-2	0	
Black-backed forms	1st PA	11	0	7-10	79	0	3-5	0	12-12	100	
	ad PA	18	0	4-10	39	0	3-5	0	12-12	100	
LAWRENCE'S GOLDFINCH	1st PB	27	0	10-10	100	0	1-5	44	0-12	33	See Table 2
Carduelis lawrencei	1st PA	20	100	0-0	0	78	0-3	100	0-0	0	
	ad PA	20	100	0-0	0	69	0-3	100	0-0	0	
AMERICAN GOLDFINCH	1st PB	23	0	4-10	22	91	0-1	100	0-0	0	33
Carduelis tristis	1st PA	20	35	0-6	0	90	0-1	100	0-0	0	
	ad PA	20	70	0-2	0	100	0-0	100	0-0	0	
EVENING GROSBEAK	1st PB	30	0	5-10	10	100	0-0	100	0-0	0	10
Coccothraustes vespertinus											See Notes

Table 2. Range of variation in numbers of primaries and primary coverts replaced during partial molts in species of North American passerines in which some primaries are replaced in at least some birds. The proportion represents that of the sample (n) in which primaries or primary coverts were replaced. Ranges represent mean ± twice the standard deviation rather than true ranges and specific notes are given following the table (see Table 1). The sequence of primary and primary covert replacement follows that of the type of molt, as indicated in Figures 5 or 6. See Table 1 for data on replacement of secondaries in these species and for information on the "Notes" column.

			Primaries		Primary Coverts			
Species	Molt	n	Proportion	range	Proportion	range	Type	Notes
OLIVE-SIDED FLYCATCHER	1st PB	16	1.00	5-9	0.28	1-3	Eccentric	53
YELLOW-BELLIED FLYCATCHER	1st PA	12	1.00	5-10	0.00	0-0	Eccentric	21, 26, 53
WILLOW FLYCATCHER	1st PA	37	1.00	5-10	0.00	0-0	Eccentric	53
VERMILION FLYCATCHER	1st PB	82	1.00	5-10	0.70	1-5	Eccentric	53
TROPICAL KINGBIRD	1st PB	12	1.00	1-5	0.00	0-0	Eccentric	53
	1st PA	13	1.00	2-5	0.00	0-0	Eccentric	See Notes
CASSIN'S KINGBIRD	1st PB	15	0.33	1-4	0.00	0-0	Eccentric	53
	1st PA	18	0.78	1-5	0.00	0-0	Eccentric	
WESTERN KINGBIRD	1st PB	27	0.81	1-3	0.00	0-0	Eccentric	53
	1st PA	48	1.00	2-5	0.00	0-0	Eccentric	
SCISSOR-TAILED FLYCATCHER	1st PB	21	0.71	1-5	0.00	0-0	Eccentric	53
	1st PA	17	1.00	2-5	0.00	0-0	Eccentric	
GREEN JAY	1st PB	10	0.20	2-4	0.40	1-3	Irregular	See text
PLAIN TITMOUSE	1st PB	19	0.11	1-3	0.11	1-3	Typical	12
TUFTED TITMOUSE	1st PB	16	0.06	5-5	0.06	4-4	Typical	See Notes
VERDIN	1st PB	20	1.00	4-7	0.06	1-2	Eccentric	66; See Notes

Table 2 (cont.)

Species	Molt	n	Primaries		Primary Coverts		Type	Notes
			Proportion	range	Proportion	range		
CACTUS WREN	1st PB	23	1.00	4-8	0.13	1-3	Eccentric	63
ROCK WREN	1st PB	53	0.17	2-8	0.06	1-3	Eccentric	See Notes
CAROLINA WREN	1st PB	15	0.53	4-8	0.00	0-0	Both	See Notes
BEWICK'S WREN	1st PB	32	0.34	4-7	0.00	0-0	Eccentric	See Note 1 See Notes
HOUSE WREN	1st PB	30	0.07	4-5	0.00	0-0	Eccentric	See Note 1 See Notes
SEDGE WREN	1st PB	13	0.08	2-2	0.00	0-0	Typical	See Note 3 See Notes
MARSH WREN	1st PB	34	0.65	5-7	0.15	1-4	Eccentric	23, 73; See Notes See Note 3
NORTHERN MOCKINGBIRD	1st PB	26	0.26	1-4	0.22	1-3	Typical	32
BENDIRE'S THRASHER	1st PB	8	0.25	4-6	0.25	2-3	Eccentric	See Note 1
CURVE-BILLED THRASHER	1st PB	16	0.44	2-5	0.44	1-3	Eccentric	See Notes
CRISSAL THRASHER	1st PB	13	0.85	3-8	0.00	0-0	Eccentric	
LE CONTE'S THRASHER	1st PB	18	0.11	3-5	0.00	0-0	Eccentric	
PHAINOPEPLA	1st PB	30	0.70	1-9	0.60	1-8	Typical	35, 69; See Note 4
LOGGERHEAD SHRIKE	1st PB	30	0.50	4-6	0.00	0-0	Eccentric	34
WHITE-EYED VIREO	1st PB	12	0.83	1-8	0.00	0-0	Eccentric	16, 25, 67
BELL'S VIREO	1st PB	26	0.38	4-5	0.00	0-0	Eccentric	
COMMON YELLOWTHROAT	1st PB	70	0.21	3-5	0.00	0-0	Eccentric	10, 14; See Note 1

Table 2 (cont.)

Species	Molt	n	Primaries Proportion	Primaries range	Primary Coverts Proportion	Primary Coverts range	Type	Notes
YELLOW-BREASTED CHAT	1st PB	20	1.00	3-7	0.00	0-0	Eccentric	48, 69
NORTHERN CARDINAL	1st PB	36	0.28	1-9	0.25	1-8	Typical	57, 61, 65, 69, 77 See Note 4
PYRRHULOXIA	1st PB	29	0.38	2-7	0.18	1-1	Eccentric	
BLUE GROSBEAK	1st PB	27	0.88	3-7	0.67	1-5	Both	10, 69; See Notes See Note 4
LAZULI BUNTING	1st PB	16	1.00	4-8	0.81	1-5	Both	10, 69, 80; See Notes
INDIGO BUNTING	1st PB	21	1.00	2-7	0.48	1-2	Eccentric	10, 58, 69
VARIED BUNTING	1st PB	17	1.00	4-8	0.29	1-3	Both	
PAINTED BUNTING	1st PB	18	1.00	3-7	0.56	1-4	Eccentric	68, 69
RUFOUS-CROWNED SPARROW	1st PB	17	0.18	4-5	0.12	1-3	Eccentric	78
FIELD SPARROW	1st PB	19	0.53	3-7	0.00	0-0	Eccentric	75, 76; See Notes
LARK SPARROW	1st PB	32	0.78	1-9	0.34	1-3	Typical	
BLACK-THROATED SPARROW	1st PB	17	1.00	3-6	0.00	0-0	Eccentric	
LARK BUNTING	1st PB	19	1.00	2-5	0.58	1-1	Eccentric	
HENSLOW'S SPARROW	1st PB	18	0.17	4-5	0.11	1-3	Eccentric	See Notes
NELSON'S SHARP-TAILED SPARROW	1st PA	14	1.00	3-6	0.14	1-1	Eccentric	See text
	ad PA	16	1.00	3-5	0.19	1-1	Eccentric	See Notes
SEASIDE SPARROW	1st PB	24	0.87	5-6	0.50	1-2	Eccentric	See Notes
SONG SPARROW	1st PB	94	0.49	1-7	0.00	0-0	Both	10; See Notes See Note 4

Table 2 (cont.)

Species	Molt	n	Primaries Proportion	Primaries range	Primary Coverts Proportion	Primary Coverts range	Type	Notes
ORCHARD ORIOLE	1st PB	32	1.00	5-7	0.81	1-5	Eccentric	
HOODED ORIOLE	1st PB	29	0.83	4-7	0.55	1-3	Eccentric	See Notes
STREAK-BACKED ORIOLE	1st PB	17	0.12	2-5	0.00	0-0	Eccentric	
SCOTT'S ORIOLE	1st PB	21	0.14	4-5	0.10	1-1	Eccentric	
HOUSE FINCH	1st PB	52	0.52	2-7	0.13	1-4	Both	30, 64; See Note 4 See Notes
WHITE-WINGED CROSSBILL	1st PB	31	0.03	8-8	0.03	1-1	Eccentric	10
LESSER GOLDFINCH (all)	1st PB	31	0.65	5-7	0.17	1-1	Eccentric	See Notes
Black-backed forms (only)	1st PA	11	1.00	5-7	0.45	1-6	Eccentric	
Black-backed forms (only)	ad PA	18	1.00	4-6	0.44	1-5	Eccentric	
LAWRENCE'S GOLDFINCH	1st PB	27	0.33	2-6	0.00	0-0	Eccentric	

NOTES

Note 1. Molt limits in these species were difficult to detect, at least in specimens. It is possible that, in some of these species, they are easier to detect on birds in the hand.

Note 2. Beware of pseudolimits among the greater coverts of these species, in both first-year birds and adults, that make inner feathers appear fresher and more recently replaced than outer feathers of the same generation.

Note 3. Beware of pseudolimits among the inner secondaries of these species, in both first-year birds and adults, that make one or more tertials appear fresher and more recently replaced than the middle secondaries of the same generation.

Note 4. Some first-year birds of these species may have undergone a complete first prebasic molt and were thus assumed to be adults. The proportions of birds with incomplete molts, therefore, may be biased upwards.

Eastern Phoebe. Results of this study indicate tertial replacement in a greater proportion of birds during the first prebasic molt than was found at Powdermill Nature Reserve, Pennsylvania (R.S. Mulvihill, pers. comm.).

Tropical Kingbird. The data refer to the western Mexican subspecies *(T.m. occidentalis)* only. The eastern Mexican subspecies *(satrapa)* averages fewer feathers replaced during all molts, more similar in extent to those of Couch's Kingbird (see Table 1).

Tufted Titmouse. Replacement of primaries during the first prebasic molt was found in the Black-crested subspecies *(P.b. atricristatus)* group only (one of three specimens examined). None of 13 HY/SYs of the Tufted *(P.b. bicolor)* subspecies group had replaced more than four secondaries, although all the rectrices were replaced in all specimens.

Verdin. Results of this study indicate primary-covert replacement in a smaller proportion of birds during the first prebasic molt than was found by Taylor (1970).

Rock Wren. Eccentric molts were found much more regularly in specimens (7 of 16) collected from Farallon Island and the Channel Islands off California, than in specimens (2 of 37) collected from mainland western North America.

Carolina and Bewick's wrens. No evidence of complete prealternate molts, as reported by Pyle et al. (1987) and references therein, was found during this study.

House Wren. Data from live birds at Powdermill Nature Reserve, Pennsylvania (R.S. Mulvihill, pers. comm.), indicate that most or all birds replace all rectrices and that a larger proportion (~77%) show an eccentric replacement pattern, of 1-5 primaries (usually 4) and 1-3 inner secondaries, during the first prebasic molt, than was found in this study. As mentioned above, molt limits were very difficult to determine on specimens of this species; thus, the data based on live birds is likely correct, at least for eastern populations of this species.

Sedge Wren. No evidence of complete prealternate molts, as reported by Pyle et al.(1987) and references therein, was found during this study.

Marsh Wren. Various versions of the extents of molts in this species have been reported, including the presence of complete first prebasic and prealternate molts (see Welter 1936, Kale 1966). The results of this study contradict those of all previous examinations, to some degree at least.

American Dipper. The sequence of greater-covert molt appears to be irregular in this species, with the inner and outer three or four feathers being replaced before the central three or four feathers.

Gnatcatchers and House Finch. A small-to-moderate proportion of adults of these species appear to suspend replacement of one or more primary coverts corresponding to p7-p9, perhaps until the fall migration has been completed. This results in molt limits within this tract that should not be confused with those following a first prebasic molt. See Michener and Michener (1940) and Pyle and Unitt (in press) for more details; more study is needed on this interesting replacement pattern.

Catharus *thrushes.* Note that the outer greater coverts are not typically replaced during the first prebasic molt. Thus, age-specific variation noted in the occurrence of buffy tipping to the outer greater coverts of HY/SYs (e.g., Collier and Wallace 1989) is due to intraspecific variation in this juvenal character rather than variation in the retention of these coverts during the first prebasic molt.

Brown and Long-billed thrashers. No evidence of rectrix replacement during the first prebasic molts, as reported by Pyle et al. (1987) and references therein, was found during this study.

Curve-billed Thrasher. Data for this study indicate that complete first prebasic molts, as reported by Pyle et al. (1987) and references therein, rarely if ever occur.

Red-eyed Vireo. Evidence suggests that similar replacement extents and sequences occur in Yellow-green *(Vireo flavoviridis)* and Black-whiskered *(V. altiloquus)* vireos, although more study is needed using an adequate sample of specimens. Note also that AHY/ASYs, probably of all three species, show molt limits in fall and winter (see Mulvihill and Rimmer 1997).

Orange-crowned Warbler. Results of this study indicate rectrix replacement during the first prebasic molt in a smaller proportion of birds, and to a lesser extent, than was found by Foster (1967).

Cape May Warbler. Results of this study indicate complete greater-covert replacement during the first prebasic molt, contra Cramp and Perrins (1994b).

Pine Warbler. No evidence of rectrix replacement during the first prebasic molt, as reported by Norris (1952) and Pyle et al. (1987), was found during this study.

Ovenbird and ***Northern and Louisiana waterthrushes.*** No evidence of rectrix or tertial replacement during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Hooded Warbler. No evidence of flight-feather replacement during the first prebasic molt, as reported by Walters and Lamm (1980) and Pyle et al. (1987), was found during this study. The bird described by Walter and Lamm was likely undergoing an adult prebasic molt.

Blue Grosbeak. Note that AHY/ASYs can also regularly retain flight feathers during the adult molts, often 1-4 secondaries among s3-s6. Use caution when ageing birds with this pattern of retained feathers.

Lazuli Bunting. Results of this study indicate primary-covert replacement during the first prebasic molt in a greater proportion of birds, and to a greater extent, than was found by Young (1991).

Dickcissel. Results of this study indicate complete greater-covert replacement during the first prebasic molt, and no greater-covert replacement during the prealternate molt, contra Cramp and Perrins (1994b). It is possible that a presupplemental molt occurs in this species (considered the first prebasic molt by Cramp and Perrins), with the first prebasic molt (considered the prealternate molt by Cramp and Perrins) occurring on the winter grounds.

Eastern Towhee. Results of this study indicate greater-covert, tertial, and rectrix replacement during the first prebasic molt in a greater proportion of birds, and to a greater extent, than were found by Cramp and Perrins (1994b).

Abert's Towhee. No evidence of rectrix replacement during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Rufous-winged Sparrow. No evidence of eccentric replacement patterns during the first prebasic molt, as indicated by Thompson and Leu (1994), were found during this study. Thompson and Leu apparently misinterpreted Phillips (1951), who indicated that limited replacement of primaries in typical sequence rarely could occur.

American Tree Sparrow. Results of this study indicate tertial and rectrix replacement during the first prebasic molt in a greater proportion of birds, and to a greater extent, than was found by Willoughby (1991). Willoughby also found a small proportion of birds that had replaced primaries or rectrices during the prealternate molt.

Chipping Sparrow. No evidence of primary replacement during the first prebasic molt, as reported for a small proportion of birds by Willoughby (1991), was found during this study.

Field Sparrow. No evidence of primary-covert replacement during the first prebasic molt, as reported for a small proportion of birds by Willoughby (1991), was found during this study.

Black-chinned Sparrow. No evidence of tertial replacement during the first prebasic molt, as reported by Willoughby (1991), was found during this study. Also, tertial replacement during the prealternate molts was found in a smaller proportion of birds than was found by Willoughby.

Vesper Sparrow. No evidence of replacement of the outer primary during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Five-striped Sparrow. No evidence of primary replacement during the first prebasic molt, as reported to occur rarely by Pyle et al. (1987) and references therein, was found during this study.

Henslow's Sparrow. No evidence of a complete first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Saltmarsh and ***Nelson's sharp-tailed sparrows.*** No evidence of primary replacement during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Seaside Sparrow. No evidence of a complete first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study. The patterns noted in Tables 1 and 2 exclude the Dusky Seaside Sparrow *(Ammodramus maritimus nigrescens)*, specimens of which indicated a different pattern than the other subspecies, appearing to have replaced all greater coverts and either all or (more likely) no flight feathers during partial first prebasic and prealternate molts.

Song Sparrow. The extent of the first prebasic molt varied extensively by North American subspecies group. Higher proportions of birds with eccentric replacement occurred among the California Mainland *(Melospiza melodia gouldii)*, Channel Island *(M.m. clementae)* and Eastern *(M.m. melodia)* subspecies groups (42 of 55 specimens); whereas few, if any, birds among the Alaska *(M.m. insignis)* and Pacific Northwest *(M.m. rufina)* groups (0 of 19 specimens) replaced primaries. Birds of the Interior Western *(M.m. montana)* group occasionally (4 of 20 specimens) showed eccentric replacement patterns. More study is needed on variation in the first prebasic molt of this species.

Swamp Sparrow. Data from live birds at Powdermill Nature Reserve, Pennsylvania (R.S. Mulvihill, pers. comm.), indicate that a small proportion of birds may replace all rectrices and primaries in typical sequence during the first prebasic molt.

White-throated Sparrow. Results of this study and that based on live birds at Powdermill Nature Reserve (R.S. Mulvihill, pers. comm.) indicate complete or near-complete greater-covert replacement and no tertial replacement during the first prebasic molt, contra Cramp and Perrins (1994b). It is possible that pseudolimits (see Notes 2 and 3) resulted in the conclusions in Cramp and Perrins.

White-crowned Sparrow. The prealternate molts differ in extent by geography. In *Zonotrichia leucophrys gambelii, oriantha,* and *leucophrys,* 3-7 greater coverts, 2-3 tertials, and the central rectrices usually (~84%) are replaced; whereas in *pugetensis* and, especially, *nuttalli,* fewer feathers are replaced on average: typically, 0-3 greater coverts and tertials and only occasionally (~17%) the central rectrices. Replacement of head feathers also is more restricted in *nuttalli* than in the other subspecies.

Yellow-eyed Junco. No evidence of rectrix replacement during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.

Snow Bunting. No evidence of partial greater-covert replacement or of tertial replacement during the first prebasic molt, as reported by Cramp and Perrins (1994b), was found during this study, although molt limits were difficult to infer on specimens of this species.

Hooded Oriole. Data for this study indicate that the first prebasic molt of the western subspecies, *I.c. nelsoni,* averages more extensive than that of the eastern and southern subspecies, *cucullatus* and *sennetti.*

Gray-crowned Rosy-Finch. Data for this study indicate that the first prebasic molt averages more extensive in the Alaskan island subspecies *L.t. griseonucha* and *umbrina,* usually including 1-9 greater coverts; whereas, in the other subspecies, it includes 0-4 greater coverts.

House Finch. See comments above under Gnatcatchers.

Red Crossbill. Molts in this species are extremely complex (Cramp and Perrins 1994b, Jenni and Winkler 1994). In Europe, occasional birds replace 5-7 primaries, 5-6 secondaries, 4-12 rectrices and, possibly, some outer primary coverts, in an eccentric pattern, during the first prebasic molt. Although no specimen evidence indicating replacement of primaries during the first prebasic molt was found in North American specimens (Table 1), occasional eccentric replacement should be expected, perhaps in birds that fledge during the winter. Also, note that AHY/ASYs can regularly retain flight feathers during the adult molts, often 1-4 secondaries among s3-s6. Use caution when ageing birds with this pattern of retained feathers.

Pine Siskin. Look for occasional birds to replace primaries (often just p5-p6 or p5-p8) in an eccentric pattern, as occurs in Eurasian Siskin *(Carduelis spinus;* see Jenni and Winkler 1994).

Lesser Goldfinch. The extent of the first prebasic molt seems comparable throughout the range of this species in North America. The prealternate molts, however, differ substantially by geography, depending on the back color of males. The prealternate molts of green-backed birds (including *Carduelis psaltria "hesperophilus")* are much less extensive than those of black-backed birds (including *mexicanus* and *psaltria*); see Tables 1 and 2. Birds from intermediate populations (in Utah, Colorado, northern Arizona, and New Mexico) may show intermediate extents to this molt, and those of Mexico *(mexicanus)* may show complete or near-complete molts. E.J. Willoughby (pers. comm.) has independently documented these patterns and plans to publish his (much more detailed) results.

Evening Grosbeak. No evidence of tertial replacement during the first prebasic molt, as reported by Pyle et al. (1987) and references therein, was found during this study.