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AGE DETERMINATION OF SIX SPECIES OF NORTH AMERICAN SHOREBIRDS

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INTRODUCTION

Internal (anatomic) age criteria applied to shorebirds, such as the rate of skull ossification and the presence and size of the bursa of Fabricius, have already been published (McNeil and Burton, 1972). These criteria may have limited use in aging live shorebirds: skull ossification remains incomplete, with large "windows" even in adult birds, and the involution of the bursa of Fabricius is completed before the end of the first winter when plumage characteristics are best for age determination. Studies on age determination based on plumages have been published on some shorebirds: American Woodcock (*Philohela minor*) (Martin, 1964), Dunlin (*Calidris alpina*) (Holmes, 1966), and Common Snipe (*Capella gallinago*) (Tuck, 1972). The British Trust for Ornithology Wader Study Group has published a "Wader ageing guide" which indicates mainly the differences between adults and juveniles.

In the present paper, plumage characteristics are considered as an external age determination guide which has been tested in the field through three years of banding activities (1970-1972) for six species of North American shorebirds: Semipalmated Plover (*Charadrius semipalmatus*), Greater Yellowlegs (*Tringa melanoleuca*), Lesser Yellowlegs (*Tringa flavipes*), White-rumped Sandpiper (*Calidris fuscicollis*), Least Sandpiper (*C. minutilla*) and Semipalmated Sandpiper (*C. pusilla*).

Age determination is essential in field studies considering the value and the diversity of the information derived from it. For example, we have studied the differences in arrival dates, relative abundance, length of stay, changes in weight and migration routes between juveniles, first-year birds and older ones over a period of three years in the course of a study on fall migration (Burton, 1974; Burton and McNeil, 1975).

METHODS

From May to October, specimens were collected in the lower St. Lawrence Valley and on the Magdalen Islands, Quebec, in 1968 and 1969 respectively. They were prepared with one wing spread out and deposited in the collection of the Département des Sciences biologiques, Université de Montréal. Specimens taken on the breeding grounds were studied at the Museum of Natural Sciences, National Museums of Canada, Ottawa, whereas skins of wintering

birds were examined at the American Museum of Natural History, New York, and at the Smithsonian Institution, United States National Museum, Washington, D.C. Working from these skins, the first step was to characterize the juvenal plumage. It is generally well described (Ridgway, 1919; Bent, 1927, 1929; Snyder, 1957; Palmer, 1967; Minton, no date) and different from the Basic (winter or nonbreeding) and Alternate (summer or breeding) plumages. We identified as juveniles those birds from our collection which had an apparent bursa of Fabricius, and we characterized the juvenal primaries and secondaries which are retained during the first year of life (Dwight, 1900; Palmer, 1967).

The second step was to look for juvenal characteristic remiges in the adult plumages, Basic and Alternate, in order to identify the first year plumages: Basic I (first winter) and Alternate I (first summer) plumages will have the same primaries and secondaries as the juvenal plumage, along with variable amounts of wing coverts that are retained through the first cycle of plumages (Juvenal, Basic I and Alternate I). The next step was to compare the characteristic first-year feathers with their homologues found on other birds, in order to determine a second-year plumage, and so on.

Black-and-white photographs of characteristic remiges can be used in the field as a guide to age identification (Burton, 1970). The use of such photographs copes with the subjective appreciation of slightly different shades of browns and grays present in most shorebird plumages.

We used the nomenclature of Humphrey and Parkes (1959) which is based on two plumages per cycle as follows: Juvenal (HY: alpha code, U.S. Bird Banding Laboratory), Basic I (HY-SY) and Alternate I (SY) for the first cycle; Basic II "definitive" (SY-ASY) and Alternate II "definitive" (ASY) for the second and subsequent cycles as we did not find any difference between birds two years old and older ones. Our color terminology is based on Palmer's (1962) "Added Arbitrary List of Named Colours" and "Neutrals."

RESULTS

Semipalmated Plover

"In fresh juvenal plumage the crown, back, rump, scapulars and wing coverts are 'buffy brown', narrowly edged with creamy or buffy white, the edgings broadest on the wing covers; the lores, cheeks, and a broad band across the chest are 'buffy brown' to 'sepia'; the forehead, throat, a ring around the neck, and the entire underparts are white; the tail is like the adult, but tipped with 'pinkish buff'" (Bent, 1929). The buffy edgings fade out to whitish by the end of August and wear away rather rapidly. We found a dark subterminal line between the buffy brown part and light tip of the back feathers, scapulars and tertiary coverts. This dark line can still be seen when the tip of the feather wears away, late in the fall. The juvenal bill is mostly black at the base.

This juvenal plumage is retained through the first winter, modified only by wear (Dwight, 1900) and at the time of the first pre-

Alternate molt (prenuptial), the plumage becomes practically similar to that of adults except for a few juvenal wing coverts.

In the field, the main difference between Alternate and Basic plumages is in the color of the head markings (anterior portion of the forehead, loreal stripe including the auricular region, forepart of the crown), and collar. In the Alternate plumage, these areas are velvety black and they are replaced by grayish brown in Basic plumage. Moreover, the bright yellow of the basal one half of the bill in Alternate plumage fades to blackish on the maxilla in Basic plumage with very little yellow remaining at the base of the mandible.

The main difference between the first cycle plumages (Juvenal, Basic I and Alternate I) and subsequent ones is the size of a white spot located on the outer vane of the sixth primary. During the first cycle this spot covers almost two thirds of the width and one half of the length of the exposed outer vane of the sixth primary (Fig. 1-a). This white marking is restricted to a narrow line, including the rachis, during the following cycles. With a specimen in the hand, one should look at the fifth remex from the tip of the wing (which is the 6th primary); the size of the white spot on the outer vane reveals at all times if the bird is in its first year or older.

Greater Yellowlegs

In the Juvenal plumage, “. . . the crown is ‘bister’, streaked with white; the feathers of the back, scapulars, and wing-coverts are ‘bister’ or ‘warm-sepia’, spotted or notched with ‘pinkish buff’ of buffy white, whitest on the upper back and most buffy on the scapulars; the sides of the neck and upper breast are streaked with and the flanks are barred with dusky; the rest of the under parts are white” (Bent, 1927). Moreover, a narrow terminal dark line is found on the tip of the lateral rectrices, tertiaries, scapulars and the median and lesser secondary coverts of the Juvenal plumage. This line wears away rapidly and can be identified on new feathers only. A dark area, however, including the tip of the rachis which is edged by two white notches is also present on the tertiaries, scapulars, median and lesser secondary coverts of the Juvenal plumage. The legs are olive.

In October, the Juvenal plumage is molted and the Basic I plumage is acquired but many wing coverts and scapulars are retained. The Basic I median and lesser secondary coverts have the same dark tip as their Juvenal homologues. Then, when the bird molts again in March and April to the Alternate I plumage, a few Juvenal and Basic I wing coverts still remain.

The difference between Alternate and Basic plumages is one of general aspect: the Alternate plumage of the Greater Yellowlegs displays a dark crown, a dark mantle, and scapulars notched with white spots. The neck is white and the breast and flanks are more or less heavily barred with dark sepia. In Basic plumage, the general color of the upper parts is light gray with white spots whereas the streaks of the neck and flanks are narrower and grayish instead of dark sepia and the breast is almost immaculate.

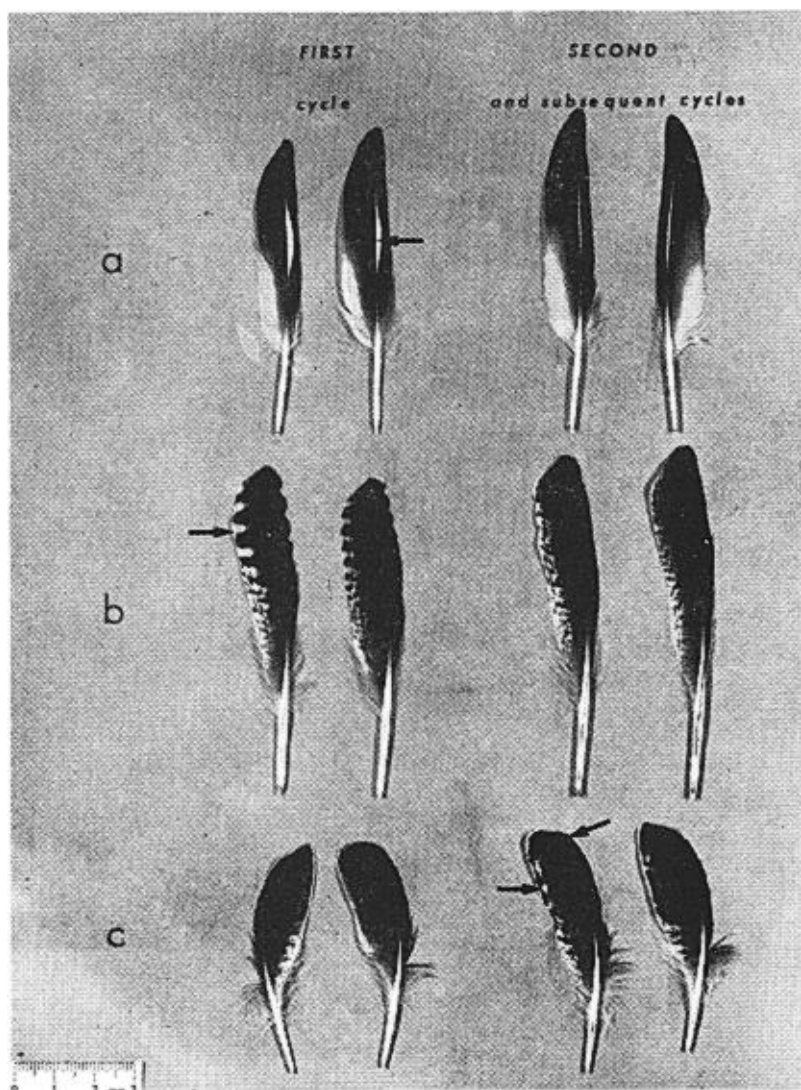


FIGURE 1. Characteristic color patterns of the
 a) the sixth primary of the Semipalmated Plover,
 b) the first secondary of the Greater Yellowlegs,
 c) the first secondary of the Lesser Yellowlegs.

The difference between first-year and older birds is based on the particular color patterns found on the first secondary. During the first cycle, the inner vane of this feather has a black-and-white sawtooth pattern which is replaced during the following cycles by a speckled area (Fig. 1-b). Birds in their first year of life can then

be differentiated from older ones by looking at the pattern of the first secondary, which is the eleventh remex from the tip of the wing.

Lesser Yellowlegs

"In fresh juvenal plumage the feathers of the crown are tipped with whitish, and those of the back, scapulars, and wing coverts are edged, tipped or notched with pale buff to white" (Bent, 1927). The same terminal dark line found in the Juvenal plumage of the Greater Yellowlegs is present on the tip of all the rectrices, tertiaries, scapulars, median and lesser secondary coverts. The same dark area, including the tip of the rachis, is seen on the central rectrices, tertiaries, scapulars, median and lesser secondary coverts. Some of these Juvenal feathers have been found on birds with the Alternate I plumage in March and April. The legs are also tinged olive.

Subsequent plumages, both Basic and Alternate, are much similar to those described for the Greater Yellowlegs. The difference between the first cycle plumage and the following ones is noticeable on the fifth secondary. The inner vane of this feather is more or less evenly colored with a paler edge during the first cycle. After the second pre-Basic molt (second and subsequent cycles), the inner vane of the fifth secondary becomes speckled and displays a large subterminal dark line (Fig. 1-c) which fades shortly after, but the speckling remains.

White-rumped Sandpiper

Ridgway (1919) describes the Juvenal plumage as follows: "Scapulars and interscapulars blackish margined terminally with white and edged laterally with cinnamon-rufous or rusty, the median scapulars tipped with the latter color; feathers of pileum, and rump, as well as tertials, dusky margined with rusty; wing-coverts margined with pale grayish buffy; otherwise as in winter plumage, but chest, etc., tinged, more or less stongly, with buffy or pale fulvous." The first pre-Basic molt begins in September and the Basic I plumage can be identified by the tawny and buffy edges of feathers of the Juvenal plumage retained in the mantle and wing coverts. Some of the Juvenal wing coverts can still be found in the Alternate I plumage.

The Alternate plumage is very different from the Basic plumage. In the former, the mantle is richly colored with rusty, white, and black, and the rump is white; the throat and breast are pale buff and streaked with dusky. In Basic plumage, the adult is grayish with diffuse streaking on the breast.

First cycle birds can be identified by the pattern of the ninth secondary. During the first cycle the rachis has a small dark lanceolate marking that extends into the white tip of this feather. This dark marking is much longer in the ninth secondary on older birds (Fig. 2-a).

Least Sandpiper

Palmer (1967) gives a brief summary of the Juvenal plumage: "Juv. plumage - upperparts rather somber darkish browns, the

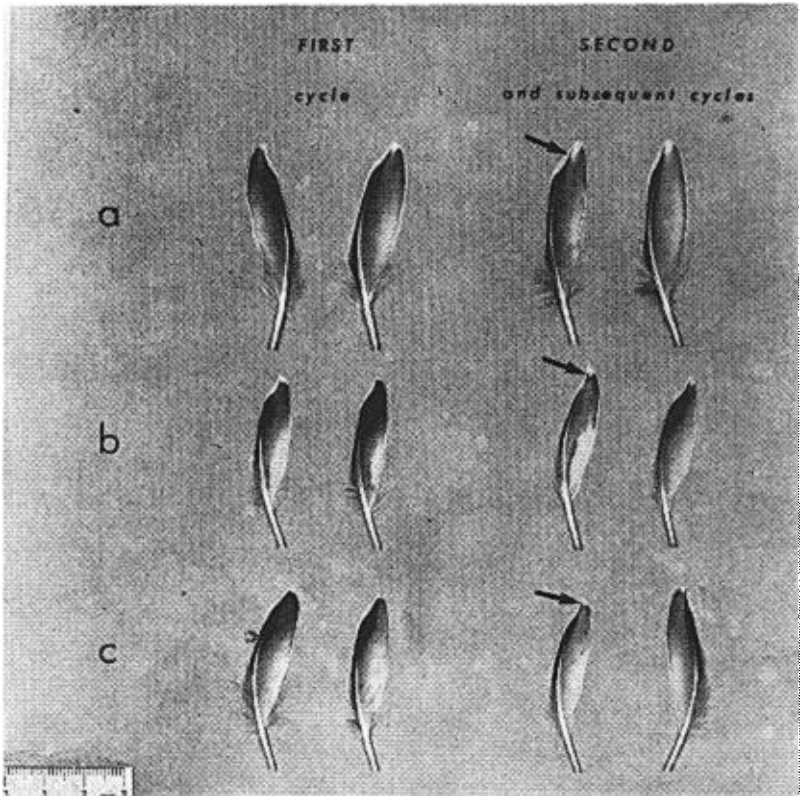


Figure 2. Characteristic color pattern of the
 a) the ninth secondary of the White-rumped Sandpiper,
 b) the ninth secondary of the Least Sandpiper,
 c) the ninth secondary of the Semipalmated Sandpiper.

feathers margined buffy-brown or (scapulars) creamy; underparts light buff with somewhat diffuse dusky streaking on neck and breast; tail-feathers predominantly ashy, central pair edged buffy-brown; wings more or less sepia, the coverts edged buffy." The first pre-Basic molt replaces most of the contour feathers but some Juvenal wing coverts, tertiary and scapular feathers are retained; some of the old Juvenal secondary wing coverts (buffy edged) can still be found after the first pre-Alternate molt in March. In the Basic plumage, the upper parts are brownish gray with a variable amount of feathers with a dark rachis and the ashy breast is not distinctly streaked. In the Alternate plumage, the upper parts are darkish brown edged or tipped with buff or rufous; the throat is white; the neck and breast are buff streaked with fulvous.

The difference between the first cycle plumages and the following ones can be seen on the ninth secondary, as in the preceding species. The rachis forms a small dark lanceolate marking into the white feather tip only during the second and following cycles. There is

no such marking in the white tip of the ninth secondary (Fig. 2-b) during the first cycle.

Semipalmated Sandpiper

"Juv. plumage - over-all tone of upperparts rather sandy (less gray) than Basics. Most of the feathers of upperparts have very dark centers and brownish-buff edges (a few grade to white). There is a buffy cast to upper breast and, usually, quite fine but not very clear-cut darker streaking; rest of underparts white. Tail-feathers have buff edges. Many wing-coverts have buffy or sandy edges" (Palmer, 1967). Some of these Juvenal wing coverts have been found in Basic I and Alternate I plumages.

The differences between Basic and Alternate plumages are much the same as in the preceding species. In the Alternate plumage, the upper parts are blackish brown with broad ashy and cinnamon (scapulars) edges; the breast is white and streaked with sepia. In the Basic plumage, the feathers of the grayish upper parts have dark rachis and the white breast is only faintly streaked with dusky.

The same age criterion described for the Least Sandpiper can be used here; a small dark lanceolate marking extends from the rachis into the white tip of the ninth secondary during the second cycle; first cycle plumages have a white tipped ninth secondary without this dark marking (Fig. 2-c).

DISCUSSION

The above-described aging techniques have been tested in the field, over a period of three years (1970-1972). Of the 15,082 shorebirds aged and banded by out group, 44 returned to the banding sites one year later and 17 after two years. Four of the six species treated here were represented among these returns of banded birds: Semipalmated Plover (4), White-rumped Sandpiper (7), Least Sandpiper (17) and Semipalmated Sandpiper (27). We had no returns of Greater and Lesser yellowlegs.

Along with the relative difficulty in the application of the aging technique when the bird is first aged (when banded), there is an additional source of error at recapture when the bird is aged for the second time. We should mention here that probably none of the recaptured birds have been aged by the same person who aged it at banding, except for the birds aged on Sable Island. Moreover, we emphasize the fact that some individuals cannot be correctly aged because of the wear at the tip of the ninth secondary (the three species of small sandpipers). These individuals were not aged but divided into only two categories, immatures and adults.

We calculated the percentage of success in the use of our aging technique, assuming that the birds were aged correctly when banded. We then considered recaptured birds as correctly aged when their age corresponded to the sum of their age at banding and the number of years between banding and recapture.

We had full success with our age determination of Semipalmated Plovers and very good results with second cycle and older birds of

the three other species (75%, 85%, and 80% respectively) that have returned to the banding sites. Identification of first cycle (Least Sandpiper 45%, Semipalmated Sandpiper 56%) plumages was successful in 50 percent of the cases, except for the White-rumped Sandpiper (no success out of only four returns). These results indicate that higher success is expected from the observation of well marked structures, such as the white spot on the sixth primary of the Semipalmated Plover and the lanceolate marking of the rachis of the ninth secondary of the three other species (second and subsequent cycles). We have no results for the Greater and Lesser yellowlegs (no returns to our banding sites). But, because these two species display well marked plumage characteristics, we suspect that the efficiency of the aging technique could be as high as with the other species and/or age classes also characterized by well marked plumage characteristics.

SUMMARY

Working first from the characteristics of the juvenal plumage, mainly primaries and secondaries, it was possible to determine the plumages of the first cycle (retained primaries and secondaries and other juvenal traces, mainly wing coverts). The first cycle remiges were compared to their homologues in order to characterize the second cycle plumages. For the six species studied (Semipalmated Plover, Greater Yellowlegs, Lesser Yellowlegs, White-rumped Sandpiper, Least Sandpiper, and Semipalmated Sandpiper), black-and-white photographs illustrate the diagnostic differences found on the primaries or secondaries between first-year birds and second-year birds (or older ones). The method has been tested in the field through three years of banding activities for four of the six species studied.

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