TIMING OF MOLT IN STELLER JAYS OF THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA

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Among birds, molt occurs in a particular interval of the annual cycle, and its timing bears a relatively fixed chronological relation to breeding and to migration in temporarily resident species. At temperate and higher latitudes, a question arises as to the extent that molt occurs in the summer period, that is, in the interval devoted in the main to reproductive effort. Lack (1954) maintains that in general the breeding season is so timed that young are being raised when their food is most plentiful. But it appears that at higher latitudes, as the summers become shorter, this relationship may be compromised by molt (Pitelka, 1957). In other words, regardless of the part of the summer that has the maximum amount of food available for adults and young of a given species, the farther north we go, the more likely it becomes that the programming of molt for the population as a whole will intrude upon that period. This will be true at least of permanently resident species and of species which are only summer residents but undergo the annual molt while still on the breeding grounds. Examples of the first group are the Blue Grouse (*Dendragapus obscurus*), Steller Jay (*Cyanocitta stelleri*), and chickadees (*Parus* sp.); examples of the second group are the Lapland Longspur (*Calcarius lapponicus*) and Snow Bunting (*Plectrophenax nivalis*).

It is the objective of this paper to examine timing of molt in Steller Jays of the Queen Charlotte Islands, off the coast of British Columbia at latitudes 52° to 54° N. Here this jay occurs as a permanent resident in luxuriant cool temperate forests of spruce, hemlock, and cedar. It is represented by a race (*C. s. carlottae*) confined to the islands (Osgood, 1901). The species, however, has a wide distribution in western and middle America, from southern Alaska to Nicaragua, latitudes 60° to 13° N. Although it occurs almost everywhere in association with coniferous forests of boreal or cool temperate type, these environments vary sufficiently in climate that the annual cycle of the jay may be expected to differ significantly from one region to another. This pertains as much to timing of molt as to any other important annual event. Hence, beyond the Queen Charlotte Islands, the picture presented here may apply at most only to coastal populations of Canada and southern Alaska. In other parts of the distribution of the Steller Jay, the climates are warmer and drier, or more markedly seasonal, or both, and characteristics of timing on a populational scale, if they differ from those of the northwestern coast, do so to degrees as yet undetermined.

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MATERIALS AND METHODS

The data reported here were obtained from 190 specimens of *Cyanocitta stelleri* collected chiefly on Graham Island, the northernmost of the Queen Charlotte Islands. The entire series available to me totals 231 specimens; most of them were taken late in the breeding season and during the molt. Those undergoing the complete molt (see table 1) were all taken in the months of May through August; those undergoing the postjuvenal molt were taken in the months of June through October.

The procedure in recording molt is one developed for purposes of quick recording in the study of banded birds. On the basis of a detailed examination of molt pattern in the Snow Bunting and Lapland Longspur at Barrow, Alaska, in 1951 (Pitelka MS), certain points or areas of plumage active in early, middle, and late intervals of the molt were selected for "reading." Scores of 0 to 10 were assigned to the sequence of stages of molt activity at each point or area, and the total scores obtained for any individual proved to correlate satisfactorily with the overall advance of molt. As the scores for a given interval of time can be cast as a frequency distribution, the method is useful in describing molt programming in the population as a whole as well as in the individual.

For *Cyanocitta stelleri* and other jays studied since my report on molt in *Aphelocoma* (Pitelka, 1945), I find the pattern of molt similar. The laborious procedure of describing each stage in terms of conditions on all important body areas, as was done in the study of *Aphelocoma,* was an essential first step. With the background of that earlier work, it proves possible now to apply the method used for living birds to museum specimens. With a pair of forceps, the blanket of body feathers can be parted to reveal stages other than the old or fully grown feathers that are evident superficially. Flight feathers can be checked by hand once the plan of wing pterylography is well in mind. The handle of the forceps can be useful to keep feathers slightly apart as one looks deeply at insertion points with a beam of light cast in the same axis.

I would add that this method can be used satisfactorily on museum specimens by students experienced in handling them considerately *and providing* such specimens are of a size and toughness similar to that of jays. In smaller birds, there are mechanical difficulties in examining plumage as well as risk to the specimen, and whether the method discussed here can be used satisfactorily will have to be determined for individual cases.

For the complete molt, the loss of primary 1 signals the onset of molt, and the complete growth of secondary 6 signals the end of molt. In some individuals, and possibly a majority, molt may actually begin first on the body before primary 1 is dropped and also end on the body after secondary 6 is fully grown. The areas concerned, respectively, are the sternal region of the ventral tract and the auricular region. Such differences between absolute onset or end of molt and the time of activity indicated by primary 1 or secondary 6 are considered insignificant because the intervals are short and the amounts of feather replacement occurring on the body before loss of primary 1 or after completed growth of secondary 6 are small.

From other flight feathers, selection can be made of those whose growth occurs over intervals which overlap so that together with primary 1 and secondary 6 they form a time series giving graded estimates of molt stages. These additional flight feathers are primaries 5 and 10, secondary 1, and rectrices 1 and 6. The molt of primaries spans a longer period than that of secondaries or rectrices, but the last activity is in the secondaries; hence the former cannot be used alone. While the primaries together with the secondaries might suffice for scoring purposes, the rectrices were included so as to have

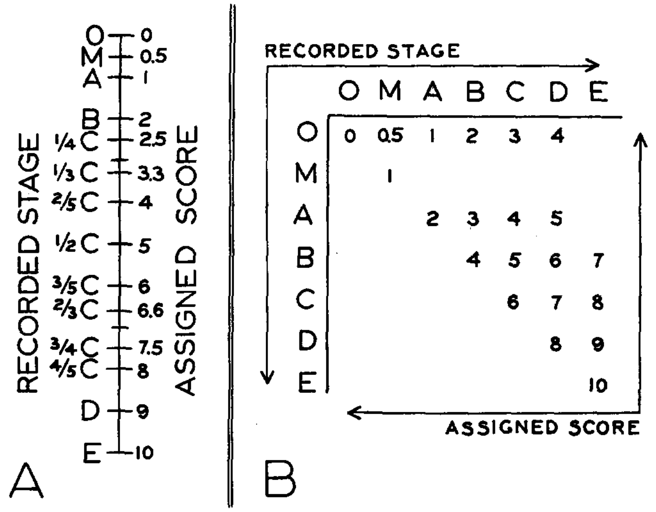

Fig. 1. A, schedule for the recording of molt stages of selected flight feathers in the complete molt, along with corresponding scores from 0 to 10 assigned to each feather.

B, schedule for the recording of molt stages on selected body areas in the postjuvenal molt, along with corresponding scores from 0 to 10 assigned to each area according to the molt stage or range of stages occurring there (see text).

Explanation: O, old feather; M, missing; A, pin feather; B, "brush" stage, pin feather burst terminally but without a flat vane yet; C, partly grown feather with at least terminal portion of vane flat; D, feather completely grown or virtually so, but still sheathed basally; E, feather completely grown.

a broader base on which to deal with intrapopulation variability and to compare populations and species. The inclusion of the rectrices in the scoring of adult molt proved inadvertently to have other advantages to be mentioned later.

For each of the seven feathers, a record is made according to the schedule shown in figure 1A. The feather may be old (O); missing (M); a pin feather (A); in a brush stage (B), burst from its sheath but still without a flat vane terminally; in various growth stages (C) in which the vane is flat at least terminally and for which the amount of growth is indicated by a fraction; completely grown or virtually so, but still sheathed basally (D); or completely grown (E). Assigned scores between 0 and 10 corresponding to these various stages are given in figure 1A. Thus, an adult midway through the molt scores about 35, and one completely molted scores 70.

The postjuvenal molt is incomplete. As in *Aphelocoma,* the flight feathers, alula, greater primary coverts, and a variable number of the greater secondary coverts are retained. Hence, the record must be based on body areas. Five were selected: lower chest (broad part, or sternal region, of the ventral tract); middle secondary coverts; crown, specifically the center portion of a band between the eyes; the throat, a band about 1/4 inch wide between the proximal ends of the rami; and the side of the upper neck and auricular region. Earliest signs of molt typically appear on the chest, whereas the last feathers to complete growth are those of the sides of the neck and auricular region.

For each of these five areas, a record is made according to the schedule shown in figure 1B and utilizing the same symbols as explained above. A first-year individual which has passed through the postjuvenal molt scores 50, or 20 points less than individuals after complete molt. The procedure differs from that used for the complete molt in two other ways: (1) As the feathers concerned are small, no estimate is made of fractional amount of growth shown by feathers in C stages; (2) as areas rather than single feathers are concerned, the observation may record a single stage, but more frequently it consists of the range shown by the majority of the feathers on the area, which means 80 to 90 per cent of them and usually all of them. The assigned scores are drawn from the table shown in figure 1B. Thus, a recorded stage may be O-A (score of 1), meaning that over the area in question, there were old feathers, feathers missing, and some pin feathers. As another example, C-E (score of 8) means feathers in growth stages, feathers of full size but still sheathed basally, plus feathers completely grown. The M stage, alone or in combination with O, A or B, is used only in recording stages of middle secondary coverts where gaps are clearly detectable.

As the postjuvenal molt does not include the flight feathers (and certain other minor series), weights of body plumage and of flight feathers were obtained so as to provide an index to the difference in metabolic burden borne by birds undergoing the complete molt versus those merely in postjuvenal molt. This was done with specimens obtained in the Berkeley Hills, Oakland, and in the Santa Cruz Mountains, all in central coastal California where the race *C. s. carbonacea* occurs. Specimens were weighed soon after collection or they were frozen in a sealed cellophane bag and later thawed and weighed. After the body weight was obtained, all primaries, secondaries, and rectrices were removed, and the specimen was again weighed. Then all remaining feathers were removed, and the specimen was weighed a third time. From the weights obtained for each individual, the per cent fractions represented by body plumage and flight feathers were calculated.

RESULTS

For the complete molt, the distribution of scored specimens for the months of May through August is shown in figure 2. There were no September-taken adults in the sample. The important facts concerning timing of the complete molt are summarized in table 1.

For the postjuvenal molt, the distribution of scored specimens for the months of June through October is shown in figure 3. For a summary of the facts, see table 1. The earliest date for a juvenile in my sample is June 1, an individual with incompletely grown juvenal rectrices and evidently only recently fledged. As is shown in figure 3, juvenal Steller Jays may enter the postjuvenal molt while the tail feathers are still sheathed basally. In these instances, the sheath indicates that a terminal fraction of growth is occurring or that growth was just recently completed. No specimen with sheathed rectrices scored higher than 5 (out of 50), indicating only a slight overlap between the end of growth of these feathers and the onset of the postjuvenal molt. Individuals showing this overlap were scattered through most of the interval over which molt began. At lower latitudes there is typically a time gap between the end of growth of juvenal rectrices and the onset of the postjuvenal molt. This is true in both *Aphelocoma* and *Cyanocitta*.

In Steller Jays of an area with so humid a climate as that of the Queen Charlotte Islands wear and fading of feathers is minimal, with the result that individuals undergoing their first complete molt are easily separated from those in later molts. This separation is possible up to a score of about 40, that is, up to the time that at least some juvenal feathers of the tail, wing, alula, and the series of greater primary coverts are retained. The distribution of scored specimens undergoing the first complete molt and those about to enter it is shown in figure 4 (see also table 1).

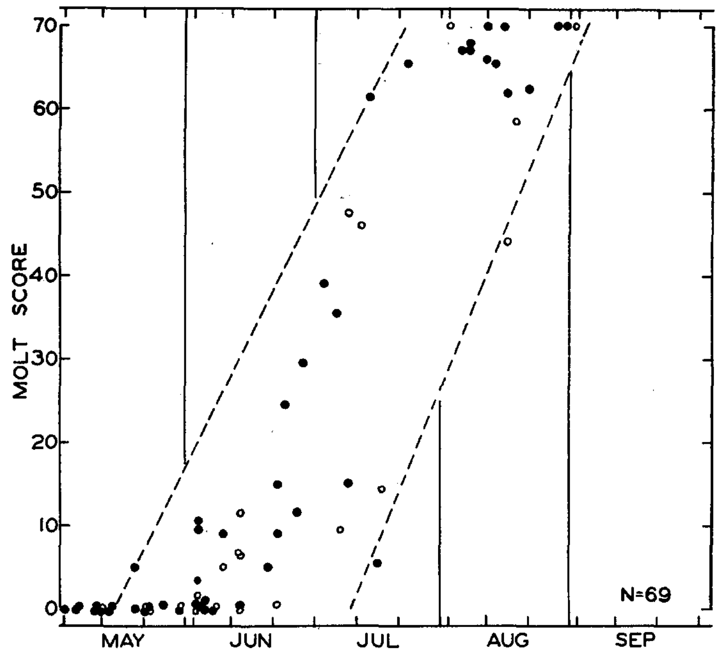

Fig. 2. Period of the complete molt in Steller Jays of the Queen Charlotte Islands according to the distribution of scored specimens against time. 0, molt not yet started; 70, molt completed. Values between 0 and 70 indicate relative advance of overall molt according to stages of seven selected flight feathers. Dots indicate males; circles, females.

Table 1

Comparison of Different Molts in Steller Jays of the Queen Charlotte Islands

	Complete molt (second or later)	First complete molt	Postjuvenal molt
Sample size (N)	69	38	83
Start of molt	May 12–July 10	May 9–June 4	June 10–July 20
Ending of molt	July 20–Sept. 10	Indeterminate	Aug. 20–Oct. 10
Period of molt in the individual	60–70 days	Presumably same as other complete molts	70–80 days
Average date of inception	June 7[1]	May 21[2]	June 29[3]
Period when central 75 per cent begin molt	May 22–June 12[4]	May 15–May 28	June 15–July 9
Latest date from specimen not yet in molt	June 12	May 23	July 10
Earliest date of completed molt	August 1	Indeterminate	Sept. 23

[1] Based on 23 specimens with molt scores of 15 or less, but not zero, for which dates of molt inception were estimated according to zero-intercepts parallel to dashed line at left or right of figure 2, whichever was closer.
[2] Based on 17 specimens with molt scores of less than 5, not but zero (fig. 4).
[3] Based on 20 specimens with molt scores of less than 10, but not zero (fig. 3).
[4] Of 23 specimens used to calculate average date of inception, the central 18 or 78 per cent fall between these dates.

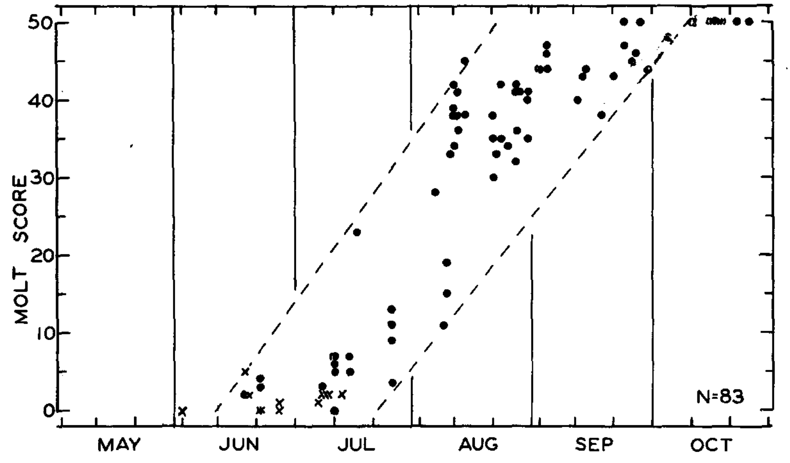

Fig. 3. Period of the postjuvenal molt, graphed as explained under figure 2. Here a score of 50 indicates molt completed; values between 0 and 50 indicate relative advance of overall molt according to stages of five selected areas of the body. Sexes not distinguished; crosses indicate individuals with tail feathers in last stages of growth.

The weights of plumages, each cast as per cent of total weight, are summarized in table 2. As the sample is small, only means and ranges are given. The data suggest no significant differences between sexes and age groups. For the population of Steller Jays occurring in central coastal California, the plumage in the spring months comprises about eight per cent of the total weight.

A few additional data indicate that, as might be expected from observations on plumage wear, this percentage trends downward during the year. For two October-taken adults, the percentages are 11.9 and 9.1. For one May-taken adult female, the percentage is 7.1, which is below the lower extreme given in table 2. The lowest value of all in table 2 is 5.5, from a first-year female taken in April. Because of this evidence, table 2 was limited to that portion of the year for which the most specimens were available. On the average, then, the *fresh* plumage of an individual comprises more than eight per cent of its total weight, probably somewhere between 9 to 11 per cent.

Table 2

Ratio of Plumage Weights to Body Weights in Steller Jays of Central Coastal California[1]

Sex and age	N	Total weight in grams	Plumage weight in per cent: All	Body	Flight feathers
Adult males	3	117.2 (106–126)	7.5 (6.9–7.9)	4.9 (4.3–5.3)	2.6 (2.5–2.8)
First-year males	3	111.1 (103–117)	8.0 (7.5–8.4)	5.4 (4.9–5.8)	2.6 (2.5–2.6)
Adult females[2]	5	106.6 (102–116)	8.1 (7.3–8.9)	5.5 (5.1–6.2)	2.6 (2.2–2.8)
First-year females	9	107.0 (95–120)	7.3 (5.5–8.5)	4.9 (3.5–6.0)	2.4 (2.0–2.9)

[1] All specimens taken in February, March and April.
[2] Females consist only of pre-breeding or non-breeding individuals; a few heavy females in egg-laying or pre-laying stages were excluded.

For our purposes, the important point is that the ratio of weights of body plumage to flight feathers is about 2:1, and that in fresh plumage the difference is greater, approaching 2.5:1 in at least some individuals. In the complete molt, therefore, the weight of plumage replaced is 1½ times that of the postjuvenal molt or slightly less. For purposes of examining certain aspects of the timing of molt, we will assume that the metabolic burden borne by adults in replacing their feathers is greater than that for juveniles by this fraction.

The total score adopted for the complete molt is 20 more than the total of 50 for the postjuvenal molt; that is, the ratio of the amount of body feathers to amount of flight feathers is 5:2, or 2.5:1. Hence the notation in the methods section that the scoring procedure proved to have some unexpected advantages, one being that the scores reflect reasonably well the relative difference in weights of plumage replaced.

No data on plumage weights are available for the Queen Charlotte Islands population, and for purposes of this paper I will assume that the ratios are similar.

DISCUSSION

Onset of the complete molt in relation to age.—There is only a slight absolute difference between the first and later complete molts in earliest records of molt. The data in figure 4 indicate a difference of three days, which is insignificant. But on a populational basis, there is a significant difference.

The scatter of scores shown in figure 4 brings out the fact that the majority of the individuals entering the first complete molt do so ahead of those in later complete molts. Thus, more than half, and perhaps as many as 75 per cent, of the individuals slightly more than a year old and entering the first complete molt do so by the time that only 25 per cent of the older individuals enter one of the later molts. Presumably this difference is correlated with non-breeding in first-year individuals. For high-latitude populations of *C. stelleri,* there are only a few scraps of evidence in direct support of this. For example, the label of a first-year male with small testes obtained on Graham Island on April 26, 1920, was annotated "would not breed this year." But evidence from other corvids supports the surmise of non-breeding among first-year birds. This line of argumentation is supported by the fact that if first-year birds breed at all, they tend to do so later than older individuals. Data from large samples of the Scrub Jay (*A. coerulescens*) obtained at Sonora, California, for example (Pitelka MS), clearly support this point, and it has been established also for various other species.

It must also be recognized that difference in onset of molt between non-breeding first-year birds and breeding birds is greater than that indicated in figure 4 due to the fact that members of pairs unsuccessful in their nesting may enter the molt ahead of those having nests with young. The tendency of such unsuccessful adults to lapse into molt, so to speak, would then bring about the negligible difference in earliest records for onset of the first complete molt versus later molts.

It is possible that if first-year individuals tend not to breed, this is not manifest equally in the two sexes. There is some suggestion in figure 4 that males entering the first complete molt do so statistically ahead of females. Taking as a break the line between areas B and C (fig. 4) and setting up a contingency table of numbers of females to either side versus numbers of males *in molt,* I obtain a chi-square value which indicates significance only at the 10 per cent level. Other manipulations of the data do not improve this. Thus, at best, there is a possibility that a difference between the sexes occurs in time of onset of the first complete molt. To settle the point, a larger sample is needed. If a significant difference were shown, the simplest hypothesis to explain it now seems to be that such a difference would occur if at least some of the females breed.

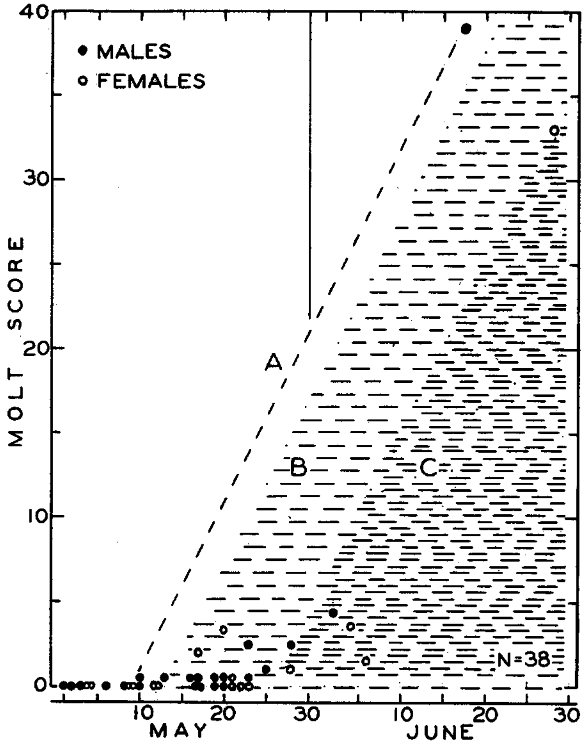

Fig. 4. Timing of the onset of the first complete molt, based on all first-year specimens available for the month of May plus all recognizable ones of this age group for June. Dots indicate males; circles, females. Line A indicates the progression of the earliest molting individuals, but only up to a score of 40 because in later stages this age group is not distinguishable from adults. Areas B and C represent the early part of the molt period for jays in second or later complete molt; the first 25 per cent or so fall within the interval B, while the remaining individuals start their molt within the interval C or later (see fig. 2).

While this is not impossible, it does seem unlikely, and from a populational standpoint it is negligible, since the proportion of such breeding females presumably would be small.

The fact remains that as a group first-year birds begin to molt ahead of older birds. Presumably, any loss to the population because of failure of the former age-group to participate in breeding is counterbalanced by an advantage which it gains because a significant portion of its members begin their molt early, as early as May 9, thereby spreading out the demands made by the population for food in support of both nesting and molt over and above that needed for mere existence.

The timing of molt with relation to summer season.—It is evident from figures 2 and 3 and from table 1 that the molt of juveniles is significantly later than that of adults. The periods over which molt occurs in each of these sub-populations and the overlap between them is shown in figure 5.

An important point is that the time when all adults are in molt occurs prior to the time when all juveniles are in molt. For the former, this interval is the month of July, for the latter, August. Thus, the use of available food in support of feather growth is at

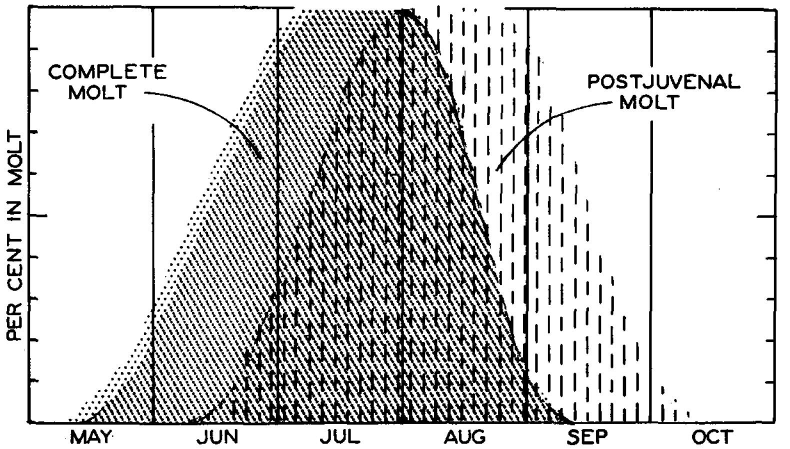

Fig. 5. Timing of molt in adults and in birds of the year, shown by successive percentages of individuals undergoing complete molt (dotted area) superimposed on successive percentages of individuals undergoing the postjuvenal molt (area of vertical dashes). A band of sparser dotting to the left suggests a slight advance in molt schedule for a portion of those individuals in their *first* complete molt.

maximal levels over these two months, and because of this earlier scheduling of molt in adults, the total demand for food at any one time is not so great as it would be were the overlap to be greater. Such overlap as occurs (fig. 5) indicates that the time when all members of all age-groups are in molt is late July and early August.

Whether the molt activity and attendant food demands truly peak at this time in a populational sense depends on several factors, one of them being the relative proportion of adults to juveniles. No nesting data are available for the jays of the Queen Charlotte Islands, but in coastal Washington and British Columbia, clutches of 3 to 5 eggs are laid (Bent, 1947), and there is no reason to expect clutch size to be smaller to the north. After eggs hatch in May, the population will contain young in excess of the number of breeding adults—for purposes of discussion, let us say 2:1. As young are lost, the difference will become smaller, but some mortality will occur in adults also, and the young may still preponderate at the end of the summer.

On the other hand, several factors counterbalance any numerical majority of juveniles over their parents. We have to allow for a segment of the population consisting of birds one year old which are non-breeders in the majority, if not all. The data from my sample suggest that in May, first-year birds comprise as much as 20 to 30 per cent of the population. Moreover, we have the facts that in the complete molt, about half again as much of the plumage weight is replaced as in the postjuvenal molt, and that the complete molt proceeds more rapidly than the partial molt of juveniles (compare figs. 2 and 3). There are still other considerations, for example, the breeding pairs whose nestings have failed.

In other words, from the standpoint of food budgeting in relation to molt in the population as a whole, adults and juveniles as sub-groups may be considered to stand in a 1:1 ratio. This simplification, although gross, is ventured because some approximation is needed to continue the discussion. For lack of information, it is not worthwhile to pursue further the arguments used to support the ratio of 1:1. My objective is to use

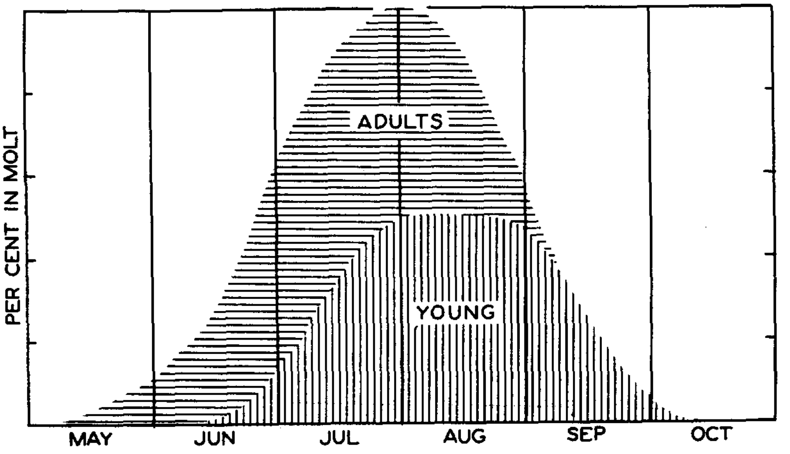

Fig. 6. Timing of molt in the population as a whole, assuming a 1:1 representation of adults and young (see text) and showing the maximal molt activity to fall in late July and early August.

this line of reasoning to show that if a ratio of body-molt units among adult and juveniles of 1:1 is adopted, and if the proportion of birds undergoing molt in the population as a whole is then graphed against time, the peak of molt activity and hence the peak of demands for food in support of molt in adults and young together occur in late July and early August. This is shown in figure 6. This is to say, peak activity evidently may occur as suggested by figure 5 even after a number of populational variables are weighed as to the degree they might deflect the peak initially indicated merely by the schedule.

Ecological reports on insects would give some suggestion of seasonal change in food availability, but I have been unable to locate any for the Queen Charlotte Islands. Characteristics of the land environments there are described by Osgood (1901) and by Munro and Cowan (1947). Temperatures on the Queen Charlotte Islands and the adjacent mainland are higher in July and August than at other times of the year, and rainfall is low then (Mackie, 1956). This is shown in figure 7 by climographs. Using such data on annual cycle in environment, I would expect that on the Queen Charlotte Islands, as in boreal-forest habitats generally, insects are present and active in greatest variety and quantity in July and early August.

Returning now to Lack's thesis, in his statements about young being raised when food is most plentiful (1954: 59 ff), he is referring to young in the nest. For Steller Jays on the Queen Charlotte Islands, this probably means mid-May to mid-June. In central California, the young remain dependent for more than a month after they are fledged, and there is no reason for expecting the Queen Charlotte Islands jays to differ. Under such circumstances, the adults may still be feeding young in July. We are left with a dilemma as to which food is important. Is it the food brought to young in the nest and of a kind more abundant then (which would be what Lack seems to be emphasizing); or is it the over-all food supply available to this omnivorous species, which surely increases beyond the nestling period and peaks some time in mid-summer, when young are still dependent and most members of the population are in molt? I would think the latter is more critical in timing. If so, then on the basis of the evidence we have concerning molt, it can be argued that the timing which has evolved in this population of Steller Jays seems to have accommodated molt first.

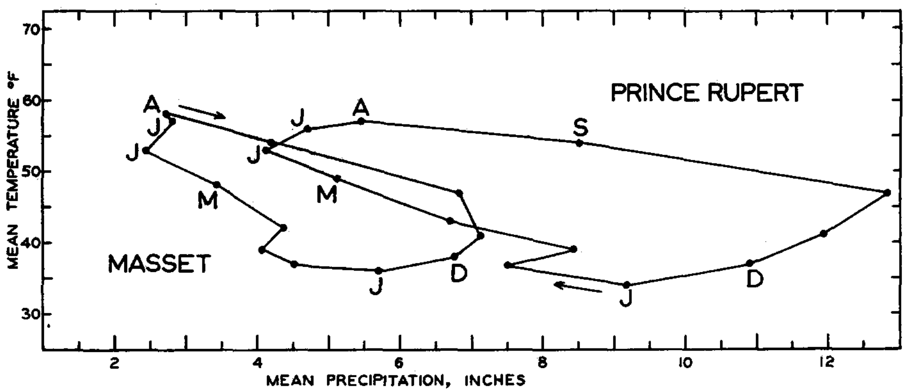

Fig. 7. Climographs for Masset (lat. 54° 0′ N), Queen Charlotte Islands, and for the nearest station on the adjacent mainland, Prince Rupert (lat. 54° 20′ N), about 80 miles away. Months of May through September, and December and January are indicated by letters.

In other words, if a choice of some vital activity in the annual cycle has to be made, it is molt which appears to be most closely adjusted to the interval of the summer when peak supplies of food for this species can be expected. Lack (1954:25 ff) has shown that there is often a significant correlation between modal sizes of clutches or litters and maximal survival. This of course is an important point apart from the question of timing in relation to food. But in those species in which clutch size varies little or not at all, adaptations other than those of clutch size are significant. Effective reproduction is controlled by several population variables which interact, clutch size being one of them. When clutch size varies little, the latitude for adjustment, which we may assume is there, is used in other ways. It should be borne in mind, also, that larger and longer-lived birds can skip a breeding season, but they do not as a rule skip a molt.

Clearly, the significant problem of timing faced by a population is not a matter alone of dependent young in relation to peak supplies of food or a matter alone of molt in relation to food. Molt and breeding along with other major events in the annual cycle are to be studied as parts of a total problem met by the population so that vital activities are programmed in relation to seasonal gain and loss in numbers with compromises in program that enable that population to maintain itself. This is a view long implicit in Kendeigh's (1949 and earlier) studies of important life activities of birds in relation to their energy-producing capacities.

In any event, the example of Steller Jays on the Queen Charlotte Islands gives us some indication of the degree to which molt occupies the most favorable season of the year in northern passerines, even permanently resident ones and also those so large and of such omnivorous habit as jays. Indeed, the peak of molt activity in the population as a whole proves to coincide with the middle of the summer. Finally, by comparison with jays of more southern latitudes (Pitelka, 1945), the complete molt proceeds more rapidly. The early scheduling of that molt results in less overlap with the postjuvenal molt than occurs to the south. This kind of critical-timing adaptation in animals of northern environments will become increasingly evident as life activities are studied in the field on a populational basis.

The picture of molt timing presented here is of necessity a generalized one because specimens were obtained in various years. Hence year-to-year variation is masked, and were good samples available for several successive years, critical characteristics of timing might stand out more sharply than they do now.

SUMMARY

Timing of molt in Steller Jays of the Queen Charlotte Islands was studied from the large series of summer-taken specimens available in American museums. The complete molt of adults two or more years old begins in the interval from May 12 to July 10, and adults individually take 60 to 70 days to molt. Individuals undergoing the first complete molt start molting sooner than older ones. The molt of juveniles begins in the interval from June 10 to July 20, and juveniles individually take 70 to 80 days to molt. Thus, adults molt ahead of juveniles, and their complete molt proceeds more rapidly than the partial molt of juveniles.

In Steller Jays of central coastal California, the plumage comprises on the average eight per cent of the body weight in the spring months and about ten per cent after the fall molt. The ratio of body plumge to flight feathers (remiges plus rectrices) is near 2:1. In the complete molt the weight of plumage replaced is thus 1½ times that of the post-juvenal molt.

In addition to differences among age groups in extent and rate of molt, factors which can affect timing of molt in the population as a whole are age composition, mortality trend according to age group, and proportion of reproductives. These factors are assessed briefly and tentatively from the standpoint of the data on Steller Jays on the Queen Charlotte Islands. In the light of all evidence and arguments brought to bear thereon, molt in the population peaks in late July and early August. This raises the question whether breeding more so than molt is critically timed with relation to peak abundance of summer foods. It appears that in these jays, in a cold temperate and densely forested region at 54°N latitude, molt is as closely linked in its timing with summer food abundance as is that interval of breeding when parents are feeding young in the nest.

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