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THE AUTUMNAL MIGRATION OF BAIRD'S SANDPIPER

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ABSTRACT.—The migratory route of Baird's Sandpiper in autumn has been the object of discussion for decades. The idea that birds migrate southward along the Cordillera to reach wintering grounds in the Andes is not supported by studies based largely on museum specimens.

Migration patterns of adults and juveniles differ markedly. After leaving the arctic in early July adults move southward over a narrow route, mostly through the High Plains. Females migrate slightly earlier than males. The northern prairies of the United States seem to constitute a staging area preparatory to a direct, 4000-mile non-stop flight to northern South America, and ultimately, in some cases, to Patagonia. This movement is extremely rapid; some adults may complete the 9000-mile trip in five weeks. Most adults depart the United States by mid-August; the latest record is 30 August.

The migration of juveniles is far more leisurely. Birds leave the arctic in late July and the peak of fall migration in the United States is reached in mid- to late August; the peak movements into Patagonia are in early October. Though concentrated in the High Plains and western U.S., the migration extends over a broad front, with records from coast to coast in North America. Apparently juveniles move into the southwestern states before migrating to South America; most bypass Middle America.

There is no evidence of wintering in North or Middle America. Its distribution in South America is not confined to mountainous regions, and the importance of the Andes as a wintering range may have been exaggerated.

The annual migration of Baird's Sandpiper (*Calidris bairdii*), from the high arctic to the tip of South America, is one of the most extensive undertaken by any bird. Baird's Sandpiper breeds from northeastern Siberia, through northern Alaska and Canada, to northwestern Greenland. It winters from "the Andes in northern Ecuador . . . and Chile . . . and from southwestern Bolivia south through western Argentina (A.O.U., 1957) to northern Tierra del Fuego (Jehl and Rumboll 1976). Though fairly common in many arctic localities (western Alaska, Bailey 1948; Point Barrow, Pitelka 1974; Victoria Island, Parmelee, Stevens, and Schmidt 1967; Banks Island, Manning, Höhn, and Macpherson 1956; Bylot Island, Drury 1961; but probably not on Ellesmere Island, Parmelee and MacDonald 1960), the species is uncommon to rare over most of the United States in fall. This fact has evoked some interest as to its migration route. Because it has been seen or collected fairly regularly at high altitudes in the Rockies, and in Mexico, and winters in the Andes, some have assumed that "*bairdii* often travels the full length of the treeless backbone of both continents" (Peterson 1961). Others consider that "the main flight seems to be directly south through the MacKenzie Valley and between the Rocky Mountains and the Mississippi River to Mexico and South America, where it probably migrates down the west coast to its winter home" (Bent 1927).

This study was undertaken to determine whether data from museum specimens would clarify aspects of Baird's autumnal migration. My interest was largely prompted by the observation that fall-taken adults were rare or absent in many collections, whereas immatures were usually well represented, which suggested that their routes might differ. Observers with whom I discussed this possibility were unable to provide much additional information; indeed, most were unaware of plumage differences that allow the age classes to be distinguished. Typically, field guides indicate that Baird's differs from other small calidridine sandpipers

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("peeps") in having a scaly back. Juveniles *are* scaly backed, but so are juveniles of *all* calidridines; adults are never so marked. Because of bias in the collections, and because field guide authors prefer to base their work on fresh, unworn (i.e., juvenile) specimens and to neglect the worn (if present) adults, published descriptions and illustrations are often incomplete. As a result, many immature calidridine sandpipers have probably been misidentified as Baird's, and many adult Baird's may have been overlooked.

METHODS

I borrowed specimens of fall-taken birds (ca. 15 June to 30 October) from most of the major museums in the United States and Canada.

When large loans were not feasible, I requested curators to provide data on the age, sex, date, and locality of specimens and provided a photograph (Fig. 1) and description of plumage differences between adults and immatures to insure that specimens were correctly aged; in these cases I requested the loan of all specimens thought to be adult.

Although specimen data provide documentation of age and sex ratios among migrating birds, their use has unavoidable drawbacks. Most notably for this study, museum collections were made largely to document distribution, not to solve biological problems. Collectors rarely worked in one area long enough to sample birds through the course of an entire migratory season. Consequently, age and sex classes that might occur could be entirely unrepresented for some localities. Further, as the intensity of collecting has varied geographically, specimen data do not necessarily provide a reliable index to a species' abundance. This is particularly true in areas where a species is common and, accordingly, receives little attention. Thus, additional distributional information was sought in the major regional literature of the United States, Canada, Middle America, and South America, and from field workers knowledgeable about shorebird migration.

For convenience in analysis North America was divided into five zones: West, Rocky Mountains, Central, Midwest, and East (Table 2).

Plumage characters allow the easy separation of adults from juveniles in fall. Briefly, adults retain the blotchy (never scaly) alternate plumage, which may become extremely worn, until after arriving on the wintering grounds. Molt, if present, is usually slight and confined to the upper body (neck, chest, upper back). Juveniles in early fall are easily recognizable by their fresh, unworn plumage, with the buff-edged dorsal feathers that characterize immature calidridine sandpipers. By late autumn some birds become heavily worn, taking on an adult-like aspect; they can still be distinguished by their relatively unworn remiges, especially the buff-edged tertials. Further details on molt are given in Appendix I.

RESULTS

Migration in North and Middle America

Adults.—Most species of calidridine sandpipers are monogamous, with males and females sharing incubation duties. Typically, both parents stay with the brood for a week or so, but the female soon departs, leaving the male to remain with the chicks until they have fledged. Although this pattern has not been firmly established for Baird's Sandpiper from studies on the nesting grounds (Dixon 1917, Parmelee, Stevens, and Schmidt 1967, Pitelka, Holmes, and Maclean 1974), it is supported by specimen data which show that females migrate earlier than males (Table 1). This pattern is somewhat obscured when data from the entire United States and Canada are combined, but is evident among large samples from specific localities (e.g., Colorado, Saskatchewan), and is also shown by the earlier arrival dates of females in South America.

Adults begin to leave the western arctic by late June and early July (Parmelee et al. 1967) and start to appear in southern Canada and the northern United States shortly thereafter (earliest 7 July; Table 2). The brief interval between departure

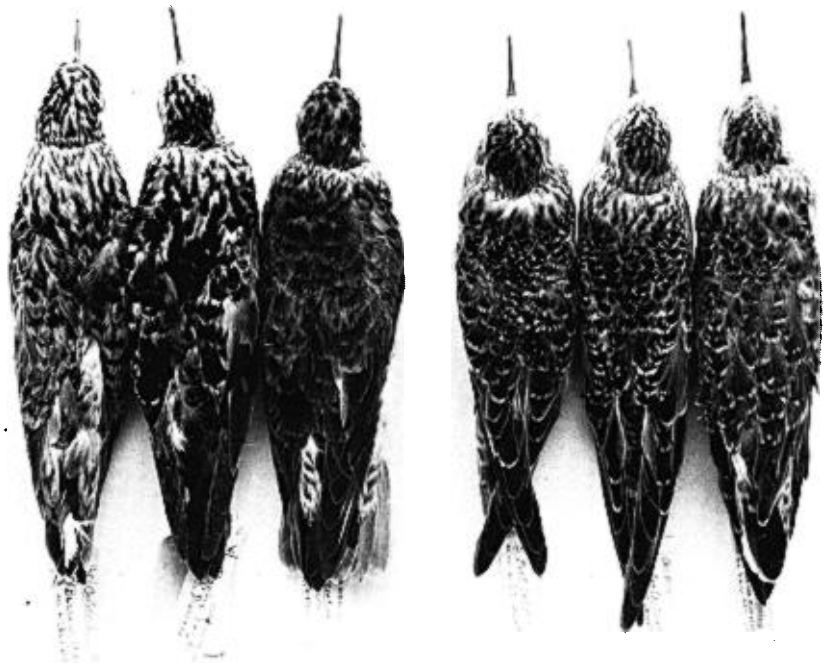

FIGURE 1. Plumage differences between adult and juvenile Baird's Sandpipers. Adults (3 left); Barrow, Alaska, 1 June 1928; Barrow, Alaska, 24 June 1930, Tierra del Fuego, Argentina, 4 November 1973. Juveniles (3 right): Curry Co., Oregon, 22 August 1933; Tillamook Co., Oregon, 11 August 1929; Santa Clara Co., California, 4 September 1937.

and arrival dates virtually requires that most of this distance (ca. 2000 miles from southern Victoria Island to northern North Dakota) be traversed in a non-stop flight.

Considering the breadth of the breeding range, the migratory route of adults is

TABLE 1
DIFFERENTIAL MIGRATION DATES FOR ADULT BAIRD'S SANDPIPERS IN AUTUMN

	Saskatchewan		Colorado		All North America			South America[a]	
Date	♀	♂	♀	♂	♀	♂	% ♀	♀	♂
1–10 July	1?[b]	–	1	–	1 (2?)	1	50	–	–
11–20 July	8	4	2	–	13	7	67	–	–
21–31 July	5	2	2	1	16	10	61	2[c]	0
1–10 August	1	6	–	2 (3?)	10	13 (14?)	43	4	0
11–20 August	–	–	–	2	1	7	12	2	0
21–31 August	–	–	–	1	1	3	25	8	1[d]
1–10 September	–	–	–	–	–	–	–	5	2
10–20 September	–	–	–	–	–	–	–	3	3

[a] Specimens from Peru, Bolivia, Argentina.
[b] Question marks indicate specimens of undetermined sex.
[c] Earliest 29 July.
[d] Earliest 12 August.

TABLE 2
DATES OF BAIRD'S SANDPIPER MIGRATION IN NORTH AMERICA AND MIDDLE AMERICA[a]

Locality	Adult females		Adult males		Immatures	
	N	Dates	N	Dates	N	Dates
WEST						
British Columbia			1	29 July	48	24 July–27 Oct. *24 Aug.*
Washington	3	8–25 July	1	17 July	41	26 July–29 Sept. *30 Aug.*
Oregon					38	23 July–9 Sept. *16 Aug.*
Nevada					6	10 Aug.–14 Sept. *25 Aug.*
California					62	31 July–6 Oct. *1 Sept.*
Hawaiian Is.					3	23 Aug.–6 Sept. *2 Sept.*
ROCKY MOUNTAINS						
Alberta	2	12–17 July	5	10–31 July, 21 Aug. *24 July*	37	27 July–11 Sept., 6 Nov. *20 Aug.*
Saskatchewan	14	17 July–1 Aug. *25 July*	12	17 July–4 Aug. *26 July*	5	1 Aug.–20 Aug. *6 Aug.*
Idaho	1	15 July	1	19 July	44	20 July–9 Oct. *24 Aug.*
Montana					1	7 Oct.
Wyoming			1	27 Aug.	3	15–25 Aug. *20 Aug.*
Colorado	5	7–29 July *20 July*	6	31 July–23 Aug. *10 Aug.*	49	9 Aug.–27 Sept., 20 Oct. *27 Aug.*
Utah			2	6 Aug.	7	19 July–12 Sept., 3 Oct. *23 Aug.*
Arizona	4	3–15 Aug. *9 Aug.*	2	31 July–3 Aug. *1 Aug.*	20	12 Aug.–12 Sept., 18 Nov. *26 Aug.*
New Mexico	1	23 July	1	29 July	12	20 Aug.–11 Sept., 2 Oct. (2) *3 Sept.*
CENTRAL						
Manitoba	2(3?)	12 July–7 Aug. *24 July*	7	26 July–26 Aug. *11 Aug.*	3	5–7 Sept. *6 Sept.*
No. Dakota	8	12 July–25 Aug. *31 July*	8	18 July–10 Aug. *2 Aug.*	17	2 Aug.–9 Sept. *25 Aug.*
Minnesota					14	16 July–19 Sept. *27 Aug.*
Nebraska	1	22 July			6	30 Aug.–13 Oct. *18 Sept.*
Kansas	1	22 July	1	30 Aug.	1	5 Sept.
Oklahoma			3	11–16 Aug. *14 Aug.*	5	21 Sept.–13 Oct. *27 Sept.*
Texas	1	8 Aug.	1	8 Aug.	2	11 Aug., 3 Oct.

TABLE 2. (CONTINUED)

Locality	Adult females		Adult males		Immatures	
	N	Dates	N	Dates	N	Dates
MIDWEST						
Wisconsin			1	14 Aug.	14	15 Aug.–20 Sept. *2 Sept.*
Michigan			(2)	4–15 Aug.	43	13 Aug.–29 Sept. *1 Sept.*
Illinois					4	8–30 Aug. *22 Aug.*
Indiana					8	19 Aug.–6 Sept. *28 Aug.*
Kentucky					1	29 Sept.
Tennessee					1	9 Sept.
Louisiana					3	15 Sept.–9 Nov. *18 Oct.*
EAST						
Newfoundland					1	14 Sept.
Ontario					23	8 Aug.–26 Sept., 7 Oct. *28 Aug.*
Quebec					5	13–24 Aug. *19 Aug.*
Massachusetts[b]						28 July–18 Oct. *mid-Aug.*
Rhode Island					1	17 Sept.
Connecticut					2	14 Sept., 19 Oct.
New York					16	14 Aug.–22 Sept., 30 Oct. *30 Aug.*
Pennsylvania					10	24 Aug.–16 Sept., 2 Nov. *5 Sept.*
Virginia					3	3 Sept.–23 Oct. *25 Sept.*
North Carolina					1	1 Sept.
Bermuda					1	6 Sept.
Florida					1	5 Sept.
MIDDLE AMERICA						
Mexico	9	28 July–13 Aug.	1	6 Aug.	10	6 Aug.–7 Nov.[c]
El Salvador			1	19 Aug.		
Costa Rica			1	4 Sept.[d]	4	25 Sept.–18 Oct.
Panama						19 Sept.–28 Oct.[e]

[a] Except where noted, this table is based entirely upon museum specimens. Mean arrival dates are given in italics.
[b] No specimens from Massachusetts were examined. Data from Griscom and Snyder 1955. Note, one exceptionally early migrant, 28 July, may be an adult.
[c] Includes two photographed in Baja California on 6 Aug. 1977 (L. Kiff and K. Axelson).
[d] Cocos Is.
[e] From Wetmore 1965: see also Ridgely 1976; age inferred from dates.

extremely narrow. They avoid coastal areas and funnel southward along a route that generally parallels the Rocky Mountains. Of 99 adult specimens examined, 91 were from the Rocky Mountain and Central zones, 5 from the West, and 3 from the Midwest. None was found in the East, although a Massachusetts specimen taken on 28 July (Griscom and Snyder 1955, specimen not seen) is suspect on the basis of date.

There are many records for high altitude localities, but little data to indicate that any significant number actually move along the Rockies. Rather, maximum abundance is achieved in the High Plains. Regional authors (Bailey and Niedrach 1965, Johnston 1960, Sutton 1967, Obserholser 1974) agree that the species is far commoner in eastern Colorado and in western Kansas, Oklahoma, and Texas, than elsewhere in those states. Large numbers of Baird's of unknown age may also occur in the Great Basin (e.g., 8000 at Bear River, Utah, in August 1975), though these movements seem to be irregular (W. H. Behle, pers. comm.).

The movement of adults through southern Canada and the entire United States is extremely rapid. Specimen dates extend from 7 July (Colorado) to 30 August (Kansas), but the bulk of the migration is completed in a matter of several weeks; adult females arrive in the second week of July and virtually disappear from North America by 10 August; adult males appear in the latter third of July and nearly all have departed by 20 August. Banding data from central Kansas show a similar pattern, adults being present from early July to late August, with the peak movements between 1 and 15 August (Ed Martinez, pers. comm.).

Evidently the large prairie region bounded approximately by eastern Alberta, western Manitoba, central Colorado, and central Kansas is the first stop in the migration of adults. Apparently this region is a major staging area and on leaving it most adults fly non-stop to the Andes of northern South America, some 4000 miles distant. A few may move through the southern United States and into northern Mexico, but the numbers involved are not large (Fig. 2). It seems extremely unlikely that the birds follow the Cordillera. These conclusions are based on several lines of evidence.

1. The regional literature indicates that Baird's Sandpipers are commoner in the northern United States than farther south. This information is equivocal because authors have consistently failed to differentiate age classes. However, approximately 75% of the adult specimens were taken north of 40°N (the latitude of central Kansas). While some collecting bias is probable, the adult/juvenile ratio (Table 2) also indicates a relatively higher proportion of adults in the north and suggests, therefore, that adults bypass more southern regions.

2. Early and mean arrival dates of adults in the southern U.S. average later than in the north, indicating that birds reaching this region have made a previous stop.

3. The period during which adults are present in the United States is so brief that there seems insufficient time for a leisurely southward movement.

4. Baird's Sandpiper is very uncommon in Middle America, having been reported from Mexico, Guatemala, El Salvador, Costa Rica, and Panama (Eisenmann 1955, Dickey and van Rossem 1938, Slud 1964, Wetmore 1965, Ridgely 1976, Land 1970, Russell 1964, Monroe 1968, Blake 1950, Friedmann, Griscom, and Moore 1950). Year-round observations at high altitudes in Guatemala failed to reveal its presence (Baepler 1962) and the only records for that country (Dick-

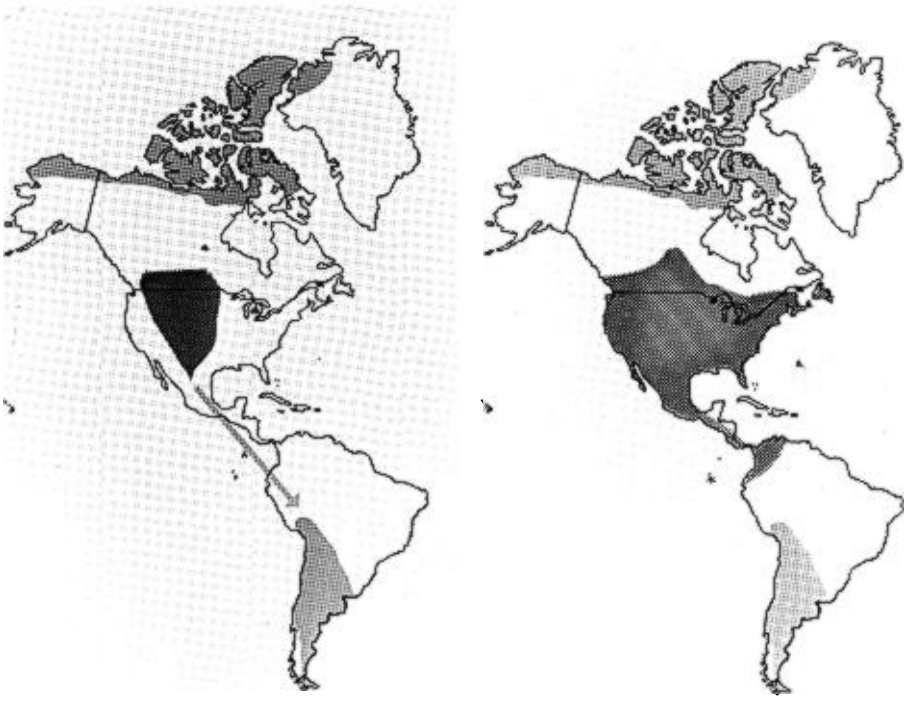

FIGURE 2. The distribution of adult (left) and juvenile (right) Baird's Sandpipers during fall migration as shown by specimen records (cross-hatched). Breeding and wintering ranges (gray) are from A.O.U. 1957, Godfrey 1966, and Meyer de Schauensee 1966. The arrow approximates a great circle route from northern Mexico to the Andes of southern Peru. Distributional records for adults in northern South America are not plotted.

erman 1977) are of three spring migrants at a coastal locality. In Mexico adults and juveniles seem equally common; all of the adults were taken at high altitudes (7000–14,500 feet) in inland localities (meadows in pine woodlands, riparian situations, the lake in the crater of a volcano). Only two fall adults have been taken farther south in Middle America, at Lake Olomega, El Salvador (elev. 2000 feet), and Cocos Island, Costa Rica. Although Cocos Island is 600 miles west of the mainland, it lies on a great circle route between northern Mexico and northern Peru. If a substantial number of birds utilized this overwater route, it would explain the virtual absence of adults (and the rarity of the species) in southern Middle America.

5. Arrival times in South America seem to correspond to the period in which emigrations from the U.S. are indicated. The data are scanty and must be interpreted with caution. Nevertheless, adult females appear so early (29 July, Perú; 10 August, Buenos Aires Province, Argentina) that a direct flight is indicated. Museum specimens of adult males are too rare for analysis; the earliest known to me is 31 August (Perú).

Arrival dates of adults in the southern parts of the Rocky Mountain and Central Zones, and in Middle America (Table 2), also seem to correspond to departure

TABLE 3
WEIGHTS (g) OF FALL-MIGRATING BAIRD'S SANDPIPERS

Area	Adult males		Adult females		Juveniles	
	N	Range and mean	N	Range and mean	N	Range and mean
Northern Alaska	26	34.5–46.8 (38.2)	5[a]	40.5–53.5 (47.3)		
Canada/U.S.	3	38.4–63.1 (49.3)	3	37.0–46.9 (41.9)	32	28.8–60.3 (39.0)
Mexico	1	44.7	3	37.2–47.2 (41.4)	1	27.5
Peru/Argentina/Bolivia			5	32.0–44.2 (37.3)	8[b]	29.5–43.0 (35.2)

[a] Excluding laying females; Museum of Vertebrate Zoology specimens.
[b] Includes six specimens of undetermined age.

periods from the northern U.S., which suggests that migrants with insufficient fat reserves drop out along the route before continuing to the wintering grounds.

6. Weight data, though scanty (see below), are consistent with the interpretation that adults are fully capable of making an extended non-stop migration.

Juveniles.—The migration of juveniles begins in late July (earliest 16 July, Minnesota; 19 July, Utah) and is largely completed by mid- to late September. Migration proceeds over a broad front, with birds moving nonstop from the breeding grounds to southern Canada and the northern United States. Peak arrival times, in the last third of August, correspond to the period when young disappear from arctic localities (cf. Parmelee et al. 1967).

The distribution of juveniles is less circumscribed than that of adults, extending from coast to coast; a few occur west to Hawaii (and beyond to the Pacific islands) and others east to Bermuda. Although specimen records suggest that juveniles are concentrated in the western United States (35% of specimens from the West, 32% Rocky Mountain, 9% Central, 13% Midwest, 11% East), collecting bias is obvious. The regional literature clearly shows that maximum numbers are encountered in mid-continent and that the species is uncommon to rare on both coasts.

The migration period is much more protracted than that of adults. Dates in Alberta, for example, span over six weeks, and along the west coast, where equable weather conditions persist late into the fall, may extend over two months or more. The later mean and early arrival dates in the southern part of each zone are further evidence for a protracted movement. This slower, broader movement in part accounts for the fact that among fall-taken specimens, juveniles are more than five times commoner than adults.

After leaving the northern United States a few young birds may move directly to South America, as indicated by very early arrival dates in Bolivia (25 August) and northern Argentina (14 September). However, the peak arrival of immatures on the wintering grounds does not occur until late September or early October. I suspect that the majority move through mid-continent to the southwestern states or northern Mexico before moving on. The species is common in Texas and Arizona in late summer and early fall (Oberholser 1974, Phillips et al. 1964); and at these periods only juveniles would be expected. Apparently they linger in the southwest until mid- or late September, then fly non-stop to northern South America. There is no evidence that any significant numbers pass through southeastern United States.

Although recorded from México to Panamá, juveniles are rare in Middle America. Indeed, dates of occurrence in Costa Rica and Panama (Table 2) average so much later than departure dates from the United States that birds occurring in the region are probably stragglers, rather than components of the main flight. It is also worth noting that Middle American records of immatures are from coastal as well as inland localities, again showing their tendency to adhere less closely to a well-defined route. As with the adults, there is no evidence to support the idea of a major movement along the Cordillera.

Migration in South America

Data from South America are few. Evidently adults and immatures make their first stop in the northern mountains prior to dispersing to mountain and coastal areas farther south; the species is virtually unreported from the northeastern part of the continent.

As elsewhere, the route taken by adults is narrower than that of the juveniles. All of the adults that I have examined from Ecuador, Perú and Bolivia were obtained at high inland localities; the northernmost coastal records are Buenos Aires, Argentina and Valparaiso, Chile. There are coastal records of juveniles and suspected juveniles in northern South America: these include a specimen from the Galapagos Islands; several sight records from the lowlands of Venezuela in late October (Wetmore, 1939), when only juveniles would be expected to occur; and records for the coast of southern Perú "mostly in September and October . . . sometimes . . . in large flocks" (Hughes 1970).

Adults begin to arrive in late July (earliest 29 July, Perú) and by mid- to late August are fairly common along the Atlantic coast as far south as Rio Gallegos, Argentina. Presumably they reach Tierra del Fuego by early September but critical observations for this period are lacking (Humphrey et al. 1970). Juveniles begin to appear in late August in the north, with peak migration occurring in late September. The migration remains more leisurely than that of the adults, as illustrated by 22 specimens from Argentina (the largest sample available) taken between 10 August and 24 October: only two are immature (14 September and 24 October). Jehl and Rumboll (1976) observed Baird's arriving in Tierra del Fuego into early November, and I suspect that these movements largely comprised immatures.

Weight and Migration

The earliest adult Baird's Sandpiper to arrive in the United States (7 July) presumably left the breeding grounds two days previously; the earliest arrival in Patagonia (Rio Gallegos, Argentina) was taken on 12 August. If some adults are able to complete this 9000-mile trip in as little as 5 weeks, they must average 260 miles a day; and since migration is not continuous, they must undertake at least one non-stop flight of greater extent to maintain this rate. Weight data bearing on this problem are summarized in Table 3.

As with other arctic waders (e.g., *Calidris melanotos*, Pitelka 1959; *C. minutilla*, *C. alpina*, Yarbrough 1970) Baird's lay on few fat reserves prior to leaving the arctic. Females from northern Alaska average only 7 to 10 g heavier than those newly-arrived in the United States, but those reserves are evidently adequate to power the first 2000-mile leg of the journey.

Adults newly arrived in the United States and Mexico range from 37–40 g; juveniles are lighter, averaging 30–35 g. In both groups the heaviest birds weigh approximately twice as much as the lightest (adult range 32–63.1 g; juveniles 27.5–60.3 g), the difference being largely due to fat deposits. In both groups the heaviest birds were taken in the United States relatively late in the migration period, and the lightest, on the average, were obtained in South America. I infer that adults migrate until dropping to a weight of ca. 40 g (juveniles somewhat less), then stop and lay on heavy fat reserves (15–20 g) before continuing.

According to equations proposed by Raveling and LeFebvre (1959) a 50 g sandpiper carrying 15 g of metabolizable fat and flying at 50 mph (McNeil and Cadieux 1972) is capable of a 4400-mile flight. This is more than sufficient to carry a bird from the northern prairies to the northern Andes. That Baird's is capable of such extended flights is evidenced by its occurrence in Hawaii and Austraila (Smith and Swindley 1975). Indeed, a 4000-mile range may be low, as one immature from Hawaii weighing 56 g had nearly 19 g of subcutaneous fat.

At an average speed of 50 mph, 180 hours (7½ days) of flight time are needed for the entire migration. Allowing two stops of 10–14 days to replenish energy reserves (cf. Thomas and Dartnall 1971b, for *Calidris ferruginea*), one in the High Plains and one in northern South America, the minimum travel time would approximate 28 to 36 days. This estimate agrees well with the minimum 5-week (36-day) period suggested by specimen data.

Distribution in Winter

Although an analysis of winter distribution is beyond the scope of this paper, some comments are warranted. Baird's Sandpiper does not winter in significant numbers except in South America, the major wintering area extending from Perú to northern Tierra del Fuego. The species is commoner in eastern Argentina than has been acknowledged (e.g., Johnson 1965, Jehl and Rumboll 1976, J. P. Myers, pers. comm.), and Howell (1975) has recently shown that it winters abundantly in the deserts in northern Chile, wherever suitable bodies of water are present. Further studies should reveal whether the importance of the Andes as a wintering area has been overemphasized.

According to the A.O.U. (1957) the winter range extends "rarely north to El Salvador, Costa Rica, and Panama," but I find no evidence for that. The only El Salvador record is for August (!) and the species is unknown in Middle America after late October (Slud 1964, Wetmore 1965, Ridgely 1976).

Wintering in North America is even less likely, although a few may manage to survive late into the year (e.g., 6 November, Alberta; Table 2). The latest specimen records are 18 November (Arizona) and 5 December (Colorado). (A Colorado specimen allegedly taken on 2 January [Bailey and Niedrach 1965] is an adult male in full breeding plumage; I cannot credit the data.) Winter sight records have been published for Colorado (Bailey and Niedrach 1965), Texas (Oberholser 1974), and Oklahoma (Sutton 1967); I find them unconvincing and in need of review by local authorities.

Since the mid-1950's, Baird's Sandpiper has been reported almost annually on Christmas Bird Counts in the United States, though none seem to have been authenticated by photographs, specimens, or even subsequent observation by

experienced observers. In 1975 for example, 500 (!) were reported (without details) at Laguna Atascosa, Texas. And at Coos Bay, Oregon, 7 were reported along with 5 Whimbrels (*Numenius phaeopus*) and 13 Wandering Tattlers (*Heteroscelus incanum*); an anonymous reviewer (American Birds 30(2):178) noted that "better details were wanting *on the tattlers*" (italics mine). I am convinced that the incomplete field guide treatment, along with a general ignorance of the species' distributional pattern, has played an important role in the submission of these uncritical and probably erroneous reports.

CONCLUDING REMARKS

Nearly seven decades after W. W. Cooke published his studies on shorebird migration, the major features of Baird's Sandpiper's autumn migration have been inferred here with some confidence largely on the basis of museum specimens, most of which have been available for many years. Similar life history data, which are essential for sound conservation programs, could also be reconstructed for many other species from existing specimen material. Unfortunately, the time required to seek out these specimens, arrange for loans, and collect and interpret data, is probably no less than in Cooke's time. The instigation of a national inventory of museum holdings—as important as an inventory of living resources—would help investigators determine whether a biological problem might be profitably attacked at the current time, or whether additional specimen material was needed. This inventory would have other benefits, not the least of which is aiding collection managers in planning for future needs. Lacking such a system, we must accept that many decades more may pass before problems that are currently resolvable or definable can even be approached efficiently. Such ought not be the pace of science in the 20th century.

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APPENDIX: NOTES ON MOLT

Pre-basic Molt

Adults.—Breeding birds become heavily worn by mid-June. At Barrow, Alaska (specimens in San Diego Natural History Museum), light molt may commence in late June, with new feathers appearing on the head, throat, neck, chest, and upper back. By early July, a few birds also show molt on the flanks and abdomen as well. On Ellesmere Island, Parmelee and MacDonald (1960) reported that the pre-basic molt "is well under way . . . by mid-July." The extent of molt on the breeding grounds seems variable, with most of the pre-basic molt taking place on the wintering grounds (Pitelka 1959).

Apparently molt is arrested during migration, as has been reported in many shorebirds (e.g., Holmes 1966, Pienkowski et al. 1976). All but two of the adults I examined from southern Canada and the United States showed little, if any, active molt, and retained enough of the alternate plumage to be easily recognized as post-breeding birds. The exceptions (Oklahoma, 11 August; Colorado, 25 August) appeared to have almost completed body molt.

Body molt is resumed after birds arrive in South America. The timing and sequence is hard to follow because of a lack of material and because a combination of wear and molt makes it difficult to distinguish adults from immatures by late October. Nevertheless, by mid-October most adults seem to have acquired the uniform drab brown basic plumage. Some birds (age uncertain) continue to show light molt on the tail, back, chest, and abdomen into January.

Molt of the primaries extends from late October (earliest 20 October) to mid-January; one specimen taken on 2 February had not yet replaced the outer two primaries. The tertials and scapulars seem to be replaced by early January. Two birds taken in early February were molting rectrices; tail molt seems to be completed by late March or early April.

Juveniles.—The pre-basic molt pattern of juvenile calidridine sandpipers seems related to the length of the migration. Short-distance migrants (e.g., *C. alpina*, Holmes 1966) do not replace the flight feathers, whereas long-distance migrants (*C. ruficollis*, *C. ferruginea*, *C. minuta*; Middlemiss 1961; Thomas and Dartnall 1971a, 1971b) replace the entire feather coat. Baird's Sandpipers fall into the latter group.

Migrating juveniles from Canada and the United States show no evidence of molt. By October, many are heavily abraded and have lost the scaly edgings to the dorsal feathers, but they may still be aged accurately by their unworn tertials and remiges.

Molt commences after juveniles arrive in South America, and by late October or early November is usually evident on the upper back, chest, abdomen and scaplars (one bird). A juvenile collected on 24 October had already replaced the entire crown, back, and scaplars, and was missing the inner 2–3 primaries. Another taken on 31 December had replaced the entire body plumage, wing coverts, and all but the outermost primary; the central rectrices had also been replaced. In some birds, body molt is still evident into January. One specimen taken in "January" showed no evidence of primary molt.

Pre-alternate Molt

No attempt was made to study the pre-alternate molt in detail, as few spring-taken specimens from the wintering grounds were encountered. Body molt resumes in early spring. Several birds taken in late March and early April showed extensive molt on the back and one bird (Peru, 31 March) appeared to have completed the molt. I suspect that most birds finish molting while en route to the breeding grounds.

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