Introduction

Since the first edition of this guide (Pyle *et al.* 1987) was published we have made some progress in our understanding of the molts, ageing, and sexing of North American birds; however, we still lag behind the Europeans in these areas, by as much as ten years according to recent estimates. As with the first edition, this revised and expanded version attempts to bridge this gap, at least partially. More importantly, it again attempts to reflect the state of our current knowledge in these areas, providing a baseline for the further development of our understanding, and pointing out many areas in need of additional study. As with the first edition, a primary objective of this guide is to call attention to unsolved problems.

Three major changes will be found in this second edition: 1) It includes all North American (north of Mexico) "near-passerines", or doves through woodpeckers in the order of the American Ornithologist's Union Check-list (AOU 1983), 2) short descriptive summaries are presented for all currently recognized subspecies, and 3) the sections on molt have been substantially expanded, incorporating many recent findings, and increasing the detail on feather replacement to the level of the wing coverts. As a consequence of the last change, the sections on ageing have also been expanded, with a greater focus on molt limits among the median, greater, and primary coverts. Much of the new information in these areas was gained through extensive specimen examination (see **Acknowledgments** and p. 38) and is in need of critical testing in the field. Several minor changes to the content and format of this edition will also be evident. These include increased information useful for species separation in the field, the addition of a section on hybrids, the presentation of bar graphs indicating temporal periods of reliable ageing and sexing, and a greatly expanded list of references.

As with the first edition, the author strongly encourages users to publish contradicting, additional, or supporting information, or to contact him (at PRBO, 4990 Shoreline Hwy, Stinson Beach, CA 94970 USA), so that it may be incorporated into future editions. Such feedback was a vital component of the current revision process (see **Acknowledgments**). In addition, as the title ambitiously states, a second part is planned to include (in the same format) information on North American waterbirds, diurnal raptors, and gallinaceous birds. Any unpublished information or leads to funding will be greatly appreciated.

SCOPE

Totals of 395 species and 857 currently recognized subspecies, of near-passerines and passerines, are treated in this guide. Most or all species which regularly breed or have bred at least once in North America (north of Mexico) are included, plus at least two other regular vagrants from tropical America. Only three introduced species and no extinct species are included. The information presented in the accounts of many migrants is applicable on both their breeding and their tropical wintering grounds. Species taxonomy and order follow those of the AOU (1983), as modified by the AOU (1985-1997). See the section on **Geographic variation** for methods used to determine subspecies taxonomy.

BIRD TOPOGRAPHY

The names of soft parts and feather tracts follow those most widely used in the current ornithological literature (Figs. 1 & 2). Primaries are numbered **distally** (innermost to outermost) and secondaries **proximally** (outermost to innermost), as in Figure 1 (see also Fig. 13). In the terminology of this guide, "p6-p9" (*e.g.*) indicates primaries 6 through 9, whereas p6 – p9 indicates p6 minus p9, a measurement used in determining wing morphology (see below). Here, the term "**flight feathers**" refers to the primaries, primary coverts, secondaries, and rectrices. "**Middle secondaries**" refer to the secondaries immediately adjacent to the tertials (*e.g.*, s3-s6 in passerines). **Wing feather edging** refers to the edging and fringing on the wing coverts and tertials.

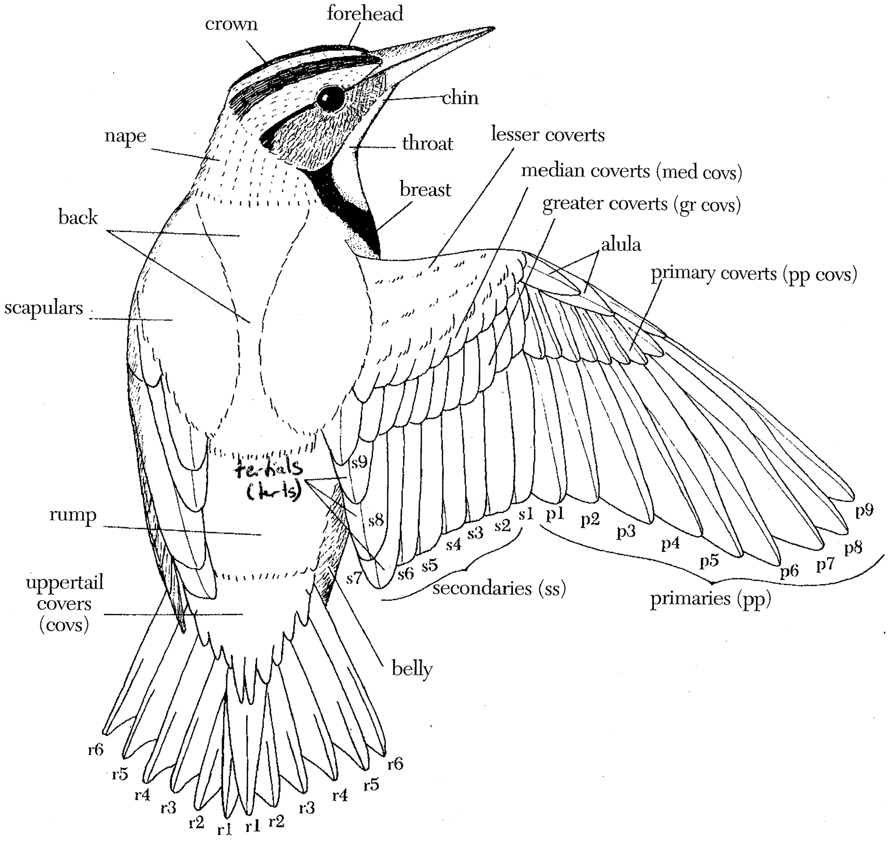


FIGURE 1. Terms used in this guide for feather tracts and anatomical areas. See Figure 13 for more details on wing feather terminology.

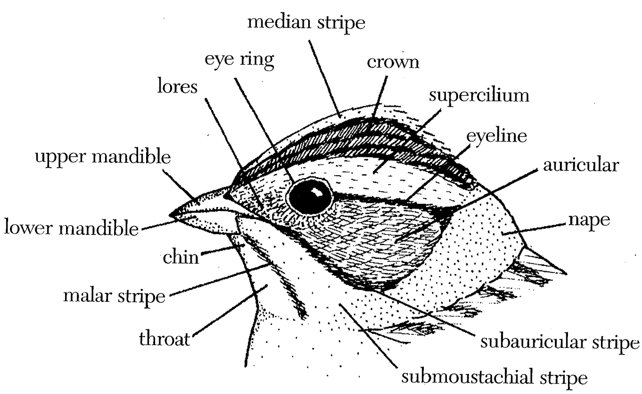


FIGURE 2. Terms used in this guide for areas of the head.

IDENTIFICATION, AGEING, AND SEXING TECHNIQUES

The accurate identification, ageing, and sexing of North American near-passerines and passerines generally is complicated by a high degree of variation in size, plumage, and molt patterns found within each species, subspecies, and age/sex class. In this guide, a format which summarizes the distinguishing features of each group, in a directly comparative manner, was chosen over the popular (but oversimplified) dichotomous-key approach, because it better represents this variability and the complexity of the subject. It also emphasizes two important aspects of accurate identification, ageing, and sexing that should always be kept in mind by users of the accounts:

1) **Determinations should be based on a synthesis or combination of all available characters (whether or not they are definitive), all of which may or may not coincide with those of one particular species, subspecies, or age/sex class.**

2) **Intermediate individuals and exceptions will always occur which are not reliably placed in a particular species, subspecies, or age/sex class by in-hand criteria alone.**

An understanding and acceptance of these concepts is crucial to the accurate identification, ageing, and sexing of birds in the field or the hand. Variation within groups, and degree of overlap between groups, can be represented statistically by "bell-shaped" curves (Fig. 3**A**). Assuming "normal distributions" (consistent variation around means) the distribution in size of a species, subspecies, or sex group can be represented directly, and the plumage conceptually, by these curves. If two groups overlap in a certain character, the proportion of birds falling in overlap zones can be represented (Fig. 3**B**). Near the tails of the bell-shaped curve lay the "outliers", such as individuals with abnormally small or large measurements or individuals with plumage anomalies that may cause them to appear more like other species or groups. Statisticians and certain ornithological groups (*e.g.*, the Canadian Wildlife Service [CWS] and Bird Banding Laboratory [BBL] when assessing the age and sex codes assigned by banders) are satisfied with 95% accuracy. Within a bell-shaped curve, the cutoffs for 95% of a population can be estimated by the mean ± twice the standard deviation (Fig. 3**A**). Ranges representing 95% of the variation within a group or sample are much more useful than the "true" ranges of a sample when assessing such criteria as measurements or wing morphology formulas, as true ranges may or may not include anomalous individuals.

Throughout this guide, ranges in measurements and plumage appearance are presented based on the concept of 95% confidence intervals. Thus, 5% of the individuals will be expected to fall outside of the ranges given, 2.5% at each end, the mean can be calculated as the midpoint between the given extremes in range (see Fig. 3**A**), and one standard deviation will equal approximately a quarter of the range. In addition, a variable proportion of individuals (up to 50% in some cases) will fall into overlap zones between groups (Fig. 3**B**), and will not be reliably aged, sexed, and/or iden-

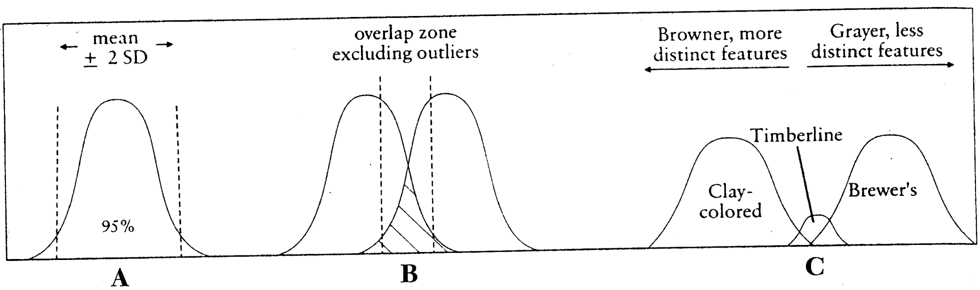


FIGURE 3. Bell-shaped curves, including 95% confidence intervals (as calculated by the mean ± twice the standard deviation), an example of an area of overlap between two similar populations, and an example of its use in *Spizella* sparrows (see pp. 566-568). Variation in both measurements and plumage descriptions in this guide are based on 95% confidence intervals (see text). Figure from Pyle and Howell (1996).

tified with any one or all of the criteria given for a particular group. By understanding these concepts and by combining all criteria with in-hand experience, users of this guide should be able to make determinations with well above 95% accuracy. References to the combination of criteria and to the potential for intermediates in specific cases occur throughout the species accounts.

MEASUREMENTS

Size often is useful for identifying, ageing, and especially, for sexing birds in the hand. In this guide, ranges of wing chord (**wg**) and tail length (**tl**) are given for every species as an indicator of sex, and for many subspecies in which geographic variation includes size. Bill measurements also are given frequently, where useful in subspecific determinations or sexing. For several species, published discriminant function analyses (see Brennan *et al.* 1991) or other formulas are referenced, which use a combination of size criteria to separate sexes or other groups within a species. Measurement data should always be considered when identifying, ageing, or sexing a bird in the hand.

In many owls, females average larger than males, whereas in most other species treated in this guide, males average larger than females. The extent to which the sexes overlap in size depends both on the species and the particular measurement being considered. Wing chord is the easiest measurement to take and serves as a useful representative of the size of a bird, at least within a certain group. Overlap in wing-chord lengths between the sexes can range from almost complete (*e.g.*, in woodpeckers, Wrentit, and some vireos) to little or none (Dickcissel and many icterids). With most North American near-passerines and passerines there is 60-80% overlap. Wing chord, therefore, varies from being practically useless to entirely reliable for sexing, and most often will reliably separate 20-40% of the individuals (see also Selander 1972, Payne 1984). Other measurements, such as those of the tail and bill, also can be useful, although the amount of overlap tends to be greater with these measures than it does with wing chord. The difference between the wing chord length and the tail length (wg – tl) also can be useful in specific and subspecific identifications.

Certain measurements vary with age, but to a lesser extent than with sex. In most passerines and many near-passerines, juvenal primaries tend to be slightly (5-10%) shorter than adult primaries. In some families (such as blackbirds and nightjars), however, the wing chords of fully-grown juveniles can average 10-20% shorter than those of the adults. Thus, the wing chords of juveniles, and of birds that retain their longest primaries during the first prebasic molt, will be slightly to moderately shorter than birds with adult primaries. Because of the individual and sex-related variation found in bird size, measurements are not recommended for ageing; however, the tendency for juvenal primaries to be slightly shorter than those of adults may sometimes be used to help sex known-age birds and vice versa. Individuals with juvenal primaries often have wing chords falling in the bottom portions of the ranges of each sex, while wing chords of adults will be longer, falling in the upper portions of the ranges. Of course, this reasoning should never be used as a sole means of ageing a bird. On the other hand, by considering age, the percentages of birds that can be sexed by wing length (and other measurements) may be increased (see Blake 1965a, Alatalo *et al.* 1983, Mewaldt & King 1986, Francis & Wood 1989).

When using measurements for identifying, ageing, or sexing near-passerines and passerines, it is important that the measuring techniques be the same as those used to obtain the published measurements with which you are comparing yours. In the following sections, the methods of obtaining the measurements used in this guide are outlined. All linear measurements given are in millimeters (mm).

Wing Length

At least three methods of measuring the wing length have been described in the literature. The wing chord, or "unflattened" wing length, is the measure most frequently used and published in North America; the "flattened" wing length is widely used with museum specimens and was previously popular in Europe; and the "maximum flattened" wing length or "maximum chord" is the measure presently used as a standard by ringers in Europe. Depending on the species and

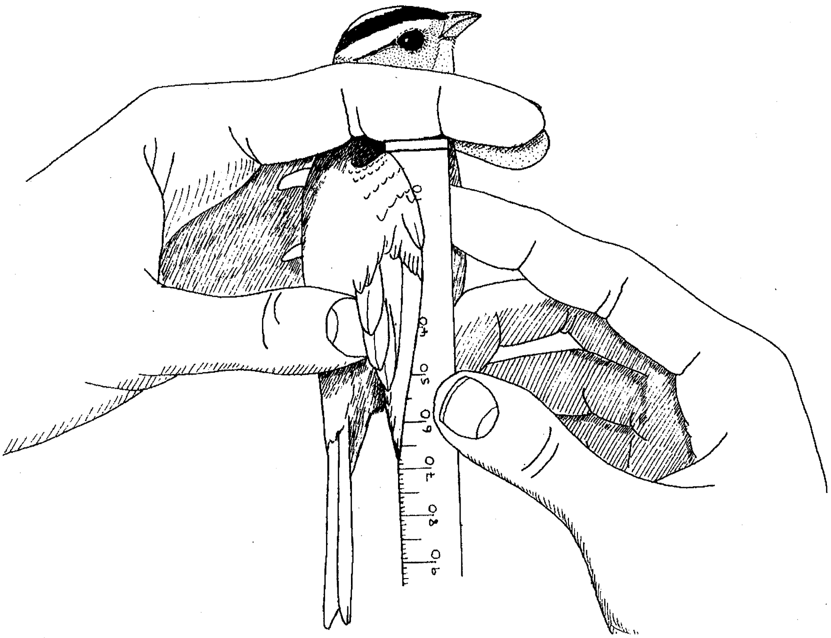


FIGURE 4. A good hold for measuring the wing chord.

handling conditions, the flattened wing length is 0.5-2% longer than the wing chord, and the maximum flattened length, in turn, is 0.5-3% longer than the flattened length. Another method, that of measuring the distance of the eighth primary from its insertion, currently is being practiced in Europe (Jenni & Winkler 1989). See Nisbet *et al.* (1970), Spencer (1984), Svensson (1992), and Gosler *et al.* (1995) for analyses and discussions of the advantages and drawbacks of each method.

In this guide, measurements of the wing primarily refer to the wing chord (wg), as this is the length most frequently used by North American banders and most widely published for North American near-passerines and passerines. In a few accounts (e.g. the *Oporornis* warblers) the flattened wing length, "wg (flat)", is used because previous major studies of these species have used this wing measurement method. A primary concern with the wing chord method is the potential for non-conformity between different species, handlers, and handling conditions (Svensson 1992). When performed properly and in a standardized way, however, the wing chord method should result in consistent and reproducible measurements (Arendt & Faaborg 1989). It also is the easiest method to use with larger birds (Baker 1993).

To measure the wing chord of a live bird, it is best to have a thin ruler with a perpendicular stop at zero. Alternatively, one's thumb or forefinger can, with care, serve as a stop. The ruler should be inserted under the wing, and the bend of the wing (carpal joint or "shoulder") should be pressed snugly against the stop. A source of potential variation with wing measurements is the amount of carpal compression applied by the pressure on the stop by the bend of the wing (Yunick 1986). It is recommended that the bend of the wing be pushed against the stop with no more pressure than the wing itself applies when the ruler is moved in a posterior direction. Once the wing

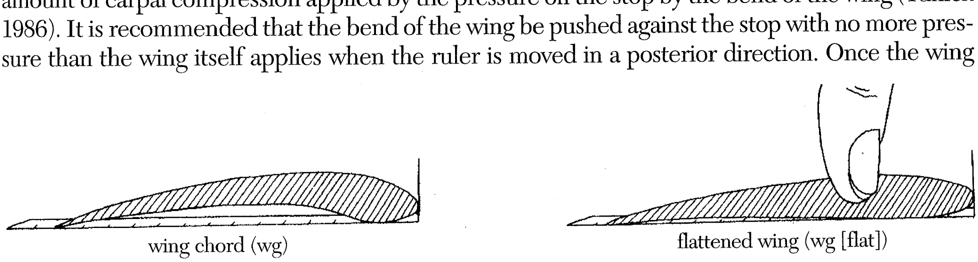


FIGURE 5. Profiles of wing measures used in this guide.

is in place, make sure that the line between the carpal joint and the tip of the longest primary lies parallel with the edge of the ruler. Gently lower the wing tip to the ruler so that it touches it, and read the wing chord length (Figs. 4 & 5). To achieve a flattened wing length, gently press the wing flat against the ruler with the thumb on the wing coverts (Fig. 5) and read the resulting, slightly longer measurement.

When measuring the wing it is important to make sure that the longest primary is not missing, broken, or growing, and to realize that older and more worn primaries in spring and summer will result in a slightly shorter measurements (by 1-5%) than freshly grown ones in fall and winter (Francis & Wood 1989, Rogers 1990). In addition, damp wings will be slightly flatter, hence longer, than dry wings (Svensson 1992), and museum specimens will show a slightly shorter wing length (up to 3%) due to shrinking during drying (Yunick 1990, Barajas & Phillips 1993, Winker 1993); this effect may be more substantial on birds with a greater amount of natural concavity to the wing. Data on wg – tl also tend to be longer in specimens than on live birds (Yunick 1990). These effects should be taken into consideration when measuring damp or wet birds, or comparing data from live birds with those from specimens.

Tail Length

Although it has received less attention than the wing length, the length of the tail also is of use in identifying, sexing, and ageing near-passerines and passerines. The tail length is defined as the distance between the tip of the longest rectrix and the point of insertion of the two central rectrices. Ideally, this distance should be measured with calipers, especially on museum specimens. But calipers can be difficult to use with live birds in the hand, and accurate and more reproducible measurements can be achieved with a ruler.

Two methods of measuring the tail with a ruler currently are practiced. In both cases, it is imperative to use as thin a ruler as possible, with the end of the ruler coinciding with zero. One method is to hold the ruler parallel to the tail and insert it between the tail and the undertail coverts (see Svensson 1992). The other method is to hold the ruler perpendicular to the tail and insert it between the two central rectrices (Fig. 6). In both cases, the zero end of the ruler should be pushed firmly against the root or point of insertion of the feathers. Both of these methods have been tried on a series of live birds and the differences found between the two were negligible (PRBO, unpublished data). The latter method (inserting the ruler between the two central rectrices) perhaps is easier and more consistent than the former method but, with practice, either technique should yield accurate and reproducible results.

As with the wing, it is important to make sure that the longest rectrices are not missing, broken, or in molt, and to realize that older and more worn feathers will result in a shorter measurement (by up to 15% on very worn tails) than fresh feathers. Note also that, if the longest rectrix is not the innermost, an attempt should be made to reduce the bias caused by the slight angle between the insertion of the central rectrix and the tip of the tail (particularly if the longest rectrices are the outermost).

Another measurement of the tail that is useful for separating certain species is that of the furca or "tail-difference", the difference in length between the outer and central rectrices (r6 – r1 in passerines; *e.g.*, see Fig. 167). A clear plastic ruler placed flush with the closed

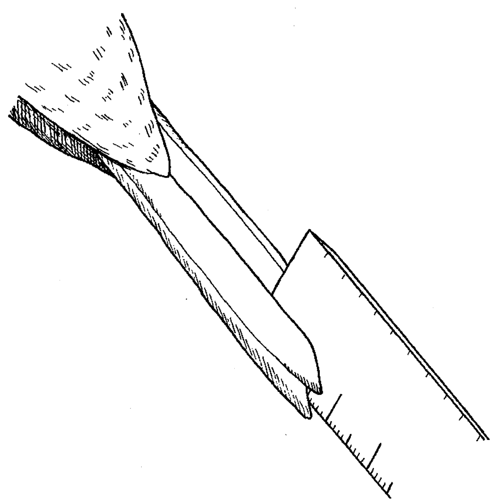


FIGURE 6. Measuring the tail between the central rectrices.

tail is the best way of achieving this measurement. As with the tail length, be sure to measure along the axis of the tail rather than at the slight angle that occurs when these feathers are in their natural position.

Bill Length

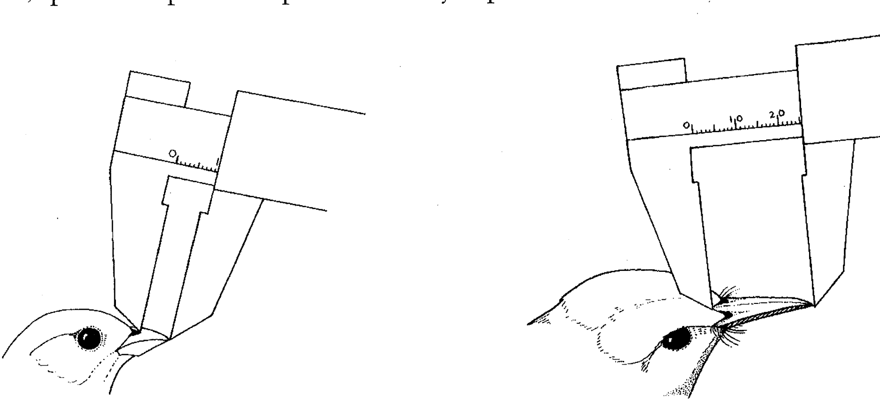
As with the wing, at least three methods of measuring the bill length currently are employed, depending on the point at the base of the bill from which the measurement is taken. In this guide, the term "**bill from nares to tip**" commonly is used and refers to the distance between the anterior end of the nostril and the tip of the bill (Fig. 7). This probably is the most consistent of the methods, although the length of the nostril itself may vary somewhat, affecting this measurement to a slight degree. The exposed culmen ("**exp culmen**") also is referred to commonly, especially in the subspecies accounts. The exposed culmen indicates the length between the tip of the feathering at the base of the bill, and the bill's tip (Fig. 7). A third method, the "total culmen" or length between the bill tip and the notch at the base of the upper mandible, where it enters the base of the skull (see Svensson 1992, Baker 1993), is perhaps the most accurate measurement; however, it has not been widely used in North America and is referred to rarely in this guide.

Since the length of the bill actually is a chord measurement (notably on species with curved upper mandibles) it is best to use calipers (Fig. 7); however, with care, a fairly accurate measurement can also be achieved with a ruler. Begin by making sure that the bill tip is not broken or deformed. Place the tip of the bill against the inner jaw (it is easier with calipers constructed of thick material) and gently slide the tip of the outer jaw to the anterior edge of one of the nares or to the feathering along the culmen. The exposed culmen measurement is taken from the tips of the feathers along the central ridge (culmen) of the bill, not the nostril feathers or those on the sides of the forehead (Fig. 7).

When using bill lengths, it should be kept in mind that slight seasonal variation may occur, the bill generally being slightly longer in the summer than in the winter (Davis 1954, 1961; Packard 1967a; Johnson 1977; Morton & Morton 1987).

Bill Depth and Width

All references in this guide to bill depth and width indicate measurements taken at the anterior end of the nostril. Again, calipers should be used. For the bill depth, place the outer jaw on the point of the culmen even with the anterior ends of the nostrils and bring the inner jaw up to the lower mandible such that the calipers are oriented at a 90° angle to the axis of the bill. When obtaining this measurement on a specimen, be sure that the bill is fully closed. To get the bill width, open the calipers to the point where they stop at the anterior end of the nostrils when they



bill from nares to tip — exposed culmen

FIGURE 7. Measuring the bill (from nares to tip) and the exposed culmen.

are gently moved toward the base of the bill. Again, the calipers should be oriented at a 90° angle to the axis of the bill.

Tarsus

The length of the tarsus is referred to in only a few instances in this guide because it is a relatively difficult measurement to perform on live birds and because variation in tarsus length between similar species and sexes is comparatively slight. Again, the measurement is best obtained with calipers. It is the length between the intertarsal joint and the distal end of the last leg scale before the toes emerge (Fig. 8).

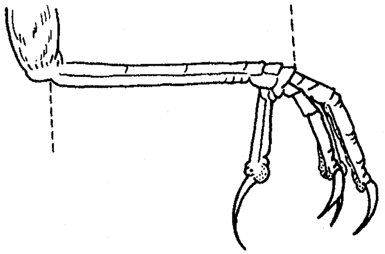


FIGURE 8. The tarsus.

Mass

Because bird mass (often called weight) varies substantially with geography, condition of the individual, stomach contents, and season or period within the life cycle of each particular species, this measurement is not as useful for ageing, sexing, or identifying birds as are the above linear measurements. In a couple of instances, however, masses are given in this guide as a useful character for sexing, or are referred to as part of discriminant function or other multiple-variable analyses. The most important considerations to make when weighing birds are how much fat is present (see Leberman 1967, Rogers 1991), and whether or not females have eggs in the oviducts, both of which can substantially increase a bird's mass (Reese & Kadlec 1982). Dunning (1993a) provided sample masses in grams (gms) for most North American birds, and Clench and Leberman (1978) provided analyses of the masses of eastern North American passerines by age, sex, and season. These should be referred to when considering bird masses.

WING MORPHOLOGY

Wing morphology (or "wing formula") refers to the shape of the wing, reflecting three aspects of the primaries of birds: the relative lengths, hence position of the tips of each primary; the occurrence and length of notches on the inner webs of each primary; and the occurrence of emargination to the outer webs of these feathers (Fig. 9). Because of such factors as distance of migration and foraging behavior, wing morphology usually differs slightly among otherwise similar species and, thus, can be very useful for separating these species in the hand. The finer details of wing morphology, furthermore, have been found useful in certain species for subspecific identifications (Unitt 1987, Mulvihill & Chandler 1991, Pyle 1997a) and ageing and sexing (Phillips *et al.* 1966; Chandler & Mulvihill 1988, 1992; Mulvihill & Chandler 1990, Pyle 1997a), and are undoubtedly useful for such determinations in other species, as well.

In this guide, the use of wing morphology is limited primarily to the positions of the tips of the outer primaries (usually p9 and p10) or longest primaries (often p8) relative to the positions of the tips of the other primaries, the tip of the longest secondary (often one of the tertials), or the tips of the primary coverts.

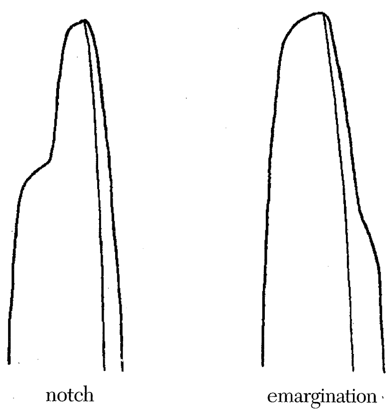


FIGURE 9. Examples of notched and emarginated primaries.

It should be noted that the illustrations of these wing morphology features are drawn with the wing open such that the relative positions of the primary tips are clearly shown. When performing wing morphology measurements, however, it is important that the wing be closed and in its natural position (Fig. 10).

When determining the distance between primary tips, it is easiest to measure the distance between the tip of the longest primary and that of each of the primaries being considered, taking the difference between these lengths to calculate distances between respective primaries. The measurements are best achieved by placing a transparent ruler (or, with more difficulty, a pair of calipers) next to the wing in its naturally closed position and putting the tip of the longest primary at zero of the transparent ruler (Fig. 10) or calipers. Always make sure that none of the primaries is broken, missing, or growing. If, during molting, an incoming feather is still in its sheath, it may not be fully grown and should not be used in wing morphology analyses.

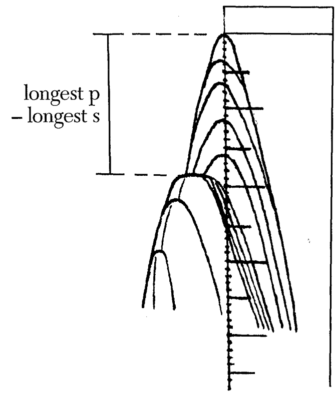


FIGURE 10. A good way to measure the distance between primary tips and the longest primary to the longest secondary.

In this guide, the measurement between the tips of two primaries, *e.g.*, the 9th and the 5th, is abbreviated as "p9 – p5". A positive value in this case indicates that p9 is longer than p5, and a negative value indicates that p5 is longer than p9. The measurement "p5 – p9" produces the same distance but with the opposite sign. In most cases, values of wing morphology are presented in terms of 95% confidence intervals (Fig. 3) based on these distances, which are more useful for identification than such vague terms as "p9 usually ≤ p5" (Pyle 1997a).

A more complete knowledge of wing morphology has developed in Europe (see Svensson 1992) than in North America, in part because of the relative prevalence of difficult-to-identify species found there. Further study in the use of wing morphology in North American near-passerines and passerines for determinations of species, subspecies, age, and sex, is encouraged (see Pyle 1997a).

SKULLING

The art of skulling, and the usefulness of skull pneumaticization for ageing passerines in the hand, have improved steadily since Miller (1946a), Norris (1961), and Baird (1964) first described and modified the process (see also Wiseman 1968a). Skulling is now recognized as being the most reliable technique for ageing passerines during the fall months and, for many species, is proving useful through the early winter and even into spring. Although many near-passerines do not seem to complete pneumaticization of the skull as adults, the relative sizes of "windows" in the skull have been found to be age-specific in certain species (D.W. Johnston 1958, R.F. Johnston 1962) and possibly is so in many others, as well, despite physiological reasons (related to brain size) that cause the skull pneumaticization process to slow substantially when a juvenile near-passerine has reached full size (Jenni & Winkler 1994). Banders are strongly encouraged to become proficient at skulling and to skull birds throughout the year, so that a better understanding of the exact timing, variation, and reliability of the pneumaticization process for ageing each passerine and near-passerine species can be achieved.

Skull Pneumaticization

When a fledgling passerine leaves the nest, the section of the skull overlying the brain (frontals and parietal) consists of a single layer of bone. From this time until the bird is four to twelve months old (depending mostly on the species), a second layer develops underneath the first, the two layers being slightly separated by spaces or air pockets, and joined by small columns of bone (Dwight 1900a). The process by which this second layer, the air pockets, and the columns develop is called skull pneumaticization.

The pattern and rate of skull pneumaticization varies both within and among passerine species. The pattern generally follows one of the two progressions illustrated in Figure 11, but may show other variations (see Yunick 1979a, 1981a; Jenni & Winkler 1994). Smaller species tend to show the peripheral pneumaticization pattern and larger species the median line pattern (Yunick 1981a), although much variation occurs, both among species and among individuals within a species. Individuals of certain species may show either pattern, and the exact shapes of the unpneumaticized areas or "windows" will also show substantial individual variation.

Generally, the skulls of smaller species become pneumaticized more quickly than those of larger ones, but this may vary somewhat depending on the family. Wood-warblers, for instance, show a faster rate than flycatchers of similar size. The rate of pneumaticization also depends more on the age of the bird than on the season, yet both factors are involved. Pneumaticization slows, for example, in stressful times, such as during fall migration and winter, and is more rapid in southern populations than northern ones. Thus, the time of the year when the skull becomes fully pneumaticized depends on the species, the age of the bird, and the amount of stress an individual endures during the fall and early winter months. These factors, hence the rate of pnematicization, can vary interannually (*e.g.*, Wiley & Piper 1992).

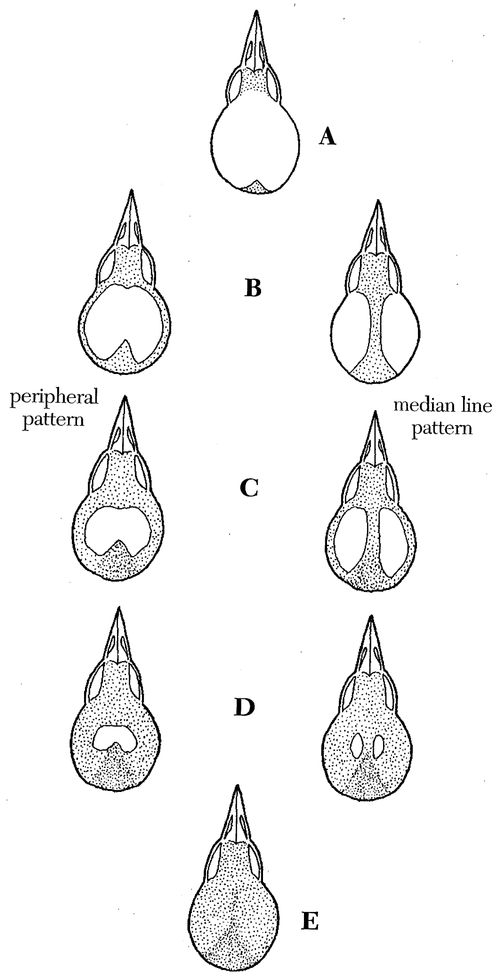


FIGURE 11. The two common sequence patterns of skull pneumaticization. See text for details.

Any passerine found with large windows in the pneumaticization of the skull (Fig. 11**A**-**C**) can be reliably aged as a first-year bird. In most North American passerine species, the skulls of the earliest first-year birds become completely pneumaticized in October and November, and in the latest birds between November and February. The date when the earliest birds complete pneumaticization is important in ageing, as this is when adults can no longer be aged reliably by skulling alone. However, completely pneumaticized skulls should still support other ageing criteria indicating adults for at least a month following the initial dates given in the species accounts.

In some (perhaps many) species, small unpneumaticized windows (Fig. 11**D**; see also Fig. 204) are regularly retained by some first-year birds until spring and even early summer. This is seen most commonly in long-distance migrants such as flycatchers, swallows, thrushes, and vireos, but can also occur in residents, particularly those that winter in colder climates. Birds with windows greater than two or three millimeters in diameter are reliably aged as first-year through

June. Birds with these windows in July-August, and birds with smaller windows should not necessarily be aged first-year because a variable proportion (depending on the species) of adults will never show complete pneumaticization. In addition, it should be noted that windows in the occipital triangle at the base of the skull, can occur more frequently (if not ubiquitously) in adults (Collier & Wallace 1989), and should not be regarded during the skulling process. It must also be stressed that birds without windows after the indicated date of earliest completion, are not necessarily first-year birds.

Thus, extent of skull pneumaticization is reliable for ageing first-year birds through October to June, and adults through September to November, depending on the species.

Skulling

Unpneumaticized areas of the passerine skull usually appear pinkish while pneumaticized areas appear grayish, whitish, or pinkish white, with small white dots indicating the columns of bone. The color and/or contrast (when present) between these two color patterns can usually be seen through the skin of the head, especially after the head has been wetted to allow parting of the feathers.

To skull a small bird, start by holding it in one of the two positions shown in Figure 12. A third method, in which the bird's head is held tucked against its chin and the thumb is run against the feather tracts from the base of the skull, presently is gaining in popularity. The hold illustrated in 12**A** or that described above may be the easier to use than that of Figure 12**B** because the skin can more readily be moved around the skull, allowing a larger area of the skull to be viewed through a smaller area of skin. With experience, however, all three holds can be used with equal effectiveness.

In order to see the skull, the feathers need to be parted such that a small opening of bare skin is created. This can be accomplished without wetting the feathers but is more easily done if a small amount of water or saliva is applied; do not use detergent or alcohol solutions. Those with extensive experience in skulling will be able to part the feathers and see the skull simply by blowing or by licking their thumb or finger. Beginners, until they are familiar with the appearance of the skull in its various stages of pneumaticization, should wet the feathers a greater amount in order to create larger viewing areas. In cold weather, however, substantial wetting should be avoided so as not to chill the bird.

It usually is easiest to part the feathers by running the thumb or finger forward over the crown, against the direction in which the feathers lie. In the late summer and early fall, when most young birds are just beginning the pneumaticization process, it is good to start at the rear of the skull and work up towards the crown. Later in the fall, the parting should be made higher up on

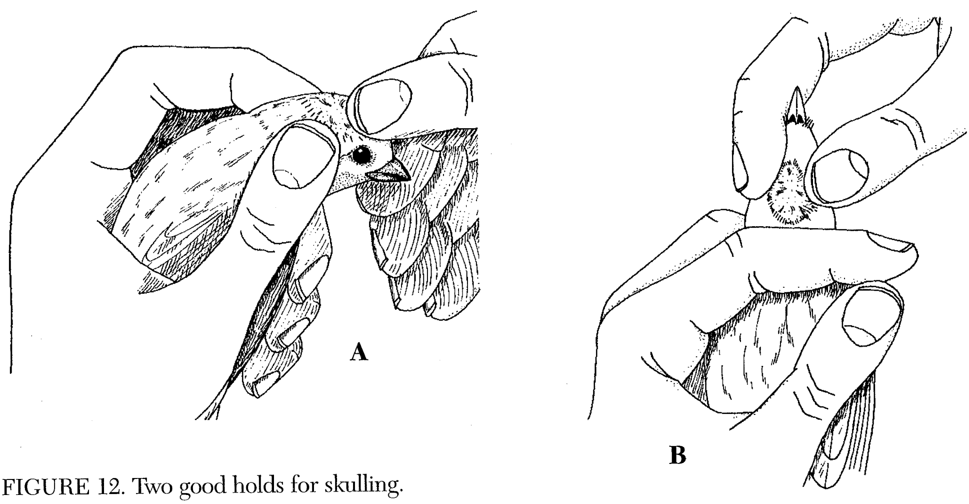


FIGURE 12. Two good holds for skulling.

the crown (in the areas just above and behind the eyes) where the last unpneumaticized windows usually occur (Fig. 11**D**). With thick-skinned birds (see below), an opening made on the side of the head or neck (where the skin is more transparent) and moved up to the crown will often improve viewing conditions. When the skulling process is finished, the feathers can be smoothed back into place.

Once an opening between the feathers has been created, gently move the skin around so that a larger area of the skull can be examined. If the skin is still dry, wetting it will make it more transparent. Hold the bird under a fairly strong light bulb or in shaded or indirect sunlight to achieve the best lighting conditions for viewing the skull. Direct and strong lighting may reflect off the skin too much, hindering the viewing process. It often is helpful to move the head around as different angles of light can make it easier to see through the skin. Finally, banders may find it helpful to look through a mounted loupe or other magnifying device.

Look for entirely pinkish skulls in very young birds (Fig. 11**A**; June-July), for contrasts between the pneumaticized and large, unpneumaticized areas (Fig. 11**B**-**C**; most frequently in August to October), for smaller windows (Fig. 11**D**; November-January or later), or for the entirely grayish or pinkish-gray skulls, with white dots, indicating complete pneumaticization (Fig. 11**E**; all months). Small windows (Fig. 11**D**) should be looked for carefully at all times of the year, indicating a first-year bird in late winter to early summer or, in some species, an adult at any time of the year. Care should be taken in separating young birds with very little pneumaticization (Fig. 11**A**) from adults with complete pneumaticization (Fig. 11**E**). With experience, the difference in color, and the presence of white dots on the completed skull, are readily detected.

Any of several factors, however, can make it difficult or impossible to see the pneumaticization of the skull. In larger passerines or those with large bills (notably the corvids, grosbeaks, and icterids), the skin of the head often is too thick to adequately discern the pneumaticization pattern, particularly when no contrasts can be seen. Birds of northern populations will increase the amount of fat in the skin during the winter, which can further hinder visibility, and thick, dark, or otherwise opaque skin occasionally is found on individuals of all species. The skin of molting birds becomes flaked and less transparent, and injury-related blood hemorrhaging sometimes is encountered which can partially or totally obscure the pneumaticization pattern or cause the skull to appear unpneumaticized. Finally, in some birds, the demarcation line between pneumaticized areas and windows is very subtle and only discernible after close scrutiny.

Despite these pitfalls, the pattern of skull pneumaticization of most individuals is readily seen and provides a reliable means of ageing passerines during at least the fall. As with all ageing techniques, the information provided by skulling should always be combined with all other ageing criteria for accurate determinations.

MOLT

A complete understanding of the timing, sequence, and extent of molts is an essential aspect of the accurate ageing and sexing of birds in the hand. Several good summaries are available on the subject of bird molt (see Dwight 1900a, 1902, 1907; Watson 1963; Palmer 1972; Payne 1972; Ginn & Melville 1983; Jenni & Winkler 1994). Readers should consult these treatments for an overall understanding of the mechanisms and finer details of bird molt. Here, molt is summarized and discussed as it pertains to ageing and sexing near-passerines and passerines in the hand.

Molt and Plumage Terminology

Molt and plumage terminology currently is a debated topic, with different nomenclatural systems being popular in Europe and North America, and disagreement within both continents concerning the best terminology to use (Humphrey & Parkes 1959, 1963; Stresemann 1963; Amadon 1966; Wilds 1989; Willoughby 1991, 1992; Rohwer *et al.* 1992; Jenni & Winkler 1994; Thompson & Leu 1994; Parkes 1995a). Much of this confusion stems from the complex and variable nature of the molts themselves, as no system is without flaws. In this guide the terminology of Humphrey and Parkes (1959, 1963), with modifications suggested by Rohwer *et al.* (1992) and Thompson & Leu (1994), is followed. This system attempts to standardize the terminology of homologous molts between age groups or related species, rather than basing them on the terms of the breeding season or time of the year, thus promoting understanding of the evolutions of molts in a context independent from other annual events. It is important to note, however, that annual events such as seasons and breeding phenologies often need to be considered in determining homologies.

The Humphrey-Parkes (H-P) system has distinct advantages over traditional terminologies in the tropics, in the southern hemisphere, and among certain non-passerines, where molt strategies are complex and can be unrelated to breeding or time of year. In north temperate latitudes and among passerines, however, the H-P system has a high rate of correspondence with traditional systems, which explains the reluctance of some ornithologists to adopt it. In the following sections, widely used traditional terminology is mentioned along with H-P terms, indicating corresponding nomenclature *in the majority of cases.* This is not to imply that the terms themselves are homologous. It also should be emphasized that, for most birds, our understanding and determination of molt homologies is still in its infancy (Jenni & Winkler 1994). It is hoped that the adoption of the H-P system in this guide and elsewhere will motivate researchers to determine molt homologies among birds, and to further refine and designate the H-P terminology, both generally and on a species-specific basis.

Prebasic Molt

All species treated in this guide have a molt strategy that includes a single "predominant" replacement of feathers during the year. In the majority of north-temperate birds this molting period occurs just after the breeding season (whether or not an individual breeds), and is termed the **prebasic molt.** In birds that have reached their maximum (adult) plumage stage, it is referred to as the "definitive" or **adult prebasic molt,** and in juveniles (birds in **juvenal plumage;** see below) it is referred to as the **first prebasic molt.** If plumages or other criteria allow for the identification of molts during the second and subsequent years, these can be termed the **second prebasic molt, third prebasic molt,** etc. Most species treated in this guide reach definitive plumage after their second prebasic molt, such that all subsequent prebasic molts necessarily are termed adult prebasic molts. In traditional terminology, the "postbreeding molt" or "postnuptial molt" often corresponds with the adult prebasic molt, and the "postjuvenal molt" often corresponds with the first prebasic molt.

The first prebasic molt results in the **first-basic plumage** (often corresponding with the "first-winter" or "first non-breeding" plumage of traditional terminology), and the adult prebasic molt results in the definitive- or **adult-basic plumage** (often corresponding with the "adult-non-breeding" or "adult-winter" plumages of traditional terminology). Note that, in this guide, the traditional term "adult" continues to be used as a synonym of the term "definitive" of the H-P system, especially when referring to molts or individual feathers, because it is felt that the reasons given by Humphrey and Parkes (1959) for using "definitive" over "adult", while perhaps a bit more than just semantic, do not justify the disruption of established terminology.

In certain species, adult feathers and definitive plumage correspond with first-basic feathers and plumage, if these are replaced during the first prebasic molt and are indistinguishable from the feathers of subsequent plumages. Alternatively, if the **second-** or **third-basic plumages** or feathers (resulting from the second- or third-prebasic molts) can be separated from definitive plumages (as in many non-passerines), these terms are used instead of "definitive" or "adult". If these plumages and molts cannot be separated from subsequent plumages and molts, the term "adult" is used.

In most north-temperate passerines and near-passerines, the first and adult prebasic molts usually take place from July to September (occasionally as early as May and as late as December or later), just after the breeding season. In these cases the molt usually occurs on the summer grounds and often in the breeding territory, but sometimes takes place during fall migration or on the winter grounds. It can also start on the summer grounds, be **suspended** during fall migration, and be completed on the winter grounds. In some species, particularly among the near-passerines, the prebasic molts can be **protracted** or suspended over winter, completing during the spring, just before the next breeding season. Protracted and suspended prebasic molts, involving the continual replacement of a single generation of feathers, should not be confused with strategies that include a prealternate molt (see below). In most of the species treated in this guide, the first and adult prebasic molts differ in extent, timing, and/or locality. These differences result in many useful criteria for ageing.

With one or two exceptions, the adult prebasic molt in passerines is **"complete"** (includes all body and flight feathers), whereas in juveniles it most often is less than complete. In some near-passerine families (*e.g.*, doves, owls, nightjars, and woodpeckers), the adult prebasic molt can be less than complete, including most (if not all) body feathers but not all flight feathers. In the complete molt (Fig. 13) of all North American passerines and most near-passerines, replacement of flight feathers of the wing proceeds in a **typical sequence** (the "basic sequence" of Ginn & Melville 1983), beginning with the tertials and the innermost primaries (p1-p4; Fig. 13). Among the primaries, the sequence of replacement proceeds **distally,** toward the outermost primary (p9 or p10; Fig. 13). After the tertials have been renewed, the remainder of the secondaries are replaced, beginning with the outermost (s1), and proceeding **proximally** through the middle secondaries and toward the body (Fig. 13). Thus, the numbering of primaries and secondaries (see also page 1, Fig. 1) follows the typical sequence of feather replacement.

Usually, s6 is the last flight feather replaced during a complete molt, although sometimes the replacement of s6 can precede that of s5. Replacement of the rectrices occurs during molt of the primaries and secondaries, usually beginning with the central rectrices (r1) and often proceeding **centrifugally** (from the inside outwards in both directions), toward the outermost rectrices (r5 or r6). In the blackbirds and meadowlarks, it proceeds **centripetally,** from the outer to the inner rectrices (K.C. Parkes 1972, pers. comm.). In many species and individuals, especially among the near-passerines, the rectrices may not be replaced in sequence; often, in these cases, the outermost rectrices will be the next pair renewed after the central rectrices. Replacement of

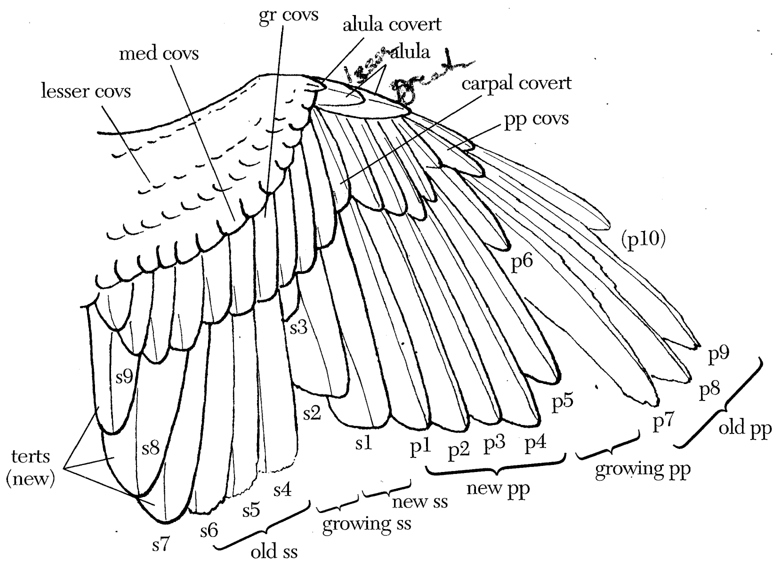


FIGURE 13. An example of a wing during complete molt in typical sequence, including wing feather terminology (see also Fig. 1). The marginal coverts are here termed "lesser coverts" following widespread current usage, despite the fact that, historically, lesser coverts referred to a separate tract (Winkler & Jenni 1996).

all wing feathers normally occurs symmetrically, the same feathers being replaced on both wings at the same time, whereas rectrices can be replaced symmetrically or asymmetrically.

In some near-passerines, notably among the cuckoos, owls, and kingfishers, the replacement of primaries and secondaries can proceed in different directions from several molt centers along the wing. Replacement of the primaries in many owls, for example, proceeds centrifugally from p6 or p7, at the same time or later proceeding distally from p1, while two or more centers can also exist among the secondaries (see p. 67). In cuckoos, the secondaries are replaced proximally from s6 to s9, and **centripetally** (inward from the outsides) within s1 to s5. In this guide, irregular flight-feather replacement sequences among near-passerines are summarized in the family sections preceding the species accounts.

In contrast to the adults, juveniles of the majority of North American passerine and near-passerine species normally do not have a complete first prebasic molt. In many species, only the body feathers, none, some, or all of the wing coverts, and perhaps 1-3 tertials and the central rectrices are replaced during a **partial** first prebasic molt. In other species, some or all of the primaries, outer secondaries, and outer rectrices can be replaced during **incomplete** molts. The juvenal primary coverts often are the last feathers replaced during incomplete, first prebasic or subsequent molts. Earlier broods and southern populations of a species often molt more feathers than later broods and northern populations, and this can vary overall from year to year.

During partial first prebasic molts, a variable number of lesser, median, and greater coverts can be replaced, usually in a fairly predictable sequence, beginning with the lesser coverts and inner feathers and ending with the greater coverts and outer feathers (see p. 207 and Fig. 133 for details). When most or all of these coverts have been replaced, one or more tertials (usually beginning with s8 but sometimes beginning with s9 or s7) and one or two central rectrices can often be replaced. Depending on the length of the breeding season, extent of the geographic range, and other factors, the amount of intraspecific variation in the replacement of these feathers can be limited or quite extensive.

Incomplete first prebasic molts also are quite variable, both among and within species. In some species, this variation ranges from none to all of the flight feathers, depending on the individual or population. In many species, incomplete molts result when the typical flight-feather replacement sequence (Fig. 13) is **arrested,** such that consecutive, juvenal outer primaries (among p5-p10) and/or consecutive, juvenal middle secondaries (among s2-s6) are retained (see Fig. 137). Certain near-passerines may also arrest irregular replacement sequences during incomplete molts (see p. 39, p. 67, and p. 163).

Another pattern found in many passerines and some near-passerines that have incomplete first prebasic molts is called the **eccentric** replacement pattern (see pp. 208-209, Fig. 136). During these molts, replacement of the primaries starts not at p1 but in the center, most commonly among p3-p7, and proceeds distally. After the tertials have been renewed, replacement of the secondaries also begins in the center, commonly among s2-s5, and proceeds proximally to the tertials. In some cases, eccentric replacement can be arrested such that, *e.g.*, just p5-p7, the tertials, and s3-s5 are replaced; but more often, once eccentric replacement begins, it proceeds through the outermost primary and s6. Note that, in this guide, the term "eccentric" refers only to the above-specified pattern of replacement which, contrary to the name, has been found quite regularly in North American passerines (Pyle in press). In Europe, other irregular replacement patterns commencing in the center of the wing may also be termed eccentric (Jenni & Winkler 1994). Although the term "eccentric" implies that the pattern is atypical, when in actuality it appears to be regular among North American birds, it is adopted here, as opposed to a newly defined term. Standard molt terminologies should strive to use fewer rather than more terms than currently exist. It should also be noted that the term "eccentric" describes a replacement pattern rather than a molting period, and can thus be used in conjunction with standard terminology on the molts themselves. Therefore, such expressions as "eccentric replacement patterns" or "eccentric sequences" are used instead of the term "eccentric molt," as employed by Jenni and Winkler (1994).

Occasional birds showing an otherwise partial molt can also replace s6 (occasionally s5-s6 and rarely s4-s6), after all three tertials have been renewed (see Fig. 133**E**). This replacement of middle secondaries might represent either an extension of the tertial replacement or the tail end of the mechanism resulting in eccentric replacement patterns.

Certain juvenile passerines (notably among swallows) and near-passerines (notably among cuckoos and hummingbirds) normally have a complete first prebasic molt. These, however, often occur during different months or at different localities than the adult prebasic molts of the same species. Complete first prebasic molts generally occur later in the fall or winter than adult prebasic molts and often take place partially or entirely on the winter grounds. This can vary substantially, however, depending on conditions during the breeding season (see Phillips 1951). In only a few North American passerines (*e.g.*, Bushtit and Wrentit) do complete first and adult prebasic molts occur during the same months and in the same general location.

Almost all ageing criteria related to variation in flight-feather color, shape, and wear (see the following sections) are based on differences between the first and adult prebasic molts. Furthermore, species where the first prebasic molt is partial, any bird showing symmetrical and sequential primary, outer secondary, or outer rectrix molt during June to September, or showing evidence of a complete molt, can be reliably aged as an adult. With consideration of the flight feathers being replaced, this often is reliable in species with incomplete first prebasic molts, as well. Late in the molting period, a complete molt can still be detected by the condition of s6, the last flight feather normally replaced. Check for the presence of a sheath or see if this feather is still growing (in most species it should not be shorter than both s7 and s5 when fully grown).

The boundaries between replaced and retained feathers during partial and incomplete molts are termed **molt limits.** Because first and adult prebasic molts usually differ in extent, the presence and/or placement of molt limits are extremely useful for separating first-year birds from adults. See the expanded section on molt limits in this guide (p. 39, p. 67, p. 163, and p. 206, and Figs. 25, 48, 62, 65-66, 71, 121-122, and 133-137), Mulvihill (1993), Jenni and Winkler (1994), Pyle (1995a, 1997b, 1997c, in press), Pyle *et al.* (1997), and Pyle and Howell (1995) for details on variation in partial and incomplete molts among birds, and for the use of molt limits in ageing.

Presupplemental Molt

In certain passerines an extra molt of some or all body feathers (and occasionally some wing coverts) has been documented in juveniles in summer, prior to the occurrence of the first prebasic molt (which includes some or all of these feathers again) in the fall. First pointed out by Sutton (1935a) in the Northern Cardinal and other sparrows, this molt has been fully documented in certain species only recently, by Rohwer (1986) and Willoughby (1986), and defined as a **presupplemental molt** by Thompson and Leu (1994). Thus far, presupplemental molts have been documented in 16 species of North American passerines, and are to be looked for in many others, as well.

Depending on the species, the presupplemental molt can either overlap with the first prebasic molt or occur during a discrete time period (Thompson & Leu 1994). When occurring in separate time periods, the presupplemental molt often occurs before the fall migration, followed by migration, and then the first prebasic molt on the winter grounds. All presupplemental molts thus far documented are followed by first prebasic molts that are incomplete or complete in most or all individuals. Many species with presupplemental molts show eccentric replacement patterns during the first prebasic molt.

The presupplemental molt results in the **supplemental plumage.** This plumage can resemble that of the juvenile but more often acquires characters of the first-basic plumage. As with juvenal plumage, males and females tend to be similar in supplemental plumage, even in species that acquire sex-specific plumage characters during the first prebasic molt.

Humphrey and Parkes (1959) originally defined presupplemental molts only as extra molts inserted within a two-plumage cycle of adults, referencing in particular the molts of waterfowl. Here, the term is expanded to include these partial molts of juveniles prior to the first prebasic molt, whether or not it occurs within a single-plumage cycle or a two-plumage cycle (see Thompson & Leu 1994).

Prealternate Molt

In many species, including most of the near-passerines treated in this guide, the prebasic molt is the only molt that occurs annually; thus, breeding occurs in basic plumage. In many passerines (approximately 161 of the 303 species treated here), however, there is a second molt of some or all body plumage (and occasionally flight feathers) that occurs prior to the next prebasic molt. This second molt is called the **prealternate molt,** and it occurs in both first-year birds (**first prealternate molt**) and in adults (definitive or **adult prealternate molt**). In north temperate latitudes, the prealternate molt corresponds with the first or adult "prebreeding molt" or "prenuptial molt" of traditional terminology.

In the species treated in this guide, all prealternate molts occur in the winter and spring, typically from January to April, and occasionally as early as November and as late as early June. The timing of prealternate molts on the tropical winter grounds can often include reduced and intensified periods (see Rohwer & Manning 1990, Lefebvre *et al.* 1992, Cramp & Perrins 1994b); more study is needed on this. During prealternate molts, note that at least some feathers are replaced for a second time during the molt cycle, as opposed to protracted and suspended prebasic molts (which can also occur in the winter and spring), in which all feathers are being replaced for the first time since the previous breeding season. Many first-year birds, however, can replace both juvenal and first-basic feathers during the first prealternate molt.

As with prebasic molts, the extent of the prealternate molt varies substantially, both among and within species. In many species, the prealternate molt of first-year males is more extensive than in the other age/sex groups. Some species may replace just a few head or throat feathers during prealternate molts, while others can replace all body plumage, the wing coverts, and some or even all (in one species, the Bobolink) flight feathers during prealternate molts. In migratory species, the prealternate molts take place primarily on the winter grounds, although individuals of certain species may still be molting during spring migration and even after they reach their breeding grounds. For some (possibly many) species, the prealternate molt may be an extended, overwinter process, albeit with concentrated periods of molting in the early spring. In some species, a limited number of head feathers may be replaced almost continually, or at least more than once, following prebasic molts (*e.g.*, see Willoughby 1991). More study is needed on this replacement pattern, and how best to apply molt terminology in such cases.

The most important aspect of the prealternate molt for ageing and sexing is the resulting change in plumage that occurs. The prealternate molts produce the **first-alternate** and definitive- or **adult-alternate** plumages, corresponding to the first- and adult-, "breeding", "summer", or "nuptial" plumages of traditional terminology. Note that, in this guide, birds with several generations of feathers are considered to be in a single "plumage" (Rohwer et al. 1992) rather than several plumages at once (Humphrey & Parks 1959, Palmer 1970, Willoughby 1992); thus, a bird in first-alternate plumage can have up to three generations of feathers, juvenal, first basic, and first alternate.

In many cases, the alternate plumages of males differ from their basic plumages, whereas in females, both plumages often are similar. In species with more extensive prealternate molts, the timing of plumage-related ageing and sexing criteria can depend on the timing of the prealternate molt, and the molt limits among the wing coverts and flight feathers produced by the first prebasic molt can be affected. In the spring and summer, care must be taken to separate first-year birds (some of which can show three generations of feathers) from adults (some of which can show molt limits) in species with extensive prealternate molts (see p. 208, Fig. 135). Typically, the first-alternate plumage (of males, at least) is duller then the adult-alternate plumage in these species.

Continued Words of Caution and Encouragement

Although we have made some progress since the first edition of this guide was published, when much of the information on molt was based on Dwight (1900a) and the accounts in Bent

(1942-1968), we still have a lot to learn about molt in North American birds. Much of the information presented in the species accounts will probably need to be updated, once thorough studies of the molts in each species are conducted. Even in Europe, where molt studies are comparatively advanced (*e.g.*, see Cramp 1985-1992, Cramp & Perrins 1993-1994b, and Jenni & Winkler 1994), there is still much to learn. The molt-limit surveys for this guide (Pyle 1995, 1997b, 1997c, in press; Pyle *et al.* 1997; Pyle & Howell 1995) concentrated on flight feathers and wing coverts, whereas detailed studies including all feathers (e.g., Rohwer 1986; Willoughby 1986, 1991, unpublished ms.; Rohwer & Manning 1990; Thompson 1991b, Young 1991, Mulvihill & Winstead 1997) are needed to determine molt homologies. Users of this guide are strongly encouraged to pay close attention to all aspects of passerine and near-passerine molt, and to publish any new or conflicting information found.

PLUMAGE

The most apparent method for determining both the age and the sex of many birds is by examining the plumage characters. Among North American near-passerines and passerines, plumage patterns vary widely according to age and sex. In some species the sexes differ markedly but the age classes do not, in others the plumage is similar in the sexes but varies with age. Many species show three or four different plumages, one for each age/sex class, while others have similar plumages regardless of age or sex. Furthermore, plumage patterns may or may not change during any or all of the various molts. One only has to look at the different plumages displayed by one passerine subfamily, the wood-warblers, to realize how complex and varying these patterns and sequences can be.

In this guide, a large part of the age and/or sex portions of the species accounts are comprised of plumage-related characters. Criteria are given only when clearly defined and consistent, age/sex-related plumage patterns occur. However, it is important that users understand the variable nature of plumage (see Fig. 3). Variation occurs both within each defined age/sex plumage association, and among the different age and sex classes, even in species with no clearly defined plumage patterns. These variations can either hinder or assist, respectively, the ageing and sexing process.

In species otherwise showing little plumage variation, males and adults often exhibit slightly brighter and more contrasting plumages than females and first-year birds. The extent to which this plumage variation occurs, itself varies substantially among the species. In many cases, when either the age or the sex is known from other criteria, the relative brightness of the plumage can assist in determining the other class. Bright or well-marked immatures likely are males, for instance, and bright females could likely be adults. The same might work in reverse, for particularly dull or indistinctly marked birds. In many cases, a small to moderate proportion of extremes may be accurately aged or sexed (see Fig. 3), especially if one is familiar with the species. See Heydweiller (1936) for a discussion of this in the American Tree Sparrow (p. 549), a species which shows no definitive age/sex plumage associations.

On the other hand, plumage variation within each age/sex class often is such that intermediates between the classes occur (see Fig. 3). In these cases it is again best to incorporate other ageing and sexing information. When plumage overlap exists, it is most often between young males and adult females, and in many species this is the normal pattern (see Rohwer *et al.* 1980). In these cases, knowing the age can result in accurate sexing, and vice versa. Plumage exceptions can also occur, even in species that normally show no overlap between age/sex classes. In many cases these are senescent females which suddenly may acquire male-like plumage (see Goodpasture 1972, Baumgartner 1986a). Males with plumage typical of females, or even birds with both male and female characters (*e.g.*, see Patten 1993) may also be encountered. When ageing and/or sexing, users are encouraged always to confirm plumage-based determinations with all other available criteria.

Finally, it should be noted that plumages, and thus many plumage-related ageing and sexing criteria, change during periods of molt. These periods can be quite extended, and may vary substantially with different individuals of the same species. Generally, the outgoing plumage will be more instructive for ageing than the incoming plumage. Users should always consider how the molt might affect the reliability of the plumage criteria when ageing and sexing birds in active molt.

Plumage changes may also occur when feathers are replaced adventitiously, especially in brightly-colored males. In tanagers, certain buntings, and certain orioles, for instance, adventitiously replaced feathers during non-molting periods can show color characters of juveniles or females (see accounts for these species), even by males in adult plumage, and this can confuse the age/sex process. This may be the rule in all species; more study is needed on this.

JUVENILES AND SOFT PARTS

The first plumage (subsequent to the natal down) acquired by the nestling and retained by the juvenile is called the **juvenal plumage.** The body feathers of this plumage are replaced during the presupplemental or first prebasic molt, which often occurs within three months of fledging, and usually takes place on the breeding grounds. Because juveniles are aged readily by many criteria and often are indistinguishable to sex, their treatment in the species accounts usually is restricted to a brief description of the differences between juvenal and subsequent plumages, and to the months of the year in which they usually are found.

Ageing Juveniles

In many North American near-passerines and passerines, the juvenal plumage differs quite substantially from subsequent plumages, allowing easy separation of juveniles from adults at the same time of year. In these cases, the juvenal plumage often is more streaked or spotted than that of the adult, will often have wing bars where the adult has none, and is displayed on more loosely textured contour feathers (Fig. 14). In certain owls, the juvenal plumage resembles a second downy stage. In species where the juvenal plumage otherwise resembles that of the adult (*e.g.*, corvids, parids, gnatcatchers, and most mimids), feather structure differences can often (but not always) be used for ageing, and are most evident in the feathers of the nape, back, and undertail coverts.

In addition, many nestling characters are evident in juveniles, and these can be helpful in separating them from adults. Most of these are more apparent through the early stages of juvenal plumage, becoming less so as the juvenile ages. Some of these characters remain useful for separating first-year birds from adults well after the first prebasic molt.

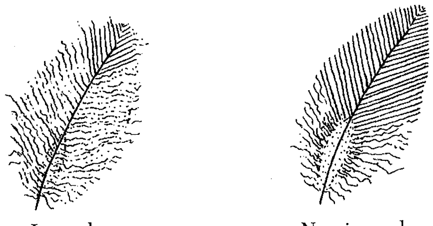


FIGURE 14. Juvenal and non-juvenal body feathers. The differences are most apparent with the undertail coverts and feathers of the nape and back.

The feathers of the tibiotarsus (leg) and underwing develop later in juveniles than other feathers, hence, these areas often are devoid of feathers for a short time after the bird has fledged. The legs of nestlings and recently-fledged juveniles also are more swollen and fleshier than those of adults, and the bill, and sometimes the wing, can take up to a month or more after fledging to reach full size. The gape of nestlings is swollen and more brightly colored than it is in adults, and these traits often carry over in postfledging juveniles. The inside of the mouth, including the "roof" (upper mandible lining) also is brighter in tone and/or paler in hue in juveniles than in adults (Fig. 15). In certain species this latter feature often is useful well after the first prebasic molt, *e.g.*, in corvids (see also Hardy 1973, Heinrich & Marzluff 1992), parids, thrushes, and vireos. In general, more study is needed on changes in the color of the roof of the mouth in these and other species.

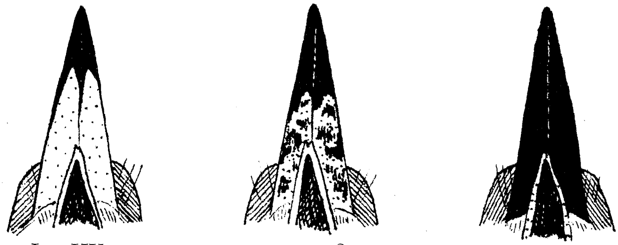


FIGURE 15. The roof of the mouth (upper mandible lining) color by age in birds. Differences have been noted in at least some species of corvids (see also Fig. 193), parids, thrushes and vireos. More study is needed.

In turn, several characters useful for separating first-year birds from adults can be applied to juveniles. Molt-related criteria such as the occurrence of molting flight feathers (Fig. 13), the differences in shape and wear of juvenal flight feathers (Figs. 16-18), and the presence of growth bars (Fig. 19) are applicable. In particular, postbreeding adults, especially first-summer birds, show very worn flight feathers while those of juveniles are much fresher. Furthermore, the pneumaticization process is just beginning in juveniles (Fig. 11**A**) whereas it should be complete (or nearly so) in adults (Fig. 11**D-E**). Finally, the eye color of juveniles usually is duller, browner, or grayer than is found in adults, especially in those species with brightly-colored eyes. In some species this difference also can be useful for separating first-year birds from adults well into the winter (see Wood & Wood 1973).

In summary, bird handlers should have no trouble with the separation of juveniles from adults during the summer months, when all criteria are used.

Sexing Juveniles

In most of the species treated in this guide, birds in juvenal plumage cannot be reliably sexed by in-hand criteria alone. Although juvenile males often average slightly brighter than juvenile females, only in a few species, where distinctive differences occur in the color pattern of the flight feathers, can juveniles be reliably sexed by plumage. These differences are noted in the species accounts. The only other potential method is by measurements, which (in most species) can probably be used to sex larger males only. Juveniles with measurements indicative of females may actually be males that have not completed growth. When attempting to sex juveniles by wing length note that, in most species, the length will average 1-3 mm shorter than on birds of the same sex with adult primaries. Thus, the wing length of most juveniles should fall in the bottom half of the ranges for each sex, once the primaries are fully grown. The best method for sexing juveniles may entail the use of a combination of characters, accompanied by the realization that only a small proportion of birds can be reliably sexed (*cf* Borras *et al.* 1993).

FEATHER SHAPE AND WEAR

In both near-passerines and passerines in which the first prebasic molt is partial or incomplete, the shape and the amount of wear and fadedness of certain flight feathers or primary coverts can serve as very useful clues for ageing. Juvenal feathers typically are thinner and more tapered than adult feathers and may often be of a less durable quality, resulting in their becoming abraded and worn at a quicker pace. These differences are particularly noticeable in first-year birds that have an incomplete first prebasic molt, resulting in the juxtaposition of retained and replaced flight feathers. In using feather shape and wear for ageing, it is important to take into account both the molt sequences and the time of year.

Feather Shape

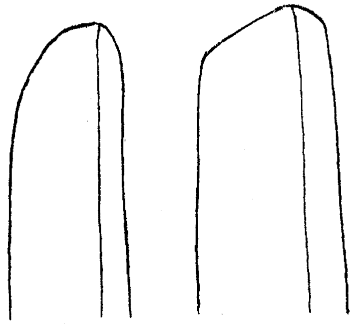


FIGURE 16. An example of the shape of the outer rectrices (r4-r6) by age in birds. See also Figure 139.

The shape of the rectrices has long been used as an ageing criterion in both near-passerines and passerines that retain juvenal rectrices during the first prebasic molt. The outer two or three rectrices (r4-r6) usually show the greatest age-specific differences, being narrower and having more tapered inner webs in juvenal feathers, and being broader and more truncate in adults (Fig. 16; see also Fig. 139). Note that the presence (adult) or absence (juvenal) of a corner to the inner web, and the angle at which the outer web descends from the tip often are the most apparent differences (see Meigs *et al.* 1983, Collier & Wallace 1989, Weinberg & Roth 1994, Donovan & Stanley 1995). North American families in which outer rectrix shape is particularly useful for ageing include the cuckoos, nightjars, trogons, corvids, chickadees, thrushes, wood-warblers, orioles, and fringillids. It is useful to varying degrees with many other species, as well.

In most of these species, however, a significant percentage of individuals will show intermediate rectrix shapes, and should not be reliably aged, especially without experience with this feature in the species at hand. Caution is advised with late spring and summer birds, as the increasing degrees of wear found in both juvenal and adult feathers can obscure the differences between the two age groups. Reliable ageing also becomes more difficult with birds that have wet or otherwise displaced rectrices, as can often happen during the capture and confinement of birds for banding. In most species, only obvious examples should be reliably aged by rectrix shape alone. Information on rectrix shape is included in most species accounts, and users of this guide are encouraged to become familiar with its usefulness for ageing.

The shape of the outer primaries (Fig. 17; see also Fig. 140) and primary coverts (Fig. 18; see also Fig. 138) also are useful for ageing certain species with partial or incomplete prebasic molts. Like the rectrices, the juvenal primaries and primary coverts tend to be narrower and more tapered than those of adults. These differences are most easily seen in the outermost feathers (p6-p9 or p7-p10 and their corresponding primary coverts).

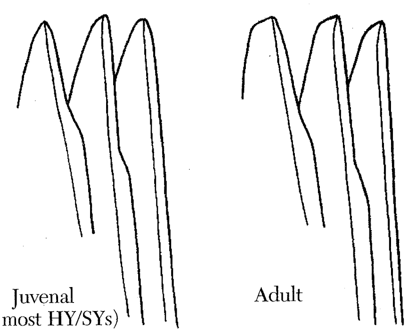


FIGURE 17. An example of the shape of the outer primaries (p6-p9) by age in birds. See also Figure 140.

FIGURE 18. Example of the shape of the outer primary coverts by age in birds. See also Figure 138.

Feather Wear

As with feather shape, differences in the amount of wear between juvenal and adult rectrices, primaries, and primary coverts can provide useful clues for ageing. "Wear" can be a function of both abrasion to the feather tips, and general degradation due to, *e.g.*, exposure to solar radiation. These differences are related both to the age of the feathers and to the fact that juvenal feathers wear more quickly than those of adults. However, feather wear also varies with the habits of the species and individuals, the amount of exposure a feather receives, and the extent and timing of molts. All of these factors need to be considered when correlating feather wear with age.

In the early fall, after the prebasic molt, retained juvenal feathers usually are 1-3 months older than corresponding adult feathers, are of a less durable quality than the feathers of adults, and usually show signs of wear. Look for small nicks in the outer webs and less glossiness, especially in the rectrices and outer primaries. Adult feathers at this time should be quite glossy and contain no nicks. On first-year birds that have replaced some but not all flight feathers, contrasts in wear between the old and the new feathers should be visible.

By spring the juvenal feathers are considerably worn and abraded while those of adults usually are only moderately so (see Figs. 138 & 139**A**), and should still show some glossiness. By mid summer, when birds are well into the breeding season, the feathers of both first-year and adult birds become very abraded, such that it becomes increasingly difficult to distinguish them. This is especially true of breeding females, males that display on open perches, and, in general, all birds that reside in harsh (*e.g.*, xeric or saltmarsh) vegetation. At this time, however, they will be easy to distinguish from the fresh feathers of newly fledged juveniles.

With the primary coverts, it often is useful to compare them with the adjacent, greater (secondary) coverts. First-year birds with partial or incomplete molts will almost always retain the primary coverts and replace some or all of the greater coverts. Next to the slightly fresher and glossier greater coverts, therefore, the primary coverts will appear contrastingly faded and worn, and will usually lack pale edges (see pp. 209-210, Figs. 136-138 for more information). Note, however, that the primary coverts are often duller in coloration than the greater coverts, in both age groups, such that attention must be paid to the degree of wear.

The combination of feather shape and wear has proven quite useful for ageing North American near-passerines and passerines that have a less than complete first prebasic molt, especially in the spring when skulling and other plumage-related criteria usually become less valuable. Unless one is quite experienced with these characters in a particular species or group, however, they should not be relied upon alone. They are best used in combination with all other ageing criteria, and with particular attention given to the timing, sequence, and extent of molts in both first-year and adult birds.

GROWTH BARS

Growth bars (Fig. 19) are caused by small structural differences in the flight feathers, resulting from stress or inconsistencies in a bird's diet when the feathers were growing. Major diet deficiencies, for example, cause actual breaks in the feather vane, referred to as fault bars (Fig. 19). Growth bars are easiest to see on the rectrices and, to a lesser extent, the secondaries, and best are viewed when the feathers are held at an angle and with a strong source of backlighting. Both juvenal and adult feathers can develop growth bars although they probably are more common in juveniles due to diet deficiencies during the nestling period.

Growth bars can be used only in species with partial or incomplete first prebasic molts, and the pattern of the growth bars is the best clue to the age of a bird. A pattern as shown in Figure 18**A** indicates that the rectrices have grown simultaneously, which always is the case with nestlings. The pattern of Figure 18**B** is typical of rectrices which did not grow simultaneously, usually the case during the adult prebasic molt. Distinguishing these two pattern types can assist with ageing.

Several problems occur with this ageing technique, however. The growth bars often can be difficult or impossible to see, especially as the feathers become older and more worn. Adults (especially among owls and blackbirds) will sometimes replace rectrices simultaneously during the prebasic molt, resulting in a growth bar pattern typical of juveniles. Birds that have lost their tails accidentally will also replace rectrices simultaneously, and many species may molt some or all of

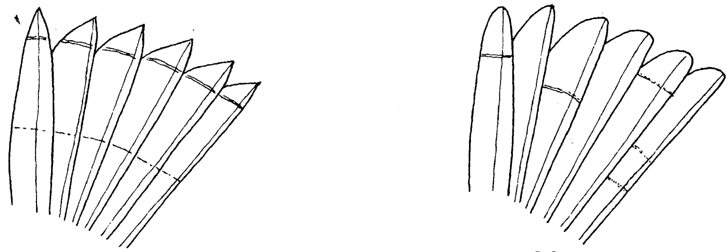


FIGURE 19. Patterns of growth bars in juvenal and adult rectrices. Breaks in the feather vein, such as the upper bar on the juvenal rectrices, are known as fault bars.

their rectrices during the first prebasic molt, producing an adult-like pattern in first-year birds. Except, perhaps, in owls, where they can be more distinct due to the structure of the feathers, growth bars should be used only to support other ageing criteria. For more information on growth bars see Wood (1950), Grubb (1991), and Svensson (1992).

BREEDING CHARACTERS

The best method for sexing similarly plumaged, adult passerines and some near-passerines during the breeding season is by the presence or absence of the breeding characters (Mason 1938): The cloacal protuberance (**CP**) and the brood patch (**BP**). All North American passerines develop these characters, at least partially, and most are reliably sexed by them during the late spring and summer months. Note that these characters are not developed by juveniles or birds in their first summer. As the user gains experience, cloacal protuberances and brood patches can be detected earlier and later in the season.

Cloacal Protuberance

In order to store sperm and to assist with copulation, external cloacal protuberances are developed by male passerines during the breeding season. They usually begin to develop early in the spring, reaching their peak size 3-5 weeks later, around the time the eggs are laid. Depending on the species and the number of clutches attempted during the breeding season, cloacal protuberances will recede from mid to late summer or later. Although the cloacal region in females will sometimes swell slightly or show a small protuberance, it rarely approaches the size found in males. During the breeding season, the presence of a distinct protuberance can be used to reliably sex males of all North American passerines except one, the Wrentit (p. 407). Among near-passerines, an external cloacal protuberance does not develop nearly as distinctly as in passerines, although it is possible that subtle, sex-specific differences in the shapes of the cloacal regions may occur. More study is needed (see the family accounts for the near-passerines).

To view the cloacal protuberance, simply blow apart the feathers in the region of the vent. Figure 20 shows a cloacal protuberance at the height of its development, as viewed from above. Figure 21 illustrates the sequence with which it develops and recedes, and a typical profile displayed by female birds during the breeding season. The shape of the protuberance, however, can be somewhat variable (see Wolfson 1952, Salt 1954), and non-breeding males may not always develop one. When the female is most swollen in this area, she usually will have a brood patch as well (see below). After a little experience with the shape of the cloacal region during the nesting season, bird handlers should have no problem separating breeding males from females.

In the species accounts, the cloacal protuberance and brood patch often are listed together, followed by the months in which they are most easily used for sexing (see p. 32). In a given population, cloacal protuberances may be developed 10-15 days earlier than brood patches and recede up to a month earlier; this should be considered when using the given month ranges.

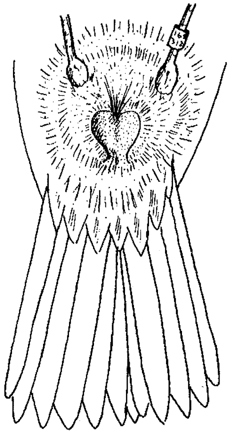


FIGURE 20. A cloacal protuberance at its peak in male passerines.

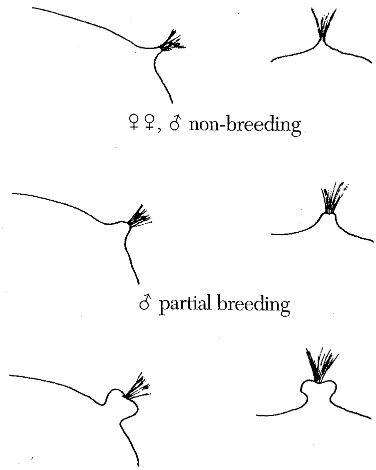


FIGURE 21. Profiles of passerine cloacal protuberances in different breeding conditions.

Males probably should be sexed by cloacal protuberance only during these months, although it is possible that certain individuals can be sexed by the shape of the cloacal region at all times of the year (see Svensson 1992). The lack of a cloacal protuberance, of course, should not necessarily be used to indicate females. Banders are encouraged to routinely examine the cloacal region of both males and females at all times of year, so that the timing and usefulness of sexual differences in cloacal shape in North American species can be more fully understood.

Brood Patch

Incubation patches or brood patches are developed by incubating birds as a means of transferring as much body heat as possible to eggs in the nest. In many near-passerines and almost all North American passerines, females perform all or most of the incubating and develop more complete brood patches than males. The presence of a distinct brood patch thus can be used to reliably sex breeding females of many near-passerine and almost all passerine species.

The development of a brood patch begins with the loss of the feathers of the abdomen, about 3-5 days before the first eggs are laid. Shortly thereafter, the blood vessels of the region begin to increase in size and the skin becomes thicker and more fluid filled. Figure 22 illustrates a full brood patch as viewed by blowing the feathers of the breast and abdomen aside. A few days after the fledglings leave the nest, the swelling and blood vascularization begin to subside. If a second clutch of eggs is laid, the process (except for defeathering) will be repeated. A new set of feathers on the abdomen usually is not grown until the prebasic molt, after completion of breeding.

Between the end of nesting and the onset of molt, the skin of the abdomen will often appear grayish and wrinkled. With experience, the abdomens of adults are distinguished from those of juveniles, which can lack feathers but otherwise are much smoother and pinker than those of the adult females. See Bailey (1952), Lloyd (1965), and Jones (1971) for more information about brood patches.

In many North American near-passerines and most passerines, the male does not develop a brood patch in the breeding season. Slightly fewer feathers may be present on the abdomen than are found in the winter, but the breast basically retains a feathered appearance (Fig. 22**B**). In a few groups, notably the mimids, vireos, *Myiarchus* flycatchers, and a few other species (see accounts), the male may assist with incubation and develop an incomplete brood patch. These will include partial or complete feather loss and slight to moderate vascularization and swelling, which

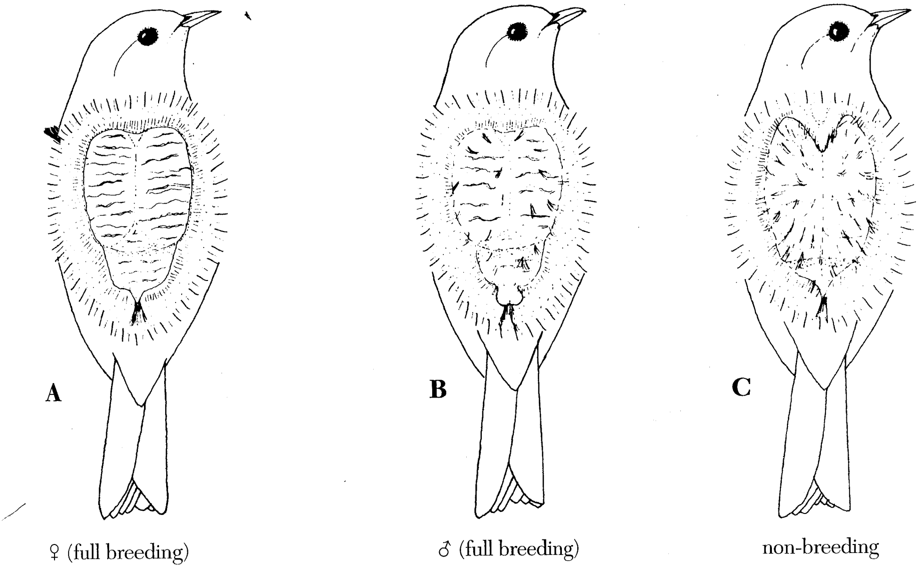


FIGURE 22. Brood patches in different stages of development.

rarely if ever approach the extent of development typically found in females of the same species. With experience, bird handlers should be able to readily distinguish male brood patches in these species, although these may be harder to distinguish from developing female brood patches. In only one North American passerine (again, the Wrentit) do males develop full brood patches that are not reliably separated from those of the female, and this also is true of several near-passerine families, notably among the doves, kingfishers, and woodpeckers. In three passerines (the cowbirds), the female does not develop a brood patch at all.

In most North American species, brood patches should be expected only from April through September, but exceptions are found, especially in southern and California populations (see species accounts) and in year-round breeders such as Barn Owl, Mourning Dove, and Red Crossbill. Finally, non-breeding females may not develop a brood patch or may only develop a partial one. Hence, males should never be reliably sexed solely by the lack of a brood patch during the breeding season.

OTHER TECHNIQUES

Several other surgical or biochemical techniques may be used to age or sex birds in the hand, in given situations. Most of these require special equipment and/or experience, and descriptions of these are beyond the scope of this guide. For sexing, these include direct cloacal examination of larger birds (see Miller & Wagner 1955, Swanson & Rappole 1992), laparotomy (see Bailey 1953, Risser 1971, Wingfield & Farner 1976, Fiala 1979, Ketterson & Nolan 1986, Piper & Wiley 1991) and the less intrusive laparoscopy (see Richner 1989), examination of DNA (see Longmire *et al.* 1993, Tiersch & Mumme 1993, Fleming *et al.* 1996), and examination of steroids (Dieter 1973, Stavy *et al.* 1979). For ageing, examination of the bursa can be used in certain larger birds (see Wight 1956, Keith 1960, Weller 1965).

A SUGGESTED APPROACH TO AGEING AND SEXING

The emphases and format of this guide (see page 3), coupled with the variability and complexity inherent in ageing and sexing criteria, might present an overwhelming scenario at first, especially to those used to dichotomous keys. Do not despair. With time and practice, users will learn this system and find it quite useful for ageing and sexing. For beginners, here are some suggested steps to accurate ageing and sexing:

1) Look for obvious and reliable age or sex indicators. From early summer through winter check the skull. Look for molting flight feathers in late summer. Are there any definitive age- or sex-related plumage characters? Check for breeding characters on adults during the nesting season.
2) Add ageing information derived from more subtle characters. What are the extent and timing of the molts, particularly those of the first prebasic molt? Examine the shape of and amount of wear on the flight feathers. Are these useful with this species? Look for molt limits. Check the skull in winter-spring. Any large windows remaining? Check the plumage for non-definitive, age-related variations.
3) Add similar sexing information. What does the wing chord indicate? Check for subtle plumage indicators.
4) Combine ageing and sexing criteria. Have you reliably determined either the age or the sex? Knowing the age, can the wing length or the plumage assist with determination of the sex? Knowing the sex, can the same be applied to help determine the age? Try to determine which of the age/sex classes fits best when all ageing and sexing information are combined.
5) Based on your experience with the species, what do you think? Can the combination of all criteria lead to reliable determinations? Are you sure of the choices you made? If not, perhaps you should write down what you think on the back of the data sheet, and leave it "unknown" in the data.
6) Is the information presented in these species accounts complete? Is it accurate? Maybe you should publish your data, or notify the author. And, most importantly, is the bird getting tired? Perhaps it should be released.

HYBRIDS

An attempt was made to list all reported hybrids involving the species treated in this guide. References to most of these hybrids can be found in the reference section, although a few reports are based on unpublished information. Good summaries of hybrids in North America are provided by Cockrum (1952) and Gray (1958).

Unless the parental species are known directly, the identity of hybrids is difficult if, not impossible, to confirm (Parkes 1978, 1988a; Sibley 1994). Thus, most of the reports should be considered tentative. Hybrids can take any or all plumage combinations of parental species, and there often is substantial individual variation in the hybrids produced by two species, *e.g.*, Blue-winged and Golden-winged warblers (Parkes 1951, Short 1963; see p. 445). Hybridization also can revive ancestral characters that can sometimes cause a hybrid to resemble an unrelated species. On the other hand, beware of pure individuals showing leucistic, melanistic, or other anomalous plumage coloration, which may coincidentally cause them to resemble a suspected hybrid with another species. Hybrids are of great interest to natural historians and taxonomists (Miller 1949, Sibley 1957a, Short 1969a), and should be documented carefully when encountered. See Sibley (1994) for an excellent treatment of hybrids.

GEOGRAPHIC VARIATION

Geographic variation within species takes many forms among North American birds. Size, plumage, and other phenotypic parameters can vary with latitude, altitude, climate, habitat, migratory strategy, and other factors (Hamilton 1961, James 1970, Selander 1971, Zink & Remsen 1986, Barrowclough 1990, Aldrich & James 1991). Many polytypic species show similar patterns of geographic variation across North America (see Fig. 23), although exceptions to these patterns also are commonplace. Certain species show clinal variation throughout their range, whereas in others, abrupt breaks can occur between adjacent or isolated populations. In many cases, knowledge of geographic variation can assist with ageing and sexing. Age-specific variation in plumage wear (Dwight 1905) and the timing of molt or skull pneumaticization, as well as sex-specific variation in size (*cf.* Aldrich & James 1991) are aspects of ageing and sexing that are particularly affected by geographic variation. Certain species (*e.g.*, see Allen's Hummingbird) may show substantially differing molt strategies by subspecies, and in others (*e.g.*, Bushtit; Yellow-rumped, Palm, and Wilson's warblers; and White-crowned Sparrow), plumage by age and sex varies with subspecies. Thus, geographic variation in a species must be considered when identifying, ageing, and sexing birds.

The most widely used method of representing geographic variation is through the naming of subspecies (Mayr 1954, 1963), as designated by subspecific terms appended to specific names to form trinomens. Despite problems with the subspecies concept (*cf.* Wilson & Brown 1953, Inger 1961, Selander 1971, Barrowclough 1982), it generally is recognized as the only functional means of representing geographic variation in phenotypic parameters (*cf.* Smith & White 1956; Amadon & Short 1976, 1992; Marshall 1967; Mayr 1982; Parkes 1955, 1982a; Phillips 1982, 1986, 1991; Zink & Remsen 1986). In North America, numerous subspecies have been identified, particularly during the latter half of the 1800's and early third of the 1900's. Despite inconsistencies in the degree of differentiation among recognized subspecies, and recent biochemical evidence suggesting that subspecific variation is not always reflected by genetic variation (*e.g.*, Ball & Avise 1992, Gill *et al.* 1993, Zink & Dittmann 1993), these recognized subspecies form the best means of defining geographic variation in North American birds. For details on the definition of subspecies in birds, including various "rules" or statistical methods for their recognition, see Chapman (1924), Relyea (1936), Rand (1948a), Amadon (1949), Rand & Traylor (1950), Mayr (1954, 1963), and Marshall (1997).

All "currently recognized" subspecies are listed in this guide, along with brief descriptive summaries which may assist in their identification (see below). Among species with many subspecies, "**subspecies groups**" are also defined, representing geographically concordant groups of subspecies (occasionally a single subspecies) with shared characters (Amadon & Short 1992; see Fig. 23). The author is not a taxonomist and does not wish for the recognized subspecies or subspecies groups to represent taxonomic opinion. Rather, the most recently recognized subspecies taxonomy is employed uncritically, and subspecies groups are based either on published definition or, in certain cases, are here defined based on shared characters. It should be recognized that subspecies taxonomy is an ever-evolving process, fraught with divergent opinions among taxonomists, and with many species in need of a critical revision. Thus, many future changes to the taxonomy recognized in this guide are anticipated.

Principal sources for the most recently recognized subspecies taxonomy include the AOU (1957) for near-passerines, Phillips (1986, 1991) for swallows through vireos, and references in the "Peters" check-list series (primarily Mayr & Greenway 1960, 1962; Paynter 1968, 1970; and Traylor 1979a) for the remainder of the North American passerines or for those species not covered by the AOU (1957). All subsequent, critical modifications to the subspecies taxonomy of these references and to that of Oberholser (1974), particularly those of Browning (1974, 1978, 1990), have been incorporated. Howard & Moore (1994) was also consulted for subspecies information. Note that the gender of subspecific names corresponds with that of the genus, following the taxonomy of the AOU (1983). Along with specific reference to the sources of the subspecific taxonomy accepted in this guide, an attempt has also been made to list all historical references bearing directly on the identification of subspecies since Ridgway's (1901-1916) classic work. All subspecies synonymized since Ridgway, along with their supposed differentiating characters, also are mentioned.

The purposes of giving descriptive summaries of all subspecies are manyfold. Besides providing information useful in ageing and sexing, it is hoped that some insights might be gained on the recognition of subspecies in the hand. By incorporating age and sex, some knowledge may be gained on geographic variation, particularly in species where females or first-year birds may display more distinctly defined geographic variation than adult males (*e.g.*, see Phillips 1966a, Stutchbury 1991a, and accounts for Northern Wheatear, Varied Thrush, Brewer's Blackbird, and Bronzed Cowbird). Users

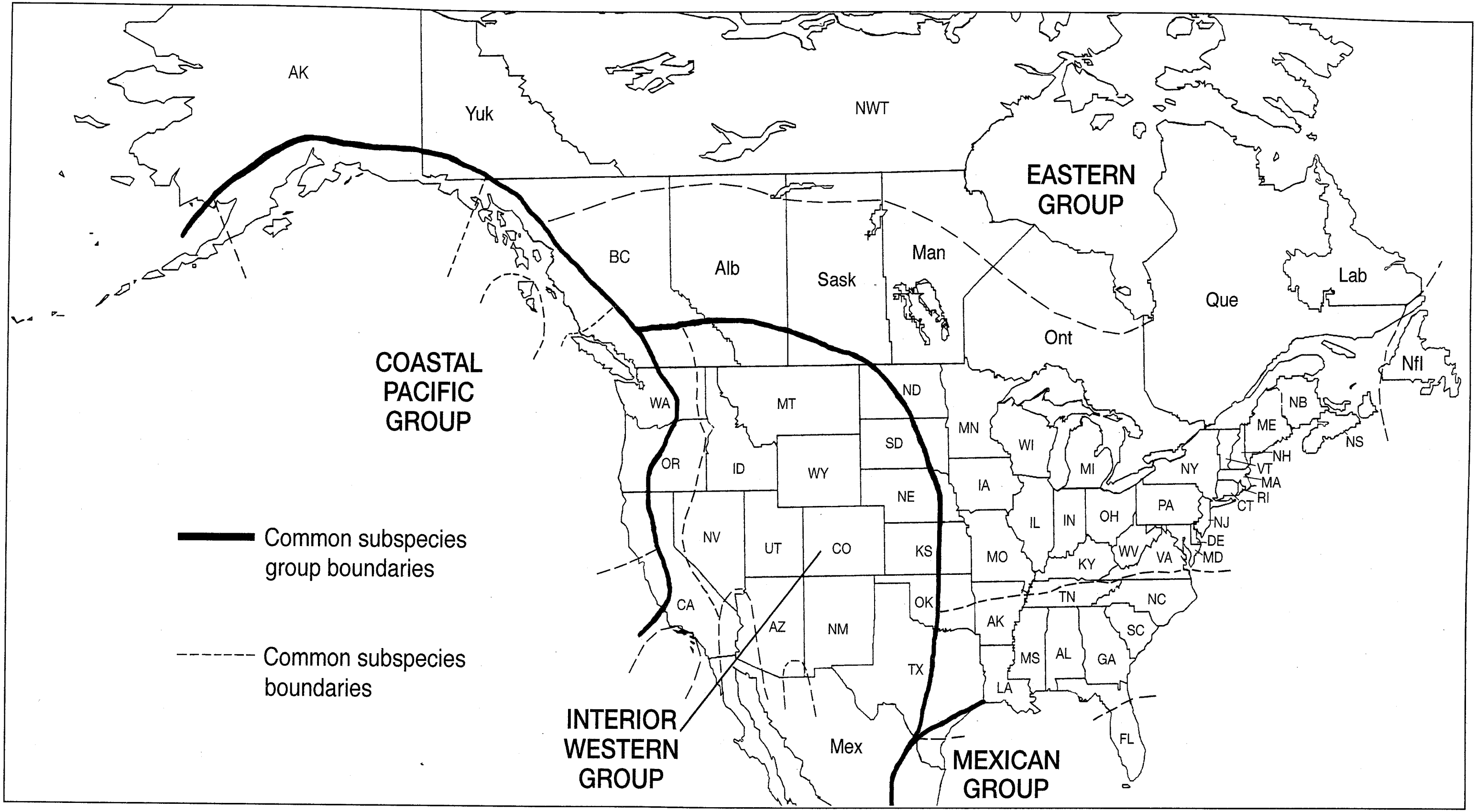


FIGURE 23. Abbreviations for geographical areas used in this guide, and common boundaries between subspecies groups (thick bold lines) and subspecies (thin dashed lines). Continent abbreviations include N.Am (North America), C.Am (Central America), and S.Am (South America). Note that, in general, subspecies of Pacific Coastal Groups are smaller and darker, subspecies of Interior Western Groups are larger and paler, and subspecies of Eastern Groups are medium-sized and more contrasting, in all cases based primarily on plumage adaptions to habitat and climate. Note also, however, that many exceptions occur (see Zink and Remsen 1986).

of this guide should beware, however, that until further insights are gained, most subspecific identifications should only be confirmed with collected individuals and an adequate series of comparative specimen material (see Monson & Phillips 1981; Phillips 1986, 1991; Knox 1994; Dunn *et al.* 1995). Nevertheless, it is hoped that the listing of subspecies will encourage banders, birders, and other ornithologists to start thinking about geographic variation and how it might apply to the birds they observe (*cf.* Norris & Hight 1957). Locally breeding subspecies can be assumed based on range, and identifications of other subspecies might then be attempted based on comparative information. Finally, the listing of references will allow users to gain further information on geographic variation in species of particular interest.

DIRECTIONS FOR USE

In this section, the abbreviations, definitions, and format used in the species accounts are detailed.

COLORS

Strictly defined and standardized color names are not used in this guide. Rather, the names used for colors are considered in a relative context when comparing those of different species or age/sex classes. The geographically and seasonally dependent variation in coloration among individuals of the same species or age/sex class, and the different appearances that colors can assume under different lighting circumstances, considerably lessen the usefulness of strictly defined color names (see Burtt 1986). The color names used in this guide follow those of the current ornithological literature, especially of recent field guides and other identification, ageing, and sexing articles. Modified color names should be interpreted as the second color tinged with the first (*i.e.*, "grayish-green" is green with a gray tinge). The modifiers "dark", "medium-dark", "medium", "medium-pale", and "pale" are used to indicate dark to light tints, respectively. The suffix "-ish" (*e.g.*, "brownish") indicates that more variability can be expected in the nature of the color than would be indicated by unmodified color names (*e.g.*, "brown"). For the definitions of color names used and for other information and examples of colors commonly found on birds, readers are referred to Ridgway (1912), Smithe (1975, 1981), or Wood and Wood (1972).

MONTHS

All months are abbreviated by their first three letters. Parentheses surrounding the months indicate that the plumage or condition described may be encountered between and/or within the range of months listed, but usually is not found or can't be reliably used outside of them. Note also that not all birds will show an indicated plumage or condition for the entire period (especially during the two extreme months), and that exceptions, occurring outside of the given month ranges, are always possible. As with ranges in measurements, month ranges should be considered in terms of 95% confidence intervals (see Fig. 3), with the indicated criteria preceding or extending beyond the given temporal ranges in 5% of individuals.

The species accounts are divided into the following sections:

FORMAT

Heading

For each species, the heading includes the English and scientific names, an alpha (four-letter) code derived from the English name, the AOU or "species" number, and the recommended band size. The English and scientific names follow those found in the AOU Check-list (1983), as modified by subsequent supplements (AOU 1985-1997), and the alpha codes, species numbers (for both species and subspecies), and band sizes are those recommended by the CWS and BBL (through BBL MTAB 81, July 1997). When two or more band sizes are given, the first usually indicates the size which best fits a majority of the individuals of the species. With polytypic species, banders should check the section on geographic variation to see if subspecies in their area are large or small, and use the appropriate band size accordingly.

Species

Accounts for identifying birds to species are given only when there exists a potential confusion species which may be difficult to distinguish in the hand. A certain basic knowledge by the user is assumed (the ability to separate a *Myiarchus* flycatcher from a kingbird, for example). The determination of when and when not to use species identifying accounts is based on the author's experience with the identification of North American birds in the hand and field. To assist with identifications, banders and other users of this guide should refer to field guides in conjunction with the use of these accounts.

Within the species identification accounts, potential confusion species are listed along with the age and sex class (if applicable) and a list of characters useful for separating the species at hand. When only one or two characters are given it should be assumed that these will separate all or a vast majority of the potentially confusing species. When many characters are given, the user should combine all of them for accurate determinations; it should be kept in mind that the potential usually exists for one or more characters not to coincide with the other characters, or with what is normal for the species (see page 3). Occasional oddities, hybrids, or intermediates will occur that may not be identifiable to species in the hand, using the characters given.

Geographic Variation

This section begins with an indication of the degree of geographic variation found within the species, the references used for the subspecific taxonomy, other pertinent references, and the number and location of extralimital subspecies. As mentioned above (pp. 26-29), all subspecies are listed based on the most recent taxonomy. English names for subspecies groups are based on the literature or, in some cases, were defined by the author; the scientific names for the subspecies groups are those of the first-named subspecies in that group. Subspecific ranges include resident (**res**), breeding (**br**), wintering (**wint**), and/or vagrant (**vag**), and are defined based on the two-letter postal abbreviations for each state in the United States and standard abbreviations for each province in Canada (see Fig. 23 for these abbreviations). Small-case letters (*e.g.* "e.", "nw.", "sc.", etc.) indicate locations within the state or province based on compass directions ("eastern", "northwestern", "south-central", etc., respectively). Other abbreviations used in these range descriptions include Co (County), Cos (Counties), I (Island), Is (Islands), and Mt (Mountain). It should be noted that the boundaries for ranges of many subspecies may be inexact or temporally unstable, and that not all vagrants may be included in the accounts; thus, the ranges given for each subspecies should be considered only in a general context.

Characters to identify each subspecies are given in the same format as for species and age/sex groups. These were derived from the literature as well as extensive specimen examination (>95% of the subspecies were examined); much new information on appearance and measurements has been incorporated. Generally, however, there is far more overlap in the listed characters between subspecies than between species or age/sex groups; thus, users of the guide should proceed with appropriate caution when considering subspecific differences (see pp. 27-29). By necessity, differentiating characters for subspecies have been exaggerated somewhat. Measurements by sex and subspecies were derived from the literature and elsewhere, augmented by extensive measuring of museum specimens (see below under Age/Sex). An attempt was made to provide wing and tail lengths of at least 10 individuals of each sex for each subspecies.

A three-letter subspecies code system to designate subspecies in data is proposed to users of this guide. For each species, the first three letters of the subspecies name can be used for each subspecies. Under this system, only seven cases of duplication occur (*e.g.*, for Steller's Jay, *C.s. carlottae* and *C.s. carbonacea*). Suggested three-letter codes are listed for the 14 subspecies affected by duplication of subspecies codes.

Molt

A simplified molt terminology, based on Humphrey and Parkes (1959, 1963) with a few modifications (see pp. 12-13), is employed. The extent, timing, location, and sequence of each molt is given for each species. Abbreviations are as follows:

PS—Presupplemental Molt.

PB—Prebasic Molt.

1st PB—First Prebasic Molt.

Adult PB—Adult (Definitive) Prebasic Molt.

PA—Prealternate Molt.

1st PA—First Prealternate Molt

Adult PA—Adult (Definitive) Prealternate Molt.

Five categories define the extent of each molt, as follows:

Absent—No molt or feather replacement occurs.

Limited—Some, but not all, body feathers and no flight feathers are replaced.

Partial—Most or all body feathers and sometimes the tertials and/or central rectrices, but no other flight feathers, are replaced. Note the slight modification to the definition in Pyle *et al.* (1987).

Incomplete—Usually all body feathers and some, but not all, primaries, inner secondaries (excluding the tertials), or outer rectrices (excluding the central pair) are replaced.

Complete—All body and flight feathers are replaced.

For convenience, all abbreviations and these definitions are repeated inside the back cover.

It must be emphasized that the extent of molt always is subject to individual, geographic, and yearly variation. When a single extent is given it is intended to include what is normal for 95% of the population (see Fig. 3); 5% of individuals can be expected with fewer or more feathers replaced. When two molt extents are given it indicates that there is substantial geographic, interannual, and/or individual variation in the extent of that particular molt, usually ranging between the two given extremes. Details on the extent of each molt, to the level of the wing coverts, are given for each species. The following modifiers are used to indicate proportions of the populations which display certain molt conditions: **rarely** (1-4% of the populations), **occasionally** (5-20%), **sometimes** (21-50%), **often** (51-75%), and **usually** (76-95%). No modifier indicates that > 95% of the population can be expected to have the indicated molting condition. Wing-covert and flight-feather replacement sequence is assumed to be **typical** (see p. 14; Figs. 13, 133, & 137) unless it is indicated to be **eccentric** (see p. 15, Fig. 136).

The timing of the molt, as indicated by the range in months, is given after the extent. As with the extent, the timing is subject to much geographic, interannual, and/or individual variation. Here, both the ranges in extent and the month ranges are intended to encompass 95% of the molt over the range of the entire species. For extents, such terminology as, *e.g.*, "0 (~61%) to 7 gr covs replaced," indicates that 61% molt no greater coverts and the remaining 39% replace between one and seven feathers. Note also that individual birds will take less time to molt and, thus, some percentage of individuals will show no molt during most or all times within the given temporal ranges, particularly in species with a wide geographic (especially latitudinal) range.

Localities are expressed by the terms "summer grounds" and "winter grounds". Note that these pertain to the general breeding and wintering areas of the species, respectively, and not necessarily to the actual territory of the molting individual. Some individuals disperse from their breeding or winter territories during part or all of their molts. Unless otherwise stated, prealternate molts in migrant species are assumed to occur on the winter grounds.

Skull

For each species, the seasonal timing of skull pneumaticization is indicated, followed by specific notes (if applicable) on the occurrence of "windows" and/or conditions that may increase the difficulty of skulling (such as the thickness of the skin) for that species. The specific date when the earliest first-year birds usually complete pneumaticization is followed by the month when the last individuals complete or nearly complete the process. The first date is more important to banders because it indicates the onset of the period when completely pneumaticized birds can no longer be assumed to be adults. This date is derived from the timing of both the pneumaticization process and the breeding season of each species, and generally is a conservative estimate. Most first-year birds will show areas without pneumaticization well after the initial dates given in this guide.

Because skulling is possible only on live or freshly dead birds, and potentially is useful for ageing every passerine species, it is afforded its own section. However, banders should always combine skulling information with the characters furnished under **Age** and/or **Sex**.

Age/Sex

In this section, specific plumage and soft-part criteria are given for ageing and sexing each species. Depending on the species and its plumage patterns, age and sex criteria may be given together or separately. A primary emphasis of this guide, however, is that ageing and sexing information should always be combined before either age or sex determinations are made. Even when these criteria are separated, therefore, users are encouraged to consider them at the same time. As with the accounts dealing with species identification, a field guide can provide additional helpful illustrations of the different age/sex classes. Note, however, that some age/sex representations found in field guides are not entirely reliable.

Before these age/sex-specific characters are given, some general characters of the species are provided. These include the timing and a description of juvenal plumage, information on the sexing of juveniles (not possible in most cases), the occurrence and timing of the cloacal protuberance (CP) and brood patch (BP), and a range of wing chord (wg) and tail (tl) lengths for males and females. Unless they are present through the fall migration, juvenal plumages otherwise are not included in the age/sex breakdowns. As with the timing of the molt, month ranges are indicated for both the juvenal plumage and the breeding characters. When the cloacal protuberance and the brood patch are listed together (as CP/BP, in most cases), the month range should be interpreted as the month when the first CP is in evidence to the month when the last BP becomes obscured. When using these month ranges, note that the CP usually develops about two weeks before, and recedes from one to two months earlier than the BP.

Wing and tail length ranges are derived from the literature, from data collected by the MAPS program of The Institute for Bird Populations ("MAPS data"), from data collected at the Palomarin and Farallon Island Field Stations of the Point Reyes Bird Observatory ("PRBO data"), from data collected in New York and New Jersey by Robert P. Yunick, and from extensive measurements by the author of museum skins at almost all museums located in California (see **Acknowledgments;** primarily the California Academy of Sciences, San Francisco, and the Museum of Vertebrate Zoology, Berkeley). If available, a sample of at least 30 wing chords and 20 tail lengths for each sex of each species is listed. Samples of "100" indicate that at least 100 birds are included. Geographic variation in these measurements, if they exist, can be derived from the subspecies accounts. Note that the ranges of measurements under Age/Sex exclude subspecies occurring entirely outside of North America, *e.g.*, those found only in Mexico. **Banders should not use wing chord or tail length data alone to designate sex codes to the CWS and BBL, unless 1) these are given under the individual age/sex groups (*e.g.*, for many icterids), or 2) the bander provides detailed documentation.** See further comments under the Bar Graph section, below.

Age coding used in this guide follows, for the most part, the system used by the CWS and BBL as listed in the Bird Banding Manual (Canadian Wildlife Service & U.S. Fish & Wildlife Service [USFWS] 1991), and is based on the calendar year. The following age codes are used:

Juv—Juvenile. A bird in juvenal plumage, before the first prebasic molt. **Note that the CWS and BBL do not accept this age designation.** Use "L" for "Local" birds that have not fledged, and "HY" for birds in juvenal plumage that have fledged.

HY—A bird in first-basic plumage in its first calendar year (i.e. from the first prebasic molt until 31 December of the year it fledged). Banders may wish to combine this category with juvenile, as is the case in the Bird Banding Manual. Note, however, that the month ranges given in the species accounts assume this distinction.

U—Unknown. This code is only used during the last months of the year, when a bird can be either HY or AHY (see below).

AHY—A bird in *at least* its second calendar year (*i.e.*, After Hatching Year). This code is more significant after the breeding season, when it implies an adult. Before the breeding season, it essentially means "Unknown" (either SY or ASY).

SY—A bird in its second calendar year (i.e. 1 January of the year following fledging through 31 December of the same year).

ASY—An adult in *at least* its third calendar year (*i.e.*, After Second Year).

TY—A bird in its third calendar year.

ATY—An adult in *at least* its fourth calendar year (*i.e.*, After Third Year).

4Y, A4Y, 5Y—Birds in their fourth, after fourth, and fifth calendar years, respectively. At this time, these codes only are suggested as possibilities under the accounts of certain owls and woodpeckers. **Note that the BBL and CWS do not accept these codes; instead, use ATY on schedules and document the age with a note.**

Because molts and plumage sequences do not adhere to the calendar year, most age codes are represented with a slash and the month ranges in which the codes can be assigned. For example, **HY/SY (Aug-Jul)** essentially indicates a bird in first-basic or first-alternate plumage, that can be aged HY in Aug-Dec and SY in Jan-Jul. The code "U/AHY" indicates a bird of unknown age (*i.e.*, U before Jan and AHY after Dec).

The age (or age/sex) code is followed by the range, in months, when the code can be assigned reliably to *at least a portion* of the individuals in the class. Note that not all birds of a specific age (or age/sex) class may be determined during the entire range of months. In most cases, the extreme months roughly indicate the central period of molts. During these months, users should always consider the molt and how it might affect the reliability of the plumage criteria. If the individual has completed the molt, for instance, the criteria may no longer apply. Alternatively, it may be reliable on molting birds a month or so before or after the period given. Both incoming and outgoing plumages should be considered carefully when ageing molting birds. Finally, when a range of months does not span an entire year (most often used with the code, "AHY"), birds found in that category during months outside of the range should be considered "unknown". See the bar graph section (below) for more information.

The age/sex characters given are those that have been found helpful for ageing and sexing each species. They should always be used not only in combination with each other, but also in combination with molt and skull information, measurements, time of year, breeding characters, and the previous experience of the user with the species at hand. Two types of characters often are referred to in these sections, and should be interpreted as follows: **Reliable** characters are those that should, on their own, accurately separate greater than 95% of individuals. **Useful** characters are those that accurately separate between 50% and 95% of individuals (i.e. there is 5-50% overlap), and should either be used only in combination with other ageing or sexing criteria, or used only to separate extremes. Note that the order of characters generally begins with measurements, followed by upperpart, head, and underpart plumage, then soft part color, and thus does not reflect the relative reliability of the listed criteria. The two tenets given on page 3 should always be considered when ageing and sexing birds.

Hybrids Reported

All species known or suspected to have hybridized with the account species are listed. Note that the parentage of hybrids often is difficult or impossible to confirm (see p. 26).

References

References for geographic variation (mostly pertaining to subspecific designations) are listed separately under that section. All other references, including those pertaining to species identification, molt, skull pneumaticization, age/sex, and hybrids, are listed at the end of the account. References used are derived almost entirely from the North American literature. For general and specific references in the European literature (some of which pertain to Holarctic species), see the Birds of the Western Palearctic series (under "Cramp" in **Literature Cited**), Svensson (1992), and Jenni & Winkler (1994). Unpublished manuscripts have only been cited in cases where they are in review or are ready for submission to a scientific journal. There is much other useful information contained in unpublished form (*e.g.*, graduate school theses) which should be published.

A total of 2442 references is listed in the **Literature Cited** section. The author would appreciate receiving reprints of any relevant references that were overlooked.

Also listed under references are unpublished information contained in the files of the Bird Banding Laboratory (indicated by "*in litt.* to the BBL"), data from the MAPS program of The Institute for Bird Populations (IBP), Point Reyes Bird Observatory (PRBO), Powdermill Nature Reserve (PNR), and other sources, and personal communications to the author. Most of the latter include feedback, corrections, or updates to Pyle *et al.* (1987).

BAR GRAPHS

Bar graphs, indicating our ability to age and sex live birds in the hand, have been constructed for each species (Fig. 24). The bar graphs have two primary purposes: 1) To present information (some of which is additional to that of the text) on the degree to which users can reliably age and sex birds throughout the year, and 2) to represent the age and sex codes currently accepted by the Canadian Wildlife Service (CWS) and Bird Banding Laboratory (BBL). They are similar to the graphs previously provided in the Bird Banding Manual (CWS & USFWS 1991), with some modifications resulting in efficiency of presentation and provision of additional information. Referring to Figure 24, the following provides information on how to use the bar graphs.

Ageing and Age Coding Based on the Bar Graphs.

Reliable ageing and age coding is represented by the horizontal bars, as broken down into monthly segments. Solid black segments indicate that > 95% of birds in that age class (essentially all) generally should be aged as indicated, when using all available criteria (primarily information based on skull pneumaticization and plumage); cross-hatched segments indicate that 25-95% of birds in that age class should be aged as indicated; dotted segments indicate that 5-25% of birds in that age class should be aged as indicated; and solid white segments indicate that < 5% of birds in that age class (usually none) should be aged as indicated (or expected, in the case of juvs early in the year). **Note that these proportions indicate the reliability of identifying all birds of the given age class, not the proportion of birds that should be assigned that age code.** For example, only a small proportion of Ruby-throated Hummingbirds will be aged juv-HY in May, but > 95% of birds that have fledged by the end of May should be identifiable as juv-HYs. Question marks indicate the possibility of accurate ageing or age coding during those months, depending on the results of further study.

The proportions indicated by the cross-hatched and dotted segments should be regarded as general, and were assigned based on the experience of the author with live birds in the hand and with specimens. These proportions may vary substantially among users of the accounts, based on their previous experience with the species. An attempt was made to assign proportions representing those of a user with an "average" amount of experience ageing a particular species.

In months when 5-95% of birds can be aged as indicated (dotted and cross-hatched segments), note that the proportion of uncertainty can depend on temporal factors, geographic variation, sex-specific differences, and/or individual variation in reliable ageing. Only about 50% of AHY Northern Cardinals can be aged AHY in October because skulling becomes unreliable for assigning this age class after the 15th of the month. Other examples of temporal factors affecting ageing include the reliable identification of SY Northern Cardinals or SY and ASY White-crowned Sparrows in August, when some birds can be identified at the beginning of the month but few, if any, are identifiable at the end of the month. An example of geographic variation in reliable ageing is that of identifying SY and ASY White-crowned Sparrows in May to July, when the Nuttall's subspecies can be more reliably aged by plumage than the other subspecies. Similarly, in many species, birds of northern populations may show different ageing proportions than birds of southern populations, due to differences in the timing of skull pneumaticization and/or the timing and extent of molts. The proportions indicated by the age-bar patterns attempt to represent the species as a whole. Examples of sex-specific effects on ageing proportions include those of SY/TY and ASY Ruby-throated Hummingbirds after March, and SY Pine Grosbeaks in September and October, when males but not females can be aged as indicated; thus, the proportions during these months are 50%, at best. Finally, much of the variation in the ageing proportions will be based on variation in plumage criteria, as explained in Figure 3.

The bars indicated by "AHY-U" require extra explanation and comparison with the other bars. First, the age code "U" should only be used after the first juveniles have hatched and when < 95% of Juv/HYs can be aged, as represented by a bar segment that is not solid black. Second, the patterning of the monthly segments indicate the proportion of non juv-HYs that should be aged AHY. In Northern Cardinal, for example, only 25-95% of non juv-HYs should be aged AHY in January to August because a portion of those AHYs (5-75%) can be recognized as SYs by

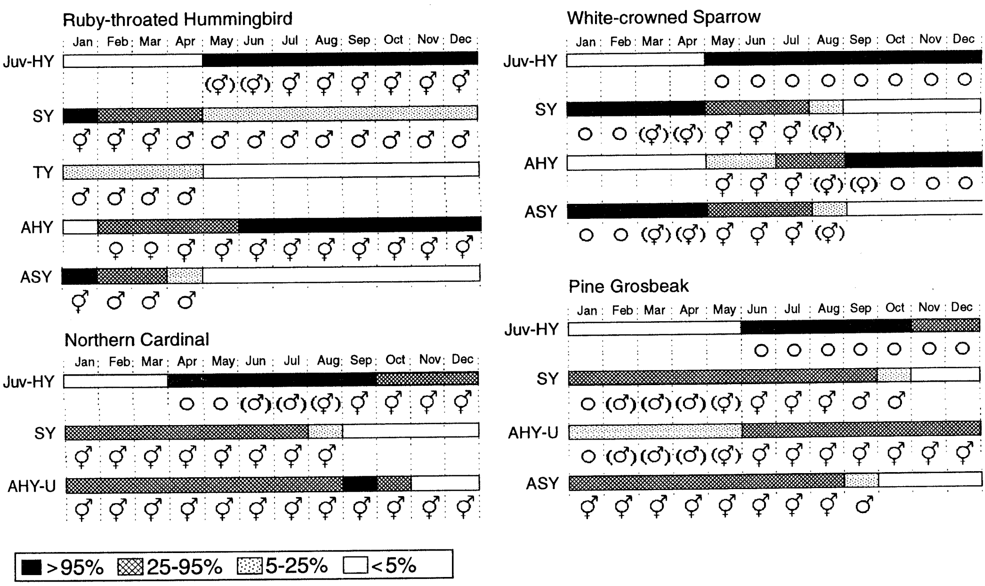


FIGURE 24. Four examples of bar graphs indicating the reliability of ageing, sexing, and age/sex-code assignment. See text for a complete explanation.

plumage. In September, all birds can be aged by skull, and few if any (< 5%) SYs are still identifiable; thus, > 95% of non juv-HYs should be identified as AHY (and > 95% of juv-HYs are also recognizable). In October, as mentioned above, only birds before the 15th can be aged AHY (by skull); the cross-hatching thus indicates approximately 50% during the entire month. In this case, the remaining birds (those after 15 October having finished their molt and with complete pneumaticization) should be aged U. In November and December, < 5% of non juv-HYs (essentially none) are reliably aged AHY; thus, > 95% (essentially all) should be aged U because some juv-HYs can acquire complete adult plumage and pneumaticized skulls by these months. Note that sex designations are given during November and December for unknown-age birds, as opposed to, *e.g.*, AHY White-crowned Sparrows in January to April, where neither AHY nor U should be assigned, and no sex designations are given. In the Pine Grosbeak, 25-95% of non juv-HYs can be aged AHY in June to December, but the reasons differ depending on the month. In June-October, a portion of non juv-HYs can be aged SY or ASY, thus 25-95% should be aged AHY. In November and December, after the skull no longer is reliable for ageing AHYs, 25-95% of non juv-HYs can be recognized as AHY by plumage and the remaining 5-75% of birds should be aged U. Note that the use of U depends on comparison with the "Juv-HY" bar: when < 95% of HYs can be aged, then a proportion of birds should be aged U, as indicated by the proportion noted on the AHY-U bar that can be aged AHY.

Note also that, by comparing bars, the ageing proportions can often be refined further than is indicated by the cross-hatched and dot patterns alone. In White-crowned Sparrow, for example, 75-95% of non juv-HYs should be aged SY or ASY in May and June, 25-75% should be aged SY or ASY in July, and 5-25% should be aged SY or ASY in August, as based on the patterns of all three (SY, AHY, and ASY) bars considered together. When such overall patterns occur, it can essentially be assumed that the proportion of birds that can be aged SY, AHY, and ASY is changing in a clinal manner.

Sexing and Sex Coding Based on the Bar Graphs

Reliable sexing and sex coding is represented by the symbols under the monthly age-bar segments. A female symbol, ♀, a male symbol, ♂, or a "female-male symbol", ⚥, indicate that > 75% of live birds in the hand, of that age-class, and in that month, can be reliably sexed as female, male, or either sex, respectively. Parentheses around these symbols indicate that approximately 5-75% of these groups of birds can be sexed as indicated. A "neither-sex" symbol, ○ indicates that < 5% of birds should be sexed. Sexing proportions are based on the sexing criteria indicated in the text, primarily those of plumage and breeding characters; note that measurement criteria are only included for species in which all or nearly all individuals, within the entire North American range of the species, can be separated based on morphology.

As with the ageing proportions, sexing proportions can reflect individual, geographic, or temporal variation (within the given month) in our ability to reliably sex birds. In the Northern Cardinal, for example, 5-75% of juveniles can be sexed male in June by incoming red plumage; < 5% of females can be reliably sexed during this month. In July, 5-75% of birds can be sexed either male or female, and by August > 75% of birds can be sexed. In the White-crowned Sparrow, 5-75% of SYs and ASYs (throughout the entire range of the species) can be sexed in March and April by brood patch or cloacal protuberance. By May to July, > 75% of all birds should be reliably sexed by breeding characters. In September, 5-75% of females may still be recognized by outgoing brood patches, while < 5% of males can still be identified by cloacal protuberance. In the Pine Grosbeak, 5-75% of SY males can be identified in February to April by the presence of a few red feathers in the plumage. By May, breeding characters allow 5-75% of both males and females to be sexed. Many instances of the male-female symbol in parentheses, (⚥), indicate overlap between the plumages of males and females (see Figure 3), which results in 5-75% of extremes being reliably sexed.

Along the "AHY-U" bar (see above), note that the sex codes under cross-hatched or dotted segments indicate the sexing of AHYs, and those under solid white segments (at the end of the year) indicate the sexing of birds aged "U". In the Pine Grosbeak, for example, > 75% (in this case, close to 100%) of AHYs in November and December can be sexed by plumage, as indicated by the symbols, while birds aged U at this time should be left unsexed, as indicated by the symbols under the Juv-HY bar for these months. Notes pointing out these cases are provided under the graphs. In the Northern Cardinal, birds aged U in November and December can still be sexed, as indicated by the male-female symbols under the solid white bar.

CWS and BBL Acceptance Criteria as Reflected in the Bar Graphs

The bar graphs represent what is currently accepted by the CWS and BBL on schedules from banders. For ageing, the CWS and BBL will accept all codes indicated with a solid black bar (> 95% should be aged as indicated) or a cross-hatched bar (25-95% should be aged as indicated). It is up to the bander to be conservative in cases indicated with cross-hatched segments, generally only ageing 25-95% of birds. For segments with the dot pattern (5-25% of birds being reliably aged as indicated), the CWS and BBL will accept these age codes, but may query certain banders that do not have adequate experience, or who are ageing more than 25% of birds without supplying any documentation. **When using the "Juv-HY" bar, note that the CWS and BBL do not accept "Juv" as an age designation. Use "L" for "Local" birds that have not fledged, and "HY" for birds in juvenal plumage that have fledged.** For sexing, all codes indicating that > 75% of birds can be sexed as indicated will be accepted, and banders may be queried if they submit a high proportion of sexed birds where a symbol in parentheses (indicating a 5-75% sexing proportion) is given. Banders may also be queried if they are not ageing or sexing most or all birds, when > 95% ageing or > 75% sexing proportions are indicated. **The CWS and BBL will not accept aged birds during a month-segment indicated by a solid white bar (including those with question marks), or sexed birds during a month indicated by a neither-sex symbol, ○, without accompanying documentation from the bander**. Certain age-sex combinations are also unacceptable to CWS and BBL, such as SY-♀♀ Ruby-throated Hummingbirds in April to December, or AHY-♂♂ White-crowned Sparrows in September, even though a code for the opposite sex may be accepted. If banders feel that they can age or sex birds in situations where the bar graphs indicate otherwise, they are strongly urged to document fully their reasoning when submitting their schedules, and to provide a copy of their documentation to the author of this guide, as well. **This will apply in all cases where banders are sexing birds in their area only by measurements or multiple-variable analyses.** In this way, our knowledge of ageing and sexing, and the bar graphs themselves, can continue to be updated and refined.