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FLEDGING DATES AND SOUTHWARD MIGRATION OF JUVENILES OF SOME *CALIDRIS* SANDPIPERS

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On 12 July 1980 I found a juvenile Semipalmated Sandpiper (*Calidris pusilla*) feeding at a small freshwater pond at Ocean Shores, Grays Harbor County, Washington. Surprised to see a juvenile of any arctic-breeding shorebird so early in the fall and knowing the rarity of the species on the Washington coast, I collected the bird to confirm my identification. This occurrence stimulated me to examine the relationship between the nesting cycle and southward migration of juveniles in this and related species.

The specimen (Washington State Museum 33605) is probably a female, although its gonads were not visible; its bill measurement (19.3 mm) is near the mean for western females given by Harrington and Morrison (1979). It is in fresh plumage, with no signs of molt, and is typical of juveniles of this species (Prater et al. 1977 and comparison with other juveniles in the WSM). The bird weighed 18.7 g and had no fat deposits. Although field guides refer to the leg color of Semipalmated Sandpipers as black, this bird's legs and feet were a rather dark olive gray, clearly visible in the field as paler than black, although not so pale as the yellowish leg color typical of Least Sandpipers (*Calidris minutilla*). If this coloration is typical of younger juveniles, field identification could be complicated.

As the Semipalmated Sandpiper is a relatively rare migrant on the Pacific coast south of Alaska, there are few records to document the period during which juveniles normally pass through the area. In 1980 the first adults appeared in Seattle, Washington, on 29 June and at nearby Iona Island, British Columbia, on 21 June, furnishing the earliest fall dates yet obtained for this region (Harrington-Tweit et al. 1980). By 30 July more juveniles were present in Seattle than ever previously reported (my observation of 10 birds at two small ponds, Hunn and Mattocks 1981). Thus in 1980, more migrants than usual were in this area, and they may have been detected earlier because of this or may actually have been earlier than normal.

Nevertheless, 12 July is amazingly early for a juvenile of an arctic-breeding species to be at this latitude. During 1979 I conducted regular censuses of shorebirds at Ocean Shores and noted the first appearance of juveniles of each species (Paulson, unpubl. data). The first juvenile appeared on 26 July, a Surfbird (*Aphriza virgata*), followed over the next two weeks by juveniles of six other species that breed in tundra or taiga habitats—Ruddy Turnstone (*Arenaria interpres*) and Short-billed Dowitcher (*Limnodromus griseus*) on 4 August and Semipalmated Plover (*Charadrius semipalmatus*), Wandering Tattler (*Heteroscelus incanus*), Western Sandpiper (*Calidris mauri*) and Least Sandpiper on 9 August. The first juveniles of eight additional tundra and taiga species arrived during the remainder of that month—Black Turnstone (*Arenaria melanocephala*) and Lesser Yellowlegs (*Tringa flavipes*) on 17 August, Lesser Golden-Plover (*Pluvialis dominica*), Black-bellied Plover (*P. squatarola*), Long-billed Dowitcher (*Limnodromus scolopaceus*) and Baird's Sandpiper (*Calidris bairdii*) on 26 August and Red Knot (*C. canutus*) and Sanderling (*C. alba*) on 31 August. First juvenile Pectoral Sandpipers (*C. melanotos*) were seen on 3 September and first juvenile Rock Sandpipers (*C. ptilocnemis*) on 20 October. First Dunlins (*C. alpina*) were seen on 6 October; adults and juveniles were not distinguished.

Information on migration of juvenile *C. pusilla* based on large samples was presented by Page and Middleton (1972) and Harrington and Morrison (1979). In the former study, the first juveniles arrived at Long Point, Ontario, on 11 August 1967 and 12 August 1969, with large numbers present in late August and early and mid-September. In the latter study, there was a strong peak of juveniles at James Bay, Ontario, in the last two weeks of August 1976, with none recorded before 1 August; and a slightly later peak at Plymouth, Massachusetts, with very few recorded before 16 August in 1973–1977.

Table 1 summarizes all the information I have been able to compile for breeding schedules of this species, covering six localities throughout the western and central parts of its breeding range during 10 years. Unfortunately, I can find no such information for 1980. From actual observations or extrapolations from first hatching dates, annual records of earliest-fledged juvenile *C. pusilla* all fall in the period 8–21 July, a rather narrow range considering the broad geographical and temporal range of the sample, but not surprising considering the shortness of the arctic summer. These data, combined with the migration data above, indicate that about one month elapses between the first fledging of juveniles in western (and presumably eastern) populations of this species and their first appearance at Long Point and Plymouth. These localities are slightly closer to the nearest breeding populations of *pusilla* (Harrington and Morrison 1979) than is Ocean Shores.

Western and Baird's sandpipers are small *Calidris* species that breed in the arctic and have been studied enough to allow comparisons with their congener. The closely related Western Sandpiper is restricted to Alaska and eastern Siberia as a breeding species, nesting south at least to the Yukon delta, as does the Semipalmated (Gabrielson and Lincoln 1959). As the Western Sandpiper is abundant on the Pacific coast, its much better documented migration patterns can be examined for similarities to the Semipalmated Sandpiper. Earliest records for juveniles of *C. mauri* on the Pacific coast of the United States south of Alaska are 7 August 1972 and 2 August 1973 at Bolinas Lagoon, California (Page et al. 1979) and in the period 14–18 August at the same locality in 1971 (G. Page, pers. comm.). During my 1979 censuses I found the first juveniles definitely on 9 August, but they may have been present on 4 August, when there were many distant birds that I was unable to assess for age. Many juveniles were present by 6 August in 1982 at Ocean Shores, and my impression from other years is that early August is the normal arrival time. Earliest specimens of juveniles from Washington in the extensive collection of this species in the WSM were collected 11 August 1934, 6 August 1938 and 13 August 1949.

First fledging dates observed or calculated for *mauri* include 3 July 1924, 9 July 1966 and 2 July 1967 in the Yukon delta (Conover 1926, Holmes 1972) and 18 July 1977, 8 July 1978 and 10 July 1979 at Wales, Alaska (W. J. Erckmann and S. Hills, pers. comm.). This range of 2–18 July is similar to that documented for *pusilla* but averages slightly earlier. Thus in *C. mauri* the earliest fledging dates again are about a month earlier than the earliest records of juveniles from the Washington and California coasts. Holmes (1972) indicated the maximum departure of juveniles from the Yukon delta as the first week in August, and juveniles peaked in numbers in the first week of September at Ocean Shores in 1979 (Paulson, unpubl. data), also indicating a month-long trip from Alaska to Washington. Juvenile Western Sandpipers were found in abundance at Bolinas Lagoon as early as late August in 1971, and they represented the majority of individuals in flocks of this species at Ocean Shores at that time of year in 1979 as well, even though they had not yet peaked (Page et al. 1972).

Jehl (1979) presented detailed information on the mi-

TABLE 1. First hatching and fledging dates of Semipalmated Sandpiper at six arctic localities.

Locality and latitude to nearest degree	Year	First hatching[1]	First fledged[1]	Reference
Barrow, Alaska (72°N)	1971	(7/1)[2]	(7/17)	Norton 1973
	1973	(6/26)	(7/12)	Ashkenazie and Safriel 1979
Arctic National Wildlife Range, Alaska (70°)	1976	7/6 (7/5)	(7/21)	W. J. Erckmann, pers. comm.
Cambridge Bay, Northwest Territories (69°)	1960	7/6 (6/30)	7/21 (7/16)	Parmelee et al. 1967
	1975	7/1	(7/17)	D. R. Paulson, unpubl. observ.
Jenny Lind Island, Northwest Terr. (69°)	1966	(7/1)	(7/17)	Parmelee et al. 1967
Wales, Alaska (66°)	1977	6/30	7/18 (7/16)	W. J. Erckmann, pers. comm.
	1978	6/24	7/16 (7/10)	same
	1979	6/26 (6/22)	(7/8)	S. Hills, pers. comm.
Hooper Bay, Alaska (62°)	1924	6/28	(7/14)	Conover 1926

[1] Dates are as observed or as calculated from known hatching or laying dates (parentheses). Incubation period is taken as 20 days, fledging period as 16 days (Ashkenazie and Safriel 1979).
[2] First hatching dates in parentheses were calculated from dates of first completed clutches.

gration of Baird's Sandpipers through North America, based on specimen records. This species also breeds in the arctic, slightly farther north on the average than the Semipalmated Sandpiper. From large series of specimens, the first dates of juveniles in the West were 24 July in British Columbia, 27 July in Alberta, 26 July in Washington, 23 July in Oregon, 20 July in Idaho, 9 August in Colorado and 31 July in California. The earliest of these dates is surprisingly early also but is surpassed by a 16 July bird from Minnesota. This bird is as anomalous as the Semipalmated Sandpiper that I collected, since other early dates for juvenile *bairdii* from Wisconsin, Michigan and New York, respectively, were 15 August, 13 August and 14 August.

C. bairdii is larger than *C. pusilla* and takes slightly longer to complete its breeding cycle (incubation period 20.5 days and fledging period 18 days, Norton 1973). Known dates of first-fledged juveniles include 21 July 1960 and 23 July 1962 at Cambridge Bay and 26 July 1966 at Jenny Lind Island, Northwest Territories (Parmelee et al. 1967). First hatching dates indicate first fledging dates of 21 July 1954 at Bylot Island, Northwest Territories (Drury 1961), 25 July at Devon Island, Northwest Territories (Hussell and Holroyd 1974), and 24 July 1969 and 23 July 1971 at Barrow, Alaska (Norton 1973). This range of 21–26 July is indeed slightly later than those for the two smaller species of *Calidris*.

From the data compiled for these three species, average fledging dates are 8 July for *mauri* ($n = 6$), 15 July for *pusilla* ($n = 10$) and 23 July for *bairdii* ($n = 7$). Thus *bairdii* fledges one to two weeks later than the two smaller species, but its juveniles have been recorded considerably earlier from specimen records (Jehl 1979) than those of *mauri* or *pusilla* in comparable areas, indicating more rapid southward migration. It may be unwarranted to compare extreme dates based on the examination of large series of specimens from many years with those generated by single studies at a few scattered localities based on captured individuals and sight records. Indeed, at Grays Harbor in 1979 the first *bairdii* were not seen until at least two weeks after the first *mauri*, and in 1982 *bairdii* had still not been observed by 15 August, when *mauri* juveniles had been common for over a week (Paulson, unpubl. data). However, in other years juveniles of *bairdii* appeared earlier, as on 16 August 1976 and 8 August 1981. As *bairdii* is much less common in Washington than *mauri*, it is less likely that the first-arriving birds will be detected as readily. Farther south at Bolinas Lagoon, Page et al. (1979) detected first juvenile Baird's two days after first juvenile Westerns in 1972 and three days before them in 1973.

Conversely, the mean arrival dates given by Jehl (1979) for juvenile Baird's are likely to be biased in the direction of lateness, as years when few specimens are collected will surely not be representative of arrival dates. Juvenile Baird's peaked at Grays Harbor in 1979 in late August and early September, about when juvenile Westerns did, so with later fledging dates it appears that they must move southward more rapidly than juvenile Westerns.

At present I cannot distinguish between three alternative hypotheses to explain the 12 July record of *C. pusilla*: (1) this bird fledged by the earliest recorded time of 8 July and reached Ocean Shores within a few days of fledging; (2) it underwent a normal development and migration and fledged somewhere at the southern end of its breeding range as early as mid-June; or (3) it hatched from a nest considerably south of the known breeding range of the species and thus with a still earlier cycle. Its appearance at Ocean Shores, where the species is quite rare, as opposed to inland Washington or Vancouver, British Columbia, where it is much more regular in the fall, may indicate direct across-water migration from southern Alaska, which would enforce a rapid flight to this latitude.

DISCUSSION

Holmes (1966, 1972) discussed different patterns of fall migration and autumnal molt in adults of several *Calidris* species and noted at least three modes, with wing molt either (1) at the end of a long-distance interhemispheric migration, (2) at the end of or during shorter-distance migration of northern hemisphere winterers, or (3) *before* migration to still more northerly wintering grounds. Many species can now be apportioned among these modes with some confidence (Prater et al. 1977; Paulson, unpubl. data).

Juveniles of these species are generally similar to the adults in their schedules, although migrating later. It appears that in *C. bairdii*, juveniles move southward relatively rapidly, as do the adults, which fall in mode 1. The species has largely passed through Washington by the end of September, when migrants of many other more northerly wintering shorebirds are still common. In *C. mauri* and *C. minutilla*, juveniles move through the area at a more leisurely pace, their passage starting just before or at the same time as that of *bairdii* and ending several weeks later. Similarly, juveniles of *C. alpina* remain in the Arctic along with the adults and molt into their first-winter plumage before moving south (Holmes 1966, 1972), and *C. ptilocnemis* follows the same pattern (Paulson, unpubl. data, for this and other statements in this paragraph).

One species of the genus, however, stands out in contradiction to this pattern. Juvenile *C. melanotos* first fledge during approximately the same period as juvenile *bairdii*—23 July 1960 and 26 July 1962 at Cambridge Bay and 24 July 1966 at Jenny Lind Island (Parmelee et al. 1967). Published reports do not allow distinction of adult and juvenile migrations in this species for the most part, although Pitelka (1959) made it clear that juveniles were

still departing northern Alaska several weeks after the last adults had gone. Hamilton (1959) observed first juveniles at Delta, Manitoba, on 25 August 1956, 36 days after the first influx of adults, again paralleling other shorebirds in which juveniles appear about a month after adults (Jehl 1963, Page et al. 1979).

However, unlike *C. bairdii* and other long-distance migrants, with which Holmes (1972) placed *melanotos,* the juveniles of this species remain in migration in northern North America quite late in the fall. At Ocean Shores, off the main migration route of this species, adults are virtually never seen, but juveniles first appeared on 3 September 1979, became common at the end of that month and in early October, and declined to a few still present as late as 11 November, over a month after the last Baird's Sandpiper was seen (6 October; Paulson, unpubl. data). The previous year, Widrig (1979) found Pectoral Sandpipers on Leadbetter Point, Washington, from 26 August to 25 October, a similarly late period, with the last Baird's on 12 September. Jehl's (1979) data likewise indicate that at the level of the northern United States, juvenile *bairdii* do not linger beyond September. In Minnesota (Green and Janssen 1975), Buffalo, New York (Beardslee and Mitchell 1965), and Massachusetts (Griscom and Snyder 1955), *melanotos* is found well beyond the occurrence of *bairdii* in the fall, although at Norman, Oklahoma, the two species apparently have rather similar fall migration patterns (Oring and Davis 1966).

As Baird's and Pectoral sandpipers have rather similar winter distributions in southern South America (Blake 1977), it is not immediately apparent why the latter should linger so much longer on their migration route. Possibly the different feeding habits of the two species, Baird's in much drier habitats than Pectoral, could have something to do with this difference. Myers (1981) has pointed out that shorebirds that have farther to go will depart earlier in migration, but it is evident from the difference between juvenile *bairdii* and *melanotos* that factors in addition to distance to be travelled enter into the timing of migration.

As more observers undertake censuses of shorebirds and routinely record age (and perhaps sex) classes, our understanding of the relationship between fledging dates and period of fall migration should improve. Large-scale banding studies should be particularly useful in this regard, accompanied by judicious collecting, but field observations without capturing or collecting birds can be of great additional value in this group, in most species of which we can fortunately distinguish juveniles from adults in the field.

Ultimate goals include (1) the use of juvenile-to-adult ratios to determine year-to-year variation in breeding success; (2) the use of temporal patterns in the migration of juveniles, as well as adults, to determine year-to-year variation in breeding seasons; (3) the determination of migration patterns, spatial as well as temporal, that differ between sexes and age classes, and an attempt to integrate these patterns into general evolutionary/ecological theory; and (4) effective management of shorebird populations based on a better understanding of their movements.

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LITERATURE CITED

ASHKENAZIE, S., AND U. N. SAFRIEL. 1979. Breeding cycle and behavior of the Semipalmated Sandpiper at Barrow, Alaska. Auk 96:56–67.

BEARDSLEE, C. S., AND H. D. MITCHELL. 1965. Birds of the Niagara frontier region. Buffalo Soc. Nat. Sci. Bull. 22.

BLAKE, E. R. 1977. Manual of Neotropical birds. Vol. 1. Spheniscidae (penguins) to Laridae (gulls and allies). Univ. of Chicago Press, Chicago.

CONOVER, H. B. 1926. Game birds of the Hooper Bay region, Alaska. Auk 43:162–180, 303–318.

DRURY, W. H. 1961. The breeding biology of shorebirds on Bylot Island, Northwest Territories, Canada. Auk 78:176–219.

GABRIELSON, I. N., AND F. C. LINCOLN. 1959. The birds of Alaska. The Stackpole Co., Harrisburg.

GREEN, J. C., AND R. B. JANSSEN. 1975. Minnesota birds. Where, when and how many. Univ. of Minnesota Press, Minneapolis.

GRISCOM, L., AND D. E. SNYDER. 1955. The birds of Massachusetts. Peabody Museum, Salem, MA.

HAMILTON, W. J. III. 1959. Aggressive behavior in migrant Pectoral Sandpipers. Condor 61:161–179.

HARRINGTON, B. A., AND R. I. G. MORRISON. 1979. Semipalmated Sandpiper migration in North America. Stud. Avian Biol. 2:83–100.

HARRINGTON-TWEIT, B., P. W. MATTOCKS, JR., AND E. S. HUNN. 1980. Northern Pacific coast region. Am. Birds 34:922–925.

HOLMES, R. T. 1966. Breeding ecology and annual cycle adaptations of the Red-backed Sandpiper (*Calidris alpina*) in northern Alaska. Condor 68:3–46.

HOLMES, R. T. 1972. Ecological factors influencing the breeding schedule of Western Sandpipers (*Calidris mauri*) in subarctic Alaska. Am. Midl. Nat. 87:472–491.

HUNN, E. S., AND P. W. MATTOCKS, JR. 1981. Northern Pacific coast region. Am. Birds 34:216–219.

HUSSELL, D. J. T., AND G. L. HOLROYD. 1974. Birds of the Truelove lowland and adjacent areas of northeastern Devon Island, N. W. T. Can. Field-Nat. 88: 197–212.

JEHL, J. R., JR. 1963. An investigation of fall migrating dowitchers in New Jersey. Wilson Bull. 75:250–261.

JEHL, J. R., JR. 1979. The autumnal migration of Baird's Sandpiper. Stud. Avian Biol. 2:55–68.

MYERS, J. P. 1981. Cross-seasonal interactions in the evolution of sandpiper social systems. Behav. Ecol. Sociobiol. 8:195–202.

NORTON, D. W. 1973. Ecological energetics of calidridine sandpipers breeding in northern Alaska. Ph. D. diss., Univ. of Alaska, Fairbanks.

ORING, L. W., AND W. M. DAVIS. 1966. Shorebird migration at Norman, Oklahoma: 1961–63. Wilson Bull. 78:166–174.

PAGE, G., B. FEARIS, AND R. M. JUREK. 1972. Age and sex composition of Western Sandpipers on Bolinas Lagoon. Calif. Birds 3:79–86.

PAGE, G., AND A. L. A. MIDDLETON. 1972. Fat deposition during autumn migration in the Semipalmated Sandpiper. Bird-Banding 43:85–100.

PAGE, G. W., L. E. STENZEL, AND C. M. WOLFE. 1979. Aspects of the occurrence of shorebirds on a central California estuary. Stud. Avian Biol. 2:15–32.

PARMELEE, D. F., H. A. STEPHENS, AND R. H. SCHMIDT. 1967. The birds of southeastern Victoria Island and adjacent small islands. Natl. Mus. Can. Bull. 222.

PITELKA, F. A. 1959. Numbers, breeding schedule, and territoriality in Pectoral Sandpipers of northern Alaska. Condor 61:233–264.

PRATER, A. J., J. H. MARCHANT, AND J. VUORINEN. 1977. Guide to the identification and ageing of Holarctic waders. British Trust for Ornithology, Field Guide 17.

WIDRIG, R. 1979. The shorebirds of Leadbetter Point. Privately published, Ocean Park, WA.

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