

## THE SPRING MOLT OF THE GAMBEL SPARROW

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A picture of the population of Gambel Sparrows (*Zonotrichia leucophrys gambelii*) at our banding station near the center of Pasadena, California, may be described as follows: Among the first arrivals in late September and early October of each year there are more adults than immatures. These include a few returns from previous years. In November and December there are fewer new birds, arriving the first time for the season; but a small number of birds, about equally divided between adults and immatures, repeat in the traps frequently, thus indicating that they are staying in the vicinity during this period. In January a rise in the number of new birds is conspicuous, immatures outnumbering adults. This continues until the end of their stay in the region, the latter part of April with an occasional bird in early May. At any time during the presence here of the species, trapping records suggest that individuals may stay in the neighborhood for a prolonged visit or may appear at intervals throughout the season, thus indicating a winter residence in the vicinity. On the other hand, many, especially those trapped in October and from January to May, are trapped but once, which suggests that those caught in October are on their way south and those taken from January to May are working their way northward.

In the Gambel Sparrow seasons of 1937-38, 1938-39, and 1939-40 a study of the spring molt was undertaken. For the three seasons 412 birds were in the traps a total of 1222 times. As soon as the birds began arriving in the fall, their plumages were examined critically and on many of them the remiges, rectrices and some of the larger of the other feathers such as wing coverts were notched. This notching was recorded and on subsequent visits of the birds it served as an infallible check on all other indications of the molt of these feathers.

The following report of the results obtained is not offered as a complete thesis on the spring molt of the Gambel Sparrow for two reasons. First, the observations were made only in one small locality. The birds that spend the winter farther north or farther south may molt differently. The former are never seen here and the latter may be seen here on one or both of their migration journeys. Second, some of the birds leave on their northward migration before their molt is completed. Law (Condor, 31, 1929: 208-212) reported upon the spring molt of several species of *Zonotrichia*. We have been able to examine many Gambel Sparrows and to follow the molt through in re-trapped immatures and adults. Thus it is possible now to add to and substantiate in part the account given by Law.

*Recognition of extent of molt.*—During the period of the spring molt of the species there should be no doubt as to whether the molt has not started or has been completed in any individual bird except in adults late in the season and even then there is usually sufficient evidence for a reasonably safe conclusion.

Any bird on which partly developed feathers can be found in bilaterally symmetrical regions is considered to be molting. Replacement of feathers fortuitously lost is rarely confusing. A bird in immature plumage in which the molt is not in progress definitely has not molted. Late-in-the-season adult birds which do not show the molt to be in progress usually show sufficient evidence that the molt has been completed by the absence of appreciable wear on those feathers that usually molt in the spring and by the greater distinctness of the diurnal bars in the two middle tail feathers as compared with the other tail feathers (Michener and Michener, Condor, 40, 1938:149-160). It

should be borne in mind, however, that the rump feathers and upper tail coverts, feathers which show the greatest wear when old, are not always molted in the spring and that new feathers in these areas sometimes show appreciable wear soon after they are fully grown. These considerations make it seem advisable to place little weight on the few members of this comparatively small group of late-in-the-season adults which do not show unmistakably whether they have or have not molted.

*Time and duration of spring molt.*—The earliest indication of the molt was seen on January 28 in two or three new quills on each side of the breast of an immature bird. From this date on the number showing the beginning of the molt increased daily until by the first of March a bird not showing the molt in progress was rare. However, some continued to be found until April 3, the latest date upon which one (an immature) showing no trace of the molt having begun was trapped. At this time other late ones show that their molts had just begun. These late molters were all new birds in the traps; at the same time there were some new birds well advanced in the molt. In other words, all those known to have wintered in the immediate vicinity began to molt before March 1 and when some of them had almost completed the molt others were appearing, some of which had not begun or were just beginning it. Where these latter wintered is not known.

Thus it is concluded that the spring molt may begin at any time from late January to early April. For those that began to molt in January and February and were under close observation because they were frequently trapped-winter residents, the duration of the molt was about two months. For the birds that began to molt later than February the time of molt completion could not be determined because practically all of them left before the first of May. It is certain that some are still molting during at least part of their northward migration. It is known that some molt fewer feathers than others and it is suspected that the latest to begin the molt renew the fewest feathers. The upper tail coverts, the rump feathers and the upper greater secondary coverts are not molted in every case and one bird was captured late in the season that had not molted the two middle tail feathers. Do any arrive on their breeding grounds with immature plumage and why do some molt so much later than others? We have no information to answer these questions but we suspect that a few arrive at their summer home with brown head feathers.

As evidence of the time required for completion of the molt the following record is offered. An immature (40-93008) had two or three quills on each side of the breast on January 28. On April 3 the molt was completed except for a few quills in the femorals. Another immature (39-55844) showed new quills on the back of the neck, in the occipital region, at the base of the bill and on the throat on January 29. On April 6 the molt was completed except for young feathers, not completely expanded, in the coronal and postventral regions. This set of observations is corroborated by many other records of immatures.

Complete records were not obtained for individual adults but from parallel progress during portions of the molt we are convinced that an adult molting the same number of feathers as an immature will do so in approximately the same time.

*Feather tracts involved in spring molt.*—The outstanding feature of the spring molt of the Gambel Sparrow is the variability among the tracts in which it originates and in the rate of progress within each of these tracts. Throat, breast, back of head, back of neck, inner surface of leg are all places where it shows first, beginning, on different birds, in only one or in any combination of these places. In the latter case it sometimes proceeds much more rapidly in one area than in another and sometimes in all areas at

about the same rate. A throat entirely bare or covered with tiny pinfeathers is common. Other birds show a gradual dropping and replacement of these throat feathers.

Almost as soon as such a beginning is made in any of these tracts which are among the first, other tracts are involved. The participation of the various tracts in the molt will be discussed in the approximate order and with the same nomenclature as used in our paper on the molt of House Finches (Michener and Michener, Condor, 42, 1940: 140-153).

The primaries are not renewed at the spring molt but a few exceptions were observed. Two birds replaced primary 9 on each wing and two replaced both 8 and 9 on each wing.

The upper greater and the upper middle primary coverts are not molted.

The upper carpometacarpal coverts are not molted.

Secondaries 7, 8 and 9 (tertials of Law) are practically always molted, 8 dropping first, then 9, then 7. Two birds were observed which molted secondary 6 and one which failed to molt secondary 9. These feathers on these birds were notched so that there is no possibility of error in judging which ones were molted.

The upper greater and the upper middle secondary coverts are practically always molted although of the former there were a number of cases in which only the proximal portion of that tract molted, with the further exception that the most proximal feather frequently was not molted.

The carpal covert, the alula and the alula coverts are not molted.

In the upper marginal coverts only a few feathers in a few individuals were found to be molted.

Feathers in the humeral tracts begin to fall at the anterior end, and the whole tract is molted in an orderly manner.

The under greater and under middle primary coverts are practically never molted. In one bird often examined one or two new pinfeathers were seen in the proximal ends of these tracts but no other feathers of these rows were renewed.

The under carpometacarpal coverts were never found molting.

The under greater and under middle secondary coverts are all molted in some cases and in others only the proximal feathers of each tract are renewed.

The under marginal coverts are renewed in many cases and no birds were seen in which it was known that they were not molted. Determination is difficult in this tract unless pinfeathers are found.

The scattered feathers of the under surface of the upper arm in all cases are molted early in the progress of the molt.

The capital tract is completely molted usually beginning in the occipital region. In many instances the time required for completion of the head molt is the time required for the entire molt. The occipital region is one of the earliest spots to show the molt and the coronal region is one of the places to hunt for the last pinfeathers. However, some individuals begin the head molt in the coronal region and a few begin it at the bill at the same time as in the occipital area, but in no case observed did it begin at the bill and proceed steadily backward to the occipital and neck regions.

The spinal tract begins its molt anteriorly; it progresses caudally but is incomplete as it approaches the caudal tract. In the rump of every bird observed there were old, worn feathers left. In some few birds only a few of the rump feathers were molted.

The ventral tract molts completely, beginning anteriorly and progressing caudad.

In the caudal tract, usually rectrices 1-1 are molted and the other ten are not. In only two birds observed did rectrices 1-1 fail to molt. In a few cases 1-1 and 2-2 molted.

In one bird 1-1 and 6-6 molted and in another 1-1, 2-2, 3-3 and 4-4 molted, 3-3 and 4-4 being short at the time of observation. The upper tail coverts are completely molted, partly molted or, in a few cases, not molted at all. In the under tail coverts and the lesser under tail coverts it was harder to distinguish old from new than in the upper tail coverts, but in many instances there was no doubt that all of them were replaced. The postventral region and the anal cirlet are completely molted.

The crural tract is completely molted. The inner surface of the leg is usually molted all at one time.

The femoral tract is most variable. In one case it was found a mass of young pinfeathers, all the same age. In others a quill or two appeared at the anterior end and the molt progressed posteriorly to be completed about the time of completion of the entire molt. This tract is one to search for the last traces of the molt. In some birds all feathers were replaced and in none was there no molt in the femoral tracts. But this area seemed to lack the orderly replacement of the humeral feathers. So often only one or two pinfeathers were found at one time that it is suspected that the molt may be variable in completeness as it is in the rump.

It would be of interest to supplement this study with an examination of the molt of these birds on both the more northern and the more southern areas where they winter and then to study the molt of late summer and fall.

A few individuals of *Z. l. pugetensis* appear here late in the *gambelii* season and, for the sake of placing them on record, we append here our meager notes on the molt of that subspecies. Of four that were caught on April 23 to 25, 1938, we noted that the molt was very much delayed. This was in comparison with *gambelii*, of course. On April 15, 1940, two were caught and taken to Mr. George Willett at the Los Angeles Museum who identified them as *pugetensis*. One, an adult, showed the molt not yet begun and the other, an immature, showed it just beginning. These individuals are too few and we are too far out on the edge of the winter range of this subspecies for us to say that their molt is typical of the subspecies.

*Pasadena, California, March 8, 1943.*