

# SUMMER SCHEDULE AND BREEDING BIOLOGY OF THE WHITE-RUMPED SANDPIPER IN THE CENTRAL CANADIAN ARCTIC

DAVID F. PARMELEE, DALE W. GREINER, AND WALTER D. GRAUL

DURING the summer of 1962, the senior author, George Miksch Sutton, H. A. Stephens, and Richard H. Schmidt visited Jenny Lind Island in the Arctic Archipelago and found an unusual breeding shorebird population. Among the many shorebirds, which included both high-arctic and low-arctic forms, the White-rumped Sandpiper (*Calidris fuscicollis*) was one of the commonest. Our stay on the island that year, from 19 June to 5 July, was much too brief to permit an extensive study of this highly provocative and puzzling species—the taxonomic position of which has been repeatedly disputed. Although the senior author wished to return soon to Jenny Lind Island for the purpose of studying White-rumps and other shorebirds, the opportunity did not occur until 1966 when he, accompanied by George Miksch Sutton, Dale W. Greiner, and Walter D. Graul, arrived there on 31 May and remained until 12 August.<sup>1</sup> The account that follows is an attempt to describe certain aspects of the White-rumped Sandpiper's complex breeding behavior, and thereby to clarify its relations to certain other scolopacids, particularly the Pectoral Sandpiper (*Calidris melanotos*). We concentrated on the incubation and fledging periods, and especially on the pair-bond relationships and role of the sexes in care of eggs and young.

## STUDY AREA AND METHODS

Jenny Lind Island lies isolated in Queen Maud Gulf at the southern edge of Victoria Strait. The Royal Geographical and King William islands are to the east, the very much larger Victoria Island is north and west, and the sprawling mainland (Perry River area) is south. Less than 20 miles across, the total area of the island is only 167 square miles. The highest land hardly exceeds 200 feet elevation anywhere, and there are no precipitous cliffs either inland or at the coast. Innumerable lakes and ponds dot the landscape, although none is deep. The few streams that flow swiftly following the thaw are reduced to a series of stagnant pools by mid-July, when coastal shore leads are wide open and the last spots of snow disappear inland. Despite the unpretentious terrain, extensive wet tundras with networks of

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<sup>1</sup>The expedition to Jenny Lind Island in 1966 was financed largely by the National Science Foundation (GB 4904) and partly by Kansas State Teachers College at Emporia. George Miksch Sutton, Research Professor of Zoology of the University of Oklahoma, joined our group as an independent investigator and bird artist. He kindly gave us his notes on the White-rumped Sandpiper for inclusion in this report.



WHITE-RUMPED SANDPIPER (*Calidris fuscicollis*) chick, newly hatched. Painted direct from life July 13, 1962, by George Miksch Sutton. The egg, taken from a nest on Jenny Lind Island, was hatched on Victoria Island by a Semipalmated Sandpiper.

marshy ponds, sandy flats, raised beaches, stony ridges and prominences, and both sandy and rocky marine beaches provide a variety of habitats favorable to the many birds that inhabit the island.<sup>2</sup>

Though south of the 69th parallel, Jenny Lind Island is cooled by chilling winds that sweep down from the ice pack of Victoria Strait. The mean daily temperature for July is only 42 F and approaches a high-arctic condition, which in part accounts for a retarded vegetative cover most evident in the willows. No doubt the cool conditions contribute to the remarkable high-arctic avifauna that breeds on the island with distinctly low-arctic species.

Detailed studies on the White-rumped Sandpiper were carried out in a circumscribed area covering 2.5 square miles of variable terrain near the east coast. The southeastern end of the study area was a barren rocky ridge (50 to 100 feet elevation) that, except for a few isolated marshy ponds, was unsuitable for nesting White-rumps. Within and beyond the limits of the study area, the ridge gave way to a gentle, well vegetated slope that ended northwestwardly in a great marsh with myriads of lakes and ponds. A few White-rumps bred near the isolated ponds and vegetated traps at the higher elevations, but the majority were in the perpetually wet habitat of the low interior.

Many parts of the study area were visited at various times round the clock daily from 1 June through 12 August—a span that covered nearly all phases of the species' summer schedule. A light-weight tundra vehicle (Jiger) was used occasionally as a means of transportation, but most visits to the study area were made afoot. Nests were found by watching or flushing females. Choice areas containing fair numbers of birds were systematically covered by rope dragging, a technique successful enough for White-rumps but not for all scolopacids. Nest markers consisting of a wire rod with a small label attached were placed at least 15 yards from each nest in an attempt to avoid predator detection of nests. Certain eggs were marked with dots of red fingernail polish for identification purposes.

Incubating White-rumped Sandpipers were live-trapped at nests by means of a Myer's (1966) trap, an ingenious device designed for catching doves, but equally suitable for shorebirds. Eleven adult females were trapped at nests within the study area and released upon banding, color banding, and feather coloring with crimson, yellow, or green water-soluble dyes for convenient field identification. Two of the 11 abandoned their nests immediately upon being handled and were not seen again. The other nine soon

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<sup>2</sup>Notes on all bird species and subspecies recorded on Jenny Lind Island in 1962 and 1966 are included in a separate publication by the senior author, H. A. Stephens, and Richard H. Schmidt, entitled "The Birds of Southeastern Victoria Island and Adjacent Small Islands" and published by the National Museum of Canada (Bulletin 222, 1967).

returned to their respective nests, and we were thus able to follow the individual movements of these birds very accurately, in some cases up to the time the parent-offspring bond dissolved. We failed to trap a single male White-rump at a nest, since the male does not sit on eggs (see page 16, below). Incubating males of some other shorebird species were quickly caught, however.

Adults were sexed mainly on the basis of calls and behavioral characteristics, since it was not practical to kill the very birds we studied. We did, however, collect one of the marked females about the time its young fledged. Male White-rumps behaved so differently from females on the breeding ground that sex identification was no problem afield. Moreover, breeding males showed an enlarged throat, which readily identified them when seen at reasonable distances. In failing to color mark male White-rumps, we were unable to follow their individual movements. This proved a distinct disadvantage.

Most of the 55 young White-rumps handled by us in 1966 were banded on the left leg when newly hatched at the nest. Those young of uncertain age outside the nest were banded on the right leg as a rule. Only young with bands on left legs were later collected, thus giving us a useful series of sexed juveniles of various known ages. This method worked well with White-rumped Sandpipers, for even strong flying young were easily approached and the bands readily detected.

We considered the banding and color marking techniques essential. Without them we could not have pinned down many facts on breeding behavior. So many surprising phenomena concerning shorebird behavior came to light during the course of study, that we strongly feel that any comparable study should be based on marked individuals.

#### DISTRIBUTION AND BREEDING DENSITY

The White-rumped Sandpiper is a monotypic, Nearctic species that breeds commonly but discontinuously across Arctic Canada, and sparingly on the north coast of Alaska. On the mainland of Arctic Canada it probably breeds from near its southern limits at Chesterfield Inlet on Hudson Bay westward across northern Keewatin, Melville and Boothia peninsulas, and northern Mackenzie. On the Arctic Islands it breeds from the southern edge of the archipelago northward nearly to the 75th parallel on Melville Island, but apparently not at higher latitudes. Although a number of observers at various localities have reported on the breeding of this relatively unknown species, there are only a few detailed studies to date.

Population densities of White-rumped Sandpipers have been estimated for several localities by various means. Soper (1946) described the invasion

of Bowman Bay, Baffin Island, by "almost incredible numbers" of these birds but gave no numerical estimates. Sutton (1932) stated that the birds were abundant and widely distributed over most of Southampton Island but were less common in the eastern, more rocky part; about 60 pairs of White-rumps occurred within a radius of about four miles of his base, an area equivalent to about 50 square miles. By use of the multiplier technique, Manning et al. (1956) converted the number of White-rumps recorded per hour in a given area to an estimated standard number per square mile and concluded that a total adult population of 25,000 birds summered on Banks Island (24,600 square miles) in 1953. However, the birds were not evenly distributed over the island and appeared to be common only in the southeastern part. By employing the same method, Manning and Macpherson (1961) arrived at a 1958 estimate of 15,000 adults for Prince of Wales Island and small adjacent islands, a total area of about 12,500 square miles. The number of White-rumps varied from one locality to another. Where found, the birds ranged in density from 0.5 to 10.2 birds per square mile. Drury (1961) concentrated his studies in a circumscribed area on Bylot Island and found six pairs (12 birds) in one square mile—apparently the densest population of White-rumps seen on the island by him in 1954.

The eastern half of Jenny Lind Island was surveyed for birds in general, but detailed studies on White-rumped Sandpipers were made in the 2.5-square-mile area already mentioned. At least 22 pairs occupied this area in 1966. This figure was based on 17 nests and five broods of young not more than three days of age. Older young from additional broods were not included, since they easily could have come from outside the study area. Ten of the 17 nests and four of the five broods were within a half-square-mile area; five nests and two broods were within one-eighth-square-mile area. The densest population was, therefore, seven pairs (14 birds) per 80 acres. Although these figures are minimal, they probably are fairly accurate considering the many hours spent traversing the area and observing both females and displaying males.

On the basis of 22 pairs per 2.5 square miles, one might assume a total population of 1,470 pairs for Jenny Lind Island in 1966. This figure is far too high, for much of the island is unsuitable for nesting White-rumps. Probably no more than 60 square miles would qualify as nesting habitat, and much of this ground would be marginal rather than choice. Our 2.5-square-mile area with its variable terrain, though hardly a random sample, is probably representative of the 60 square miles of seemingly suitable habitat. A generous estimate of the total breeding population based on the 60 square miles would be in the neighborhood of 528 pairs. Even this figure, though

more realistic, seems a bit high on the basis of casual observation in most areas visited.

There can be no doubt that the number of breeding pairs fluctuates considerably from time to time. The 1962 season may well have been a peak year when the density conceivably attained 20 or more pairs per 80 acres. Sixteen nests were found without much searching in a square mile of choice ground, which we later used as part of our 1966 study area. There probably were two or three times that many nests judging from the number of birds seen.

#### ARRIVAL AT BREEDING GROUND

Arrival and early courtship dates for the White-rumped Sandpiper in Arctic Canada are poorly documented. The few records indicate that the dates vary considerably from one locality to another, and may vary yearly at a given locality. At Cambridge Bay on Victoria Island where the species is uncommon, the senior author first noted a displaying male in 1960 on 7 June. In the same area in 1962, he and Sutton first noted three males (no displaying) on 7 June, and a female on 8 June. But in 1966 the species was already at Cambridge Bay the day of our arrival on 28 May (one bird, sex not known to us). Flight displaying was not observed before 31 May, however.

In 1966 we especially looked for, but failed to find, the species before 2 June on Jenny Lind Island only 95 miles from Cambridge Bay. The first White-rumps seen—two birds seemingly not paired and a solitary individual—stood near partly open ponds several miles inland, where the species later bred. A single White-rump stood with a Pectoral Sandpiper in the same marsh on 3 June, and a solitary individual was seen several miles from there the following day. On 5 June scattered males performed aerial displays—the first observed on the island that year. Many males displayed and chased females on 6 June, and commonly thereafter.

Courting White-rumps appear to be highly sensitive to changes in temperature and wind velocity. Although an exceptionally early May thaw occurred on Jenny Lind Island in 1966, the first days of June were windy and raw (mean daily temperatures only 27 F on the 1st and 26 F on the 3rd). Temperatures rose during 5 June and were mild by the 6th, when there was much thaw accompanied by increased White-rump activity. Displaying decreased appreciably during the inclement weather of 8 June, but soared during a calm on the 9th; then it fell off during the next couple of days and picked up again on the 12th.

Delayed courtship has been noted elsewhere in Canada. The snow cover was deep and winds fierce on 3 June when Sutton (1932) first noted

White-rumped Sandpipers on Southampton Island. A few bare patches of ground were evident when he saw them next on 6 June. The birds were definitely on wet breeding grounds on 8 June, but the first pronounced courting activities apparently did not take place before 11 June.

Some ornithologists report a different arrival and early courtship. Soper (1928) did not see the species at Nettilling Lake, Baffin Island, before 10 June; by 14 June the species had become quite common. At Bowman Bay, according to Soper (1946), an intensive wave of migrating White-rumps persisted during 8–14 June, after which the numbers gradually diminished, though a large population remained to nest on the surrounding tundra. On Bylot Island, the northeasternmost breeding ground known for the species, the general arrival of White-rumps took place on the afternoon of 19 June, according to Drury (1961), who inferred that ground display followed by aerial display commenced soon after the birds had arrived. Both Soper and Drury believed that the arrival was precisely timed for breeding. According to Soper (1928), both sexes arrived together, with the females almost, if not quite, ready for immediate reproduction. Drury thought that egg laying started within two days after the species arrived on Bylot Island.

Records for other areas are less instructive. Sutton and Parmelee (1956) noticed a few migrating White-rumps near the head of Frobisher Bay, Baffin Island, during 15–21 June. Macpherson and Manning (1959) noted small groups and pairs on Adelaide Peninsula during 16–20 June. Manning and Macpherson (1961) first saw the species on Prince of Wales Island on 15 June, and fairly commonly thereafter. On Banks Island, Manning et al. (1956), collected a male at Egg River as early as 1 June, and noted an individual at Cape Kellett on 2 June.

Considering all these records, it is clear that the spring arrival on the breeding ground in the Canadian Arctic may cover a span of considerable magnitude, from at least 28 May to 19 June; and that the first displays may start as early as 30 May, or as late as 20 June. It can be said with some confidence that early arrivals may be few in number and do not necessarily display or breed immediately, especially when the weather is inclement and the snow cover extensive. But courtship and breeding may start almost immediately when the majority of both sexes arrives in force, especially when the arrival takes place after the first week or ten days of June when conditions are apt to be optimal.

#### TERRITORY—DISPLAY—PAIR BOND

Territories were established on Jenny Lind Island in 1966 as early as 5 June, when aerial displays were first noted. Some males that we watched closely on 6 June amorously pursued females that ran swiftly before them

over exposed turf and banks of snow. Characteristically, the males walked and ran with tails elevated high and somewhat forward, and wings straight out with tips arched down, not fluttering. In attitudes precisely similar to those illustrated and described as the "Sharp-tailed Grouse dance" by Drury (1961), they displayed their white rumps, and fully their white under-tail feathers while uttering low buzzing notes or little growls. Paying no attention to us, one male followed a female attentively around a rather small area presumably within his territory for 20 consecutive minutes, attempting copulation not only on the run but on the wing as well. In fits of excitement it several times landed squarely on the back of the flying female, but the acts were hardly consummated. Other females seen that day were equally unreceptive. Eventually we discovered that a few had laid fertile eggs early, indicating that at least some females not seen by us had been receptive.

Sutton (1932) beautifully described the aerial hovering and calling of the male White-rumped Sandpiper on territory, and Drury (1961) elaborated further on the display with action illustrations. We, also, have noted these aerial displays many times. The hoverings and glides back to earth are used by other seemingly related sandpipers, notably the Knot (*Calidris canutus*), Baird's Sandpiper (*Calidris bairdii*), Stilt Sandpiper (*Micropalama himantopus*), and Semipalmated Sandpiper (*Calidris pusilla*). A less spectacular aerial display of the White-rumped Sandpiper, on the other hand, resembles rather closely one of the Pectoral Sandpiper, which normally does not hover or tread while calling in mid-air.

For example, the male White-rump has a horizontal flight that moves it fast and low across the tundra. The flight may terminate in a sudden rise followed by an abrupt descent. While flying horizontally, the displaying bird gives the familiar "quo-ick" calls, and some times the "typewriter carriage" series of rapid notes described earlier by Sutton. The male may drive an intruder far beyond the territory he is defending seemingly hundreds of yards at times, but then quickly flies back. Upon re-entering his favored ground, he may suddenly rise to heights of 20 or more feet and immediately glide swiftly down, calling as he goes. No hovering accompanies such displays, so far as we know. This flight, interestingly enough, appears to be remarkably like one described by Holmes and Pitelka (1964) for the Curlew Sandpiper (*Calidris ferruginea*).

Like the Pectoral Sandpiper, also, the male White-rump stands guard on some prominence in the wet tundra. From his perch he reacts quickly to strange males by driving them off, and seemingly to all females, even those of other species, which he attempts to court. Invariably when we flushed a female from its eggs in the presence of a male, there was an immediate response. With bill thrust forward, wings stiff, and tail tilted high, he



growled and buzzed incessantly while moving in close to the displaced and unreceptive bird. The action eventually terminated in a swift flight chase or simple parting. This display, essentially the one used by males in early phases of courtship, was remarkably similar to one of the male Pectoral Sandpiper, which reacts in almost the same way to displaced females.

Detailed observations on an isolated nesting in 1966 revealed noteworthy features of the territory. The nesting area was unique in being near the summit of a stony ridge within a narrow but rather long depression containing several ponds fringed with wet, grassy hummocks. The rocky ground all around was a barrier to other White-rumps on territory, the closest of which was about a half mile away. One male, first noted while performing aerial displays on 11 June, occupied the entire pond area without interference or territorial pressure from adjacent areas. On occasion the male, presumably the same individual each time, flew from the area but returned to display. The one female (color banded and dyed) that nested in the area—in a spot not often visited by the male—completed her clutch on 19 June. This was the day the male was last seen. Here is one case where the pair bond terminated with the completion of the clutch, or soon thereafter. The female alone incubated the eggs and attended the young—invariably the case with all White-rump nestings studied by us. The territory of the male, therefore, has a sexual function of short duration. The pair bond, if it can rightly be called such, is of short duration also, suggesting an incipient kind of lek behavior.

Aerial displaying in 1966 appeared to have reached a peak of activity from 6 June to about 12 June, and then declined. It was decidedly sporadic by 20 June when most females were incubating steadily. A few males defended areas vigorously as late as 27 June, but they were truly exceptional. The last flight display seen by us occurred 4 July. In the same area in 1962, we last recorded aerial displaying on 30 June, though we continued to see a few males chasing about in the breeding areas as late as 5 July.

In visiting the Jenny Lind Island nesting ground late in 1962, when most clutches were completed, we found a preponderance of females, i.e., we saw many more females than males. No doubt, this was due largely to the fact that many males had already abandoned their territories. On the breeding ground the sex ratio appeared to be equal early in the 1966 nesting season.

#### NESTING HABITAT—EGG LAYING—INCUBATION

Female White-rumped Sandpipers appear to nest without regard to the male's territory, though they often do nest within a territory. This behavior may partly explain why nests may occur close together. Two nests on Jenny Lind Island in 1962 were only 13 yards apart (Parmelee et al., 1967). Indif-



FIG. 1. Female White-rumped Sandpiper at nest on Jenny Lind Island. From a Kodachrome transparency taken 18 June 1966.

ference to the male's territory is characteristic of female Pectoral Sandpipers as well.

The territory and nesting site both occur in essentially the same type of habitat—reason enough that the two often coincide. Choice habitat on Jenny Lind Island, and apparently all across Arctic Canada, is hummocky, well vegetated tundra that remains persistently wet and often occurs near marshy ponds and lake shores. Well vegetated hummocky ground on the higher slopes is used less often. These better drained areas, though wet and muddy when the eggs are laid, often are very dry by the time incubation draws to a close and the young hatch. Nevertheless, the vegetation is dense and concealing (Fig. 1). This is not true of the strictly dry tundra where the ground cover is thin and scattered. The dense vegetation often consists of sedges and numerous other plants.

All 47 White-rumped Sandpiper nests seen by us on Jenny Lind Island were well concealed, rather deep depressions in hummocks. All were lined copiously with dry willow leaves and bits of mosses and lichens. We do not

know whether the female actively lines the depression, but it seems unlikely since plant materials readily fall into depressions situated in well vegetated hummocks. We suspect that many of the unused depressions seen in the breeding areas may be used from time to time by the same species. Presumably some individuals use the same ground, conceivably the same nest cup, in consecutive years. A male Stilt Sandpiper banded at the nest by the senior author one summer at Churchill on Hudson Bay was found nesting in the old depression the following year by Joseph R. Jehl, Jr.

Several species of sandpipers nested in wet tundra in proximity of the White-rumps on Jenny Lind Island: the Pectoral and Semipalmated sandpipers typically; the Stilt Sandpiper, and probably the Knot, occasionally. The latter two species, also, occupied dry tundra with scattered plants. Dry tundra was the preferred nesting habitat of Baird's Sandpiper, Buff-breasted Sandpiper (*Tryngites subruficollis*), and Sanderling (*Croethia alba*).

In the case of the White-rumped Sandpiper, we failed to find incomplete clutches of one or two eggs and thus did not determine precisely the time interval between layings. Drury (1961) inferred that eggs were laid every other day. From our own experience we know that as many as two days sometimes elapse between layings in certain large shorebirds, e.g., the Black-bellied Plover (*Squatarola squatarola*). Our guess, based on our observations with Baird's and Pectoral sandpipers, is that the interval falls somewhere between 24 and 30 hours for the White-rumped Sandpiper.

For example, the second egg at one Baird's Sandpiper nest was laid about 0330 on 12 June, the third egg about 0900 on 13 June, and the fourth egg about 1545 on 14 June. The eggs, therefore, were laid 29 to 31 hours apart. At another Baird's Sandpiper's nest the third egg was laid the very moment we discovered the site. The female while standing in the nest laid her egg *pointed end first*. She laid her fourth egg 29 hours later on 13 June. The interval between laying of the third and fourth eggs at a Pectoral Sandpiper's nest observed earlier at Cambridge Bay was at least 24 hours, at most 28 hours and 40 minutes, the fourth egg appearing later in the day than the third. That eggs are laid about 30 hours apart explains why laying occurs at a later hour each day until completion of the clutch.

One of our White-rumped Sandpiper nests had three eggs when found 14 June. The fourth egg was laid 29 hours later at about 1600 on 15 June. The fourth egg (marked) was the first of the clutch to hatch; all four eggs hatched between 1605 and 1710 on 7 July. The period of incubation from laying to hatching of the last (fourth) egg was 22 days (error not greater than 1.5 hours). The period or duration, heretofore not reported for the species, is close to the 21-day-period first reported for Baird's Sandpiper by Drury (1961) and later confirmed by us. The Semipalmated Sandpiper

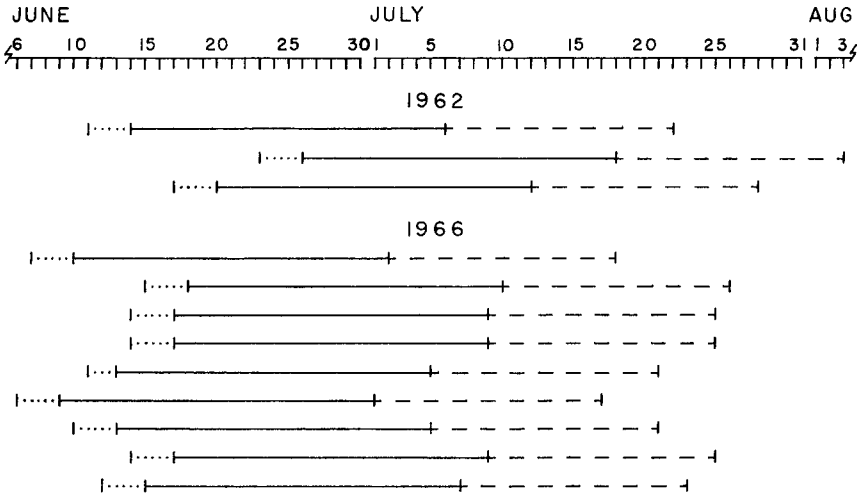


FIG. 2. Chart showing the spread of the egg laying period (dotted line), incubation period (solid line), and fledging period (dash line) for three White-rumped Sandpiper nests found on Jenny Lind Island in 1962, and for nine nests found there in 1966. Eggs presumably are laid daily at about 30-hour intervals. The period of incubation is 22 days, the period of fledging, 16 to 17 days. The period from first egg to fledging time is approximately 41 days. Egg laying may start as early as 6 June and young may fledge as late as 3 August—a span of 58 days.

appears to have a considerably shorter incubation period. Four of our records indicate that the period is only 19 days.

Assuming that White-rumped Sandpiper eggs are laid daily, and by using the 22-day incubation period as a fairly reliable standard, we have attempted to date the egg-laying and incubation periods for nine nests whose young hatched at known times in 1966 (Fig. 2). It appears that some birds had commenced laying as early as 6 June and others as late as 15 June, indicating a variation of nine days in the start of laying. Egg laying per se covered a span of 12 days (6–18 June). Seventeen or nearly 50 per cent of the 35 eggs in the nine nests were probably laid during 11–15 June, attaining a peak during 14–15 June.

Nesting data gathered on Jenny Lind Island in 1962 is of little value, since we left the breeding ground before hatching had commenced. Of 56 eggs (14 nests) examined during 20–26 June that year, all contained small embryos of various ages but indicated that egg laying had taken place chiefly in mid-June. Eggs with advanced embryos were collected early in July, and these later hatched artificially at Cambridge Bay, some as early as 6 July, and one as late as 12 July. The chick that hatched 12 July was painted directly from life by Sutton on 13 July (see frontispiece).

One clutch in 1962 was completed on 26 June—our latest date of laying for the species. Whether this late nesting was a first attempt or a repeat was not known. In any event, the egg-laying period for Jenny Lind Island was considerable, perhaps as much as 20 days. But despite the fact that some White-rumps nest very early and others very late, it is evident that most eggs are laid during mid-June. A late spring thaw probably would have little effect on the breeding schedule of the majority of White-rumps unless the season was much retarded.

The clutch size of 46 of 47 Jenny Lind Island nests was four. It may have been three at one nest, but we were not certain of this. Conceivably, an egg could have been lost to some predator before we discovered the nest.

Years ago Sutton (1932) reported that White-rumped Sandpiper males do not incubate. This observation, which is correct, had not been confirmed. Drury (1961) believed that only one sex seems to incubate, though he was vague as to which sex actually attended the eggs. In 1962 we flushed only females (three collected) from nests. But in marking nine females at nests in 1966, we were certain that the female alone incubated the eggs. Not once did we flush an unmarked bird from any of these nests, several of which were checked regularly at various hours around the clock. Observations at one nest in particular were convincing. The nest, alluded to earlier, was situated in an isolated marshy pond area between rocky ridges. The male had abandoned the territory following completion of the clutch on about 19 June. From that date the female was the only White-rumped Sandpiper on the eggs, indeed within the pond area, throughout the period of incubation. During 50 nest checks from 27 June to 10 July, this bird came off the eggs during 35 checks, or 70 per cent of the time. Seven times she appeared from over the grassy hummocks and scuttled along ahead of us, eventually returning to the eggs. Twice we watched her from afar feeding at the edge of the pond not far from the nest. Six times we failed to find her; evidently she had flown from the area before we had arrived. Our data substantiate Drury's (1961) belief that the incubating White-rump is off the nest 20 to 30 per cent of the time.

The time spent away from the nest varied. Incubating birds often left their eggs for considerable periods, at odd hours, and even during inclement spells. Some of the eggs we checked were so cold at times that we believed them to be deserted; but all these chilled eggs hatched. In this behavior the species closely resembles the Pectoral Sandpiper and Sanderling. For example, the female of a Sanderling nest we watched without letup for 21 consecutive hours frequently left her eggs unattended for short periods in late afternoon to feed close by or at a favorite lake shore fully a quarter mile away. Although she incubated her eggs constantly during the cool

hours that followed when the sun was low, she suddenly left them at 0730 and did not return during the next six hours. Once back on the eggs in the afternoon, she could hardly be driven off, though she left to feed for short periods, evidently of her own volition. Most significantly, no male was seen at or anywhere near the nest throughout the 21-hour period. This female was later collected for positive sex identification.

Other scolopacids breeding on Jenny Lind Island behaved very differently. While checking the above-mentioned White-rumped Sandpiper's nest 50 times, we also checked Baird's, Stilt, and Semipalmated sandpiper nests that were near by. In these three species both sexes shared equally the duties of incubation. So regular was the twice daily turnover at the nest of the Stilt Sandpiper, that we recorded the marked male at the nest 25 times during the bright hours from 0730 to 1920; the marked female 25 times at various times during the remaining hours. The pattern was not so clearly defined in Baird's Sandpiper, and even less so in the Semipalmated Sandpiper. Nevertheless, the role of the sexes in all three was vastly different from that of the White-rumped Sandpiper.

#### HATCHING—CARE OF YOUNG—FLEDGING

Hatching was observed at nine nests from 1 July to 10 July in 1966 (Fig. 2). Young from six of these nests hatched during 5–10 July. Six additional broods from unmarked nests were noted during 7–11 July, indicating that many young hatched during this period. Hatching at one Jenny Lind Island nest in 1962 probably was as late as 17 July, since egg-laying was late (26 June).

Hatching dates for the species elsewhere have not been reported often. Soper (1928) first noted small young on Baffin Island on 11 July. Sutton (1932) first noted them on Southampton Island on 12 July. On Bylot Island, where arrival and egg laying may be late, hatching at four nests occurred during 15–22 July (Drury, 1961). Small downies (specimens in the National Museum of Canada) collected in southeastern Victoria Island by Captain Joseph Bernard during 7–11 August (year uncertain) were from exceptionally late nestings and probably represent an extreme case.

The period of hatching from the first to the last egg of a clutch may be rapid—as little as one hour and five minutes at one of our marked nests. At another it probably was close to 17 hours. At six nests it fell between six and 13.5 hours. These figures suggest that steady incubation usually starts about, or at most a few hours before, the time the clutch is completed.

When the large end or cap broke loose from the rest of the shell, the young chick emerged quickly. As soon as the female discovered the empty half shells, she grasped and flew off with them one at a time. One female

flew about 80 yards, alighted, dropped the shell, and then promptly flew back to the nests. Another picked up a half shell which we placed two feet from the nest and carried it 150 yards before dropping it. So strong was the instinct to rid the nest of empty shells, that the attending bird quite forgot our presence, despite the fact that we held its young in plain view.

We witnessed a striking example of this type of behavior at a Stilt Sandpiper nest when we failed to entice one of the marked adults into our trap a second time in order to measure its bill. The bird repeatedly ran up to, but not into, the trap that we baited with its newly hatched young. We caught it immediately, however, when we baited the trap with an empty shell! Actually, many shorebirds show this behavior, which must have a high selective value in protecting young from the many predators that would surely detect conspicuous shells.

White-rumped Sandpiper downies remained in the nest for an indefinite period. One of our banded chicks had moved eight inches from the nest by the time it was 2.5 hours old. Another banded chick (about 7.5 hours old) having once left its nest, returned to the nest that held two siblings and an addled egg. Some chicks remained in the nest for upwards of 17 hours. Older chicks were not seen in nests. Drury (1961) stated that downy White-rumps spent the first night in the nest if they hatched in the afternoon, but did not return once they left.

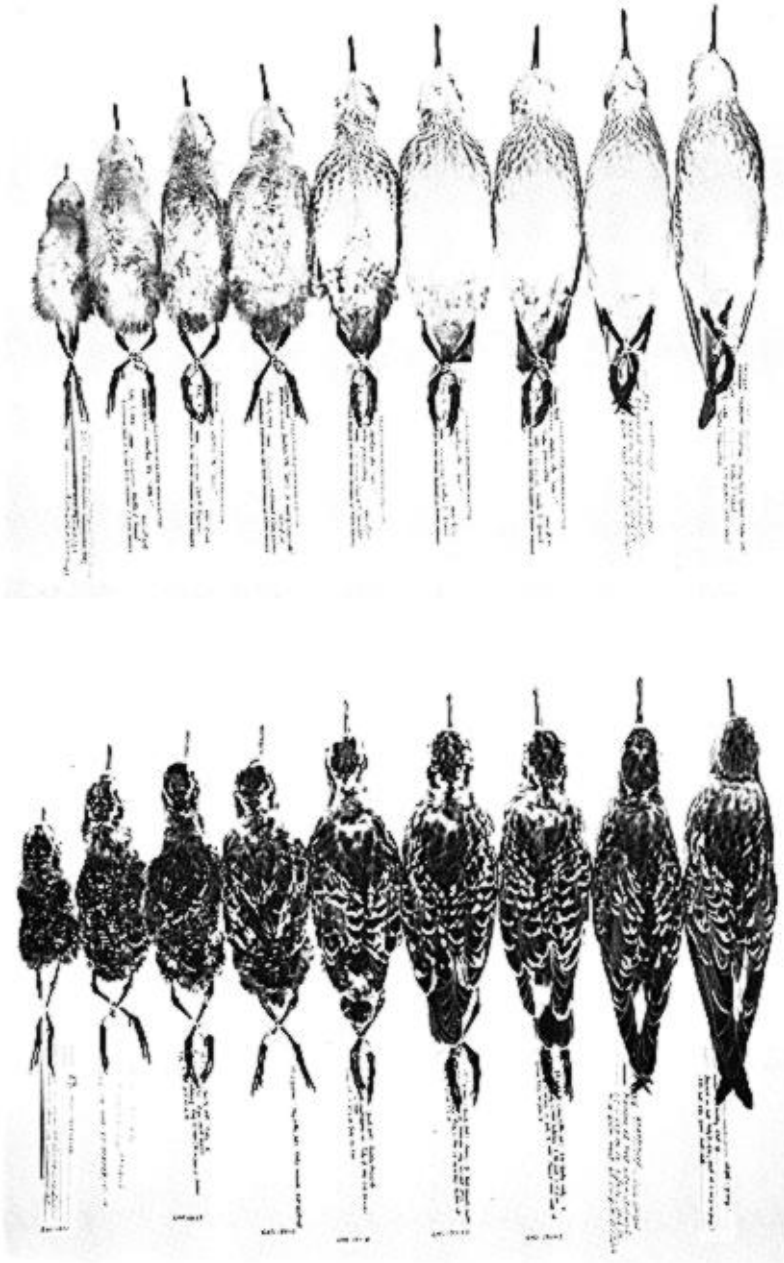
The female alone attended the brood. Following the hatch we carefully checked the movements of the marked birds that we had observed earlier at nests. Females with broods generally remained within the vicinity of their respective nests for the first six or seven days, after which time some moved out into new areas. This was especially true of those White-rumps that had nested on the drier slopes. They and other shorebirds tended to move down slope toward marshy lake areas, not necessarily in the direction of the coast as might be imagined. One marked female and brood last seen in the vicinity of the nest when the chicks were six days old had moved a mile and a half down slope by the time the young were 12 days old.

Those families moving down slope within our study area tended to pile up at the lake shores or at the maze of ponds and swales between the lakes. Many of them progressed no farther until fledging time. Those young that

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FIG. 3. Ventral and dorsal views of nine White-rumped Sandpiper young. The newly hatched downy on extreme left is six hours old. The eight banded juveniles from left to right are approximately six, nine, 11, 13, 15.5, 17, 22, and 27 days old (six, 11, 15.5, 17 day-old birds are siblings). All eight were collected on Jenny Lind Island by the authors in 1966 during 6 July-1 August and preserved by George Miksch Sutton.





had hatched near or within this labyrinth did not move very far. Broods continued to pile up until by late July the area swarmed with young of various species.

Some of the White-rumped Sandpiper females with broods we saw daily. From one such family which could be found almost any time, we collected all four siblings (Fig. 3) when six, 11, 15.5, and 17 days old respectively. The female remained with the brood to the last young, which was a strong flying juvenile when shot. At no time did we see males attending marked or unmarked broods.

Inasmuch as the female has sole charge of the brood, it was at first difficult for us to explain the occasional occurrence of two equally solicitous adults with young White-rumps, such as witnessed by Drury (1961) and others. We, also, have seen this phenomenon not only in White-rumps but in other species as well. An odd White-rump in our study area exhibited so much interest in one of our marked females, that we first thought it to be a male, possibly the mate. For at least two days the bird followed the female both in flight and on the ground, and on occasion to the nest; but it did not settle on the eggs to our knowledge, nor did it call or display. All doubts were dispelled upon collecting the bird. It proved to be a female, perhaps one that had recently lost her eggs or young.

Male White-rumped Sandpipers that are still on the breeding grounds by the time the first young hatch exhibit interest in females, but we do not know if they evince interest in chicks. At Cambridge Bay, the senior author actually witnessed a male Pectoral Sandpiper defending small downies of his kind. But the interest was short lived, for he soon abandoned the young to chase females. Both Pectoral and White-rumped sandpiper males have no real role in care of young. They differ greatly in this respect from male Knots, Baird's, Semipalmated, and Stilt sandpipers, all of which are even more solicitous and persistent than females in rearing young.

On Southampton Island, Sutton (1932) noted well developed but flightless White-rumped Sandpiper young which he felt were entirely on their own. We several times found unattended White-rump chicks, some only a few days old. One such individual, banded 621-08174 when about three days old on 13 July, we found running alone a good half mile from the point of banding on 17 July. The female and two siblings (621-08172,-73) were later found near the original banding site on 18 July, the birds evidently having remained close by since the 13th. Chick number 74 was not with them and was presumably lost to the brood. Unless adopted by another adult, a small chick would have little chance of survival. It seems likely that unemployed females would quickly adopt unattended chicks, but we do not know that this is actually the case with White-rumps. Adults of other

shorebird species, notably males of Baird's and Stilt sandpipers, may at times attended young other than their own—highly interesting behavior brought out in our banding studies.

Lost members of a brood cannot be ascribed to accident alone. Female White-rumps will fly off and temporarily abandon even small young. The best example of this behavior seen by us occurred on 11 July. A female left three newly hatched chicks and flew directly to and joined a circling flock of five White-rumps, at least one of which was a male. The latter occasionally set his wings and called "*quo-ick*" while flying with the group. When the flock ranged too far, the female quickly flew back and gathered up her brood, which in the meantime had scattered. But when the flock wheeled in close again, up she went for another spin.

The fledging period, heretofore not reported for the species, is 16 to 17 days. A marked 13-day-old juvenile captured by hand was fleet afoot but not capable of even short flights. Two siblings that were captured by hand when 15.5 days old were not quite fledged, though capable of flying weakly for short distances. One of them was flying strongly and could not be caught by hand 36 hours later when it was 17 days old. It flew well over a hundred yards per flight and was, in our opinion, fledged.

Allowing 16 days for fledging, young from nine nests in 1966 fledged during 17–26 July, the majority of them during 21–25 July (Fig. 2). Strong flying young were first seen that year on 18 July. Young from a late nesting in 1962 may have fledged as late as 3 August. Conceivably there could have been some overlapping between late hatchings and early fledgings that year.

The adult female-offspring bond dissolved soon after the young fledged. By the time unattended juveniles became conspicuous on the breeding ground, adult females became scarce. Lone females seen 31 July and 2 August were the last seen inland by us in 1966.

One of the marked females was collected 22 July when its young were 17 days old and fledged. The loss of the parent did not preclude further development of the young, for one was collected in good condition five days later on 27 July.

#### DEPARTURE FROM BREEDING GROUND

The small flocks of White-rumped Sandpipers that we saw circling low over the breeding grounds and nearby coastal areas throughout most of July were puzzling. Presumably they were composed mostly of adult males that had entered their post-breeding period. Collecting of specimens from such flocks would have been desirable, but we failed to take even a small sample.

Sutton (1932) observed that migratory tendencies were in evidence during

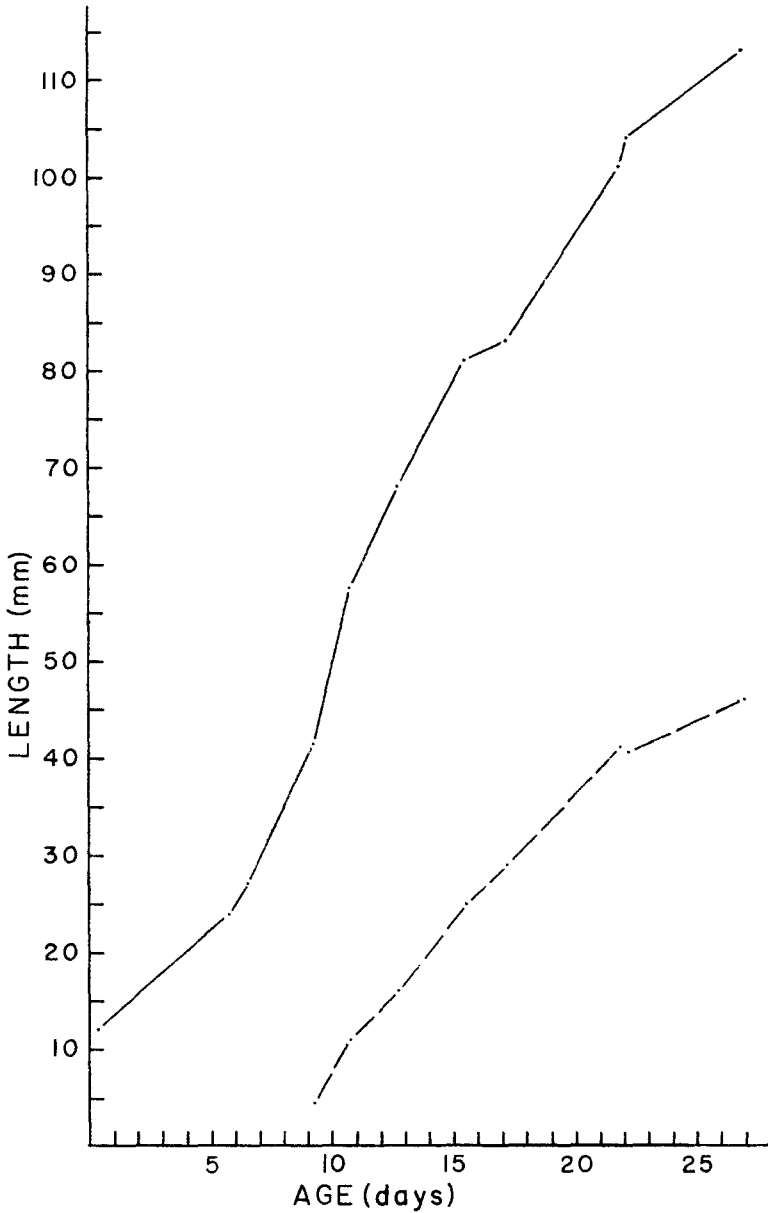


FIG. 4. Wing (solid line) and tail (dash line) growth in White-rumped Sandpiper juveniles. Curves based on measurements of wing chords and rectrices of birds of known age. Juveniles begin to fly when chord measurements exceed 80 mm.

early July before the young hatched on Southampton Island. From 9 July he observed small loose flocks of adults which he believed to be composed chiefly, if not altogether, of male birds. By mid-July males appeared to be by themselves in flocks near the coast, though not necessarily on the beaches. He witnessed a build-up or increase in the size of one flock from day to day. From these and other observations he concluded that by the time the eggs are all laid the males leave the females, go to the outer beaches, and finally flock together in small bands.

Following departure from the Jenny Lind Island breeding areas, most adult females vanished from the scene. Presumably they left the island. A few in worn and molting feather were seen occasionally among the many unattended juveniles at the marine beaches: one female each date on 3, 4, and 5 August; three on 6 August. We saw no migratory flocking of females anywhere, including the beaches of nearby Victoria Island where a single female was collected with several unattended juveniles on 13 August 1960.

Although juveniles were at the lakes and inland marshy ponds up to the time of our departure on 12 August, their numbers had fallen off appreciably inland from about the 5th. A banded juvenile 27 days old was collected within a short distance of its hatching place on 1 August. Two banded young (age uncertain) were seen on the breeding ground on 2 August, but none thereafter.

No juveniles were seen at the marine beaches during July, but when first seen there on 2 August, they had arrived in force and were second in abundance only to Semipalmated Sandpipers. Both species remained common at the beaches until 6 August, after which time their numbers fell off sharply. Macpherson and Manning (1959) reported that White-rumped Sandpipers commonly associated with the migrating flocks of Semipalmated Sandpipers that passed through Adelaide Peninsula southeast of Jenny Lind Island.

As many as 50 juveniles were seen by us at the marine beaches on 12 August, but some of these birds may have been from afar. Juvenile White-rumps are known to remain at northern beaches for a long time. It seems likely that a few remain at the Jenny Lind Island beaches after August.

#### SPECIMENS

Ten banded White-rumped Sandpiper juveniles from approximately six to 27 days of age were collected on the Jenny Lind Island breeding grounds in 1966 during 6 July-1 August. Data concerning their weights (gm) and measurements (mm) are given in Table 1 with those of a recently hatched chick taken from an egg collected on Jenny Lind Island in 1962.

From this table it is evident that wing chord and tail measurements increase steadily in length with age (see Fig. 4). Measurements of two juveniles (Nos. 621-08046 and -43) of approximately equal age are very similar, suggesting that during the period of

TABLE I

Band Number	Sex	Age	Weight	Wing (chord)	Tail	Culmen	Tarsus
	F	6 hours	5.0	12.0		9.8	20.2
621-08010	M	5 days 20 hours**	?	24.0		14.2	21.9
621-08042	F	6 days 11 hours*	18.0	27.0		15.2	22.7
621-08085	F	9 days 4 hours	19.8	41.5	4.5	15.3	23.1
621-08009	M	10 days 20 hours**	25.2	57.5	11.0	17.3	24.5
621-08015	M	12 days 19 hours**	29.2	68.0	16.0	19.0	24.0
621-08011	F	15 days 13 hours	29.7	81.0	25.0	20.9	26.3
621-08012	M	17 days 5 hours	33.4	83.0	29.0	19.4	23.7
621-08046	F	21 days 23 hours	33.8	101.0	41.0	21.7	25.5
621-08043	M	22 days 6 hours*	36.3	104.0	40.5	21.4	24.0
621-08047	?	27 days 2 hours	32.5	113.0	46.0	22.6	24.0

\*\*  $\pm$  8 hours\*  $\pm$  3.5 hours

The error for the five unstarred birds is less than one hour.

rapid growth there may be relatively slight differences in feather length of individuals of the same age. Wing chord and tail measurements probably can be used to some advantage in determining approximate ages of unbanded juveniles in the breeding areas. Verification by additional specimens of known age is needed, however.

Wing chords 80 mm long approach a critical length with respect to fledging in White-rumped Sandpipers. Chords of a 15.5-day-old juvenile that was capable of weak flight are 81 mm, whereas those of a 17-day-old sibling that was capable of strong flight are only 83 mm. Remiges continue to lengthen appreciably following fledging, chord measurements attaining a length of 113 mm by the 27th day. According to Godfrey (1966), wings of adult males average 120.4 mm, those of adult females 120.6 mm.

An abbreviated description of the body plumage development is given below for the 10 banded juveniles:

No. 621-08010 Age 5 days 20 hours ( $\pm$  8 hours)

Juvenal Plumage: inconspicuous; sheaths noticeable above on cervical, interscapular, and humeral regions; below on cervical, sternal, and axillar regions.

Down: everywhere conspicuous.

No. 621-08042 Age 6 days 11 hours ( $\pm$  3.5 hours)

Juvenal Plumage: same as 621-08010 but sheaths in axillar region bursting at tips.

Down: same as 621-08010.

No. 621-08085 Age 9 days 4 hours

Juvenal Plumage: feathers fluffed and conspicuous above on auricular, interscapular, humeral, and dorsal regions; sheaths conspicuous on femoral and cural regions.

Down: more conspicuous than juvenal plumage.

No. 621-08009 Age 10 days 20 hours ( $\pm$  8 hours)

Juvenal Plumage: sheaths conspicuous on coronal and pelvic regions; interscapular, humeral, sternal, and dorsal regions well

feathered; wing coverts fluffed out; sheaths bursting on abdominal, femoral, and cural regions.

Down: about as conspicuous as juvenal feather.

No. 621-08015 Age 12 days 19 hours ( $\pm$  8 hours)

Juvenal Plumage: feathers conspicuous on coronal and pelvic regions; white feathers of rump clearly visible; abdominal, femoral, and cural regions feathered but quite downy.

Down: less conspicuous than juvenal feather except on head, mid-pectoral, abdominal, pelvic, femoral, and cural regions.

No. 621-08011 Age 15 days 13 hours

Juvenal Plumage: buffy pectoral region distinct from whitish or pale buffy underparts.

Down: conspicuous only at base of bill, throat, neck, pelvic, abdominal, femoral, and cural regions.

No. 621-08012 Age 17 days 5 hours

Juvenal Plumage: similar to 621-08011.

Down: similar to 621-08011 but less conspicuous, especially at lower extremities.

No. 621-08046 Age 21 days 23 hours

Juvenal Plumage: typical juvenal plumage.

Down: dense and conspicuous only on dorsal cervical region; traces at base of bill, throat, and rump.

No. 621-08043 Age 22 days 6 hours ( $\pm$  3.5 hours)

Juvenal Plumage: similar to 621-08046.

Down: similar to 621-08046.

No. 621-08047 Age 27 days 2 hours

Juvenal Plumage: similar to 621-08046 and 621-08043.

Down: not conspicuous anywhere; trace on dorsal cervical region.

#### TAXONOMIC CONCLUSIONS

Drury (1961) studied the relationships of the *Calidris* species and concluded that if any were to be taken out of the genus, *melanotos* and *fuscicollis* should be the first.<sup>3</sup> He went so far as to revive the genus *Heteropygia* for the two species and included *acuminata*, but not *bairdii*. Holmes and Pitelka (1962) retorted by stating that Drury's conclusions did not reflect correctly the biological characteristics and phylogenetic relationships of the White-rumped Sandpiper. Evidence gathered by them on the Alaskan breeding ground indicated that *melanotos* differed from *fuscicollis* in displays, patterns of vocalizations, and lack of an expandable throat region. They believed that *fuscicollis* was similar to the majority of "eroliine" sandpipers while *melanotos* was unique in its characters.

<sup>3</sup> The authors follow the British Ornithologists' Union (1952. "Check-list of the birds of Great Britain and Ireland," London.) usage of the genus *Calidris*, which includes those species placed in the genus *Erolia* by other sources.

Our numerous observations on certain *Calidris* species in the Canadian Arctic lead us to believe that there are many overlapping characters among these birds. This is especially true of flight and ground displays and vocalizations, many observations of which have received cursory treatment only. For example, it has been our experience that several call notes of *Calidris bairdii* and the monotypic *Micropalama himantopus* are so similar that they can hardly be distinguished by the unaided ear alone. Such observations suggest that the two species may be more closely related than heretofore suspected. But to our knowledge no real analysis has been made of their calls to date.

Holmes and Pitelka (1962) and Drury (1961) stress the importance of the pair-bond relationship and the role of the sexes in care of eggs and young. However, they present few data of this sort for *fuscicollis*, although Pitelka's (1959) study sheds light on the breeding behavior of *melanotos*. Many of his observations on that species are substantiated by our own studies. In carefully marking incubating birds of several species, we are certain that the pair-bond relationship, and the care of eggs and young, are indeed similar in *melanotos* and *fuscicollis*. And that in these characters *canutus*, *bairdii*, and *pusilla* differ greatly—as do most *Calidris* species judged by the literature.

The taxonomic position of *ferruginea* (Curlew Sandpiper), a species we have yet to see, takes on special interest in view of the findings of Holmes and Pitelka (1964). Classified as a *Calidris* species, it apparently shows affinities to both *melanotos* and *fuscicollis*, and to others as well, including *Micropalama himantopus*. Although there are conflicting views on the breeding biology of *ferruginea*, e.g., Birula (in Pleske, 1928) and Portenko (1959), it would seem that the pair-bond dissolves following completion of the clutch, at which time the territory is apparently abandoned; and that the female alone incubates the eggs and cares for the young. We do not suggest that this behavior in itself is sufficient to bind *ferruginea* with *melanotos* and *fuscicollis*; but the behavior points to a similarity in the breeding of the birds that demands an explanation.

With respect to the pair-bond relationship and care of eggs and young, it is clear to us that *Micropalama himantopus* is very similar in its breeding behavior (as well as vocalization) to *bairdii*, but not to *melanotos* and *fuscicollis*. What little we know about *Crocethia alba* suggests to us that its breeding behavior is somewhat similar to *melanotos* and *fuscicollis*, but much more investigation is needed here. The same can be said of *Tryngites subruficollis* (Buff-breasted Sandpiper), although its many strange behaviors indicate that it is rightly called monotypic.

Our data force us to agree with Drury (1961) that *melanotos* and *fusci-*

*collis* are closely related, contrary to the views expressed by Holmes and Pitelka (1962, 1964). However we agree with Holmes and Pitelka that taxonomic revisions of the kind attempted by Drury are not in order until more information is available on the many *Calidris* species and several moot monotypic genera. The genus may well include nearly all species mentioned in this paper. If this is true, we believe that *melanotos* and *fuscicollis* must not be separated from each other in the expanded genus, which in time probably will include *Micropalama* and perhaps *Crocethia*. This is our view as of now. The service of the category subgenus probably could be used to some advantage in separating these seemingly related species.

Additional research is needed for a better understanding of *fuscicollis*. Most pressing is a real assessment of its displays and vocalizations, including an anatomical examination of the male's throat. A better understanding of the male's territorial behavior and of its behavior in the post-breeding phase is highly desirable.

#### SUMMARY

1. The summer schedule and breeding biology of the White-rumped Sandpiper were studied on Jenny Lind Island in the central Canadian Arctic from 31 May to 12 August in 1966. Emphasis was placed on the pair-bond relationship and role of the sexes during the incubation and fledging periods.
2. Detailed studies were conducted in a 2.5-square-mile area of variable terrain. Of 11 nesting females that were live-trapped, banded, color-banded and dyed for positive field identification, the movements and behavior of nine were carefully observed.
3. Twenty-two pairs bred in the study area in 1966. The highest density within this area was seven pairs (14 birds) per 80 acres. Probably two to three times as many birds occupied the same area in 1962, when a preliminary investigation was carried out from 19 June to 5 July.
4. The total breeding population for Jenny Lind Island in 1966 was estimated at 528 pairs or less. Density in peak years probably attains a level as high as any reported for Canada.
5. Early arrivals on the Jenny Lind breeding ground were few in number and not all performed aerial or ground displays immediately, as may be the case at certain localities where arrival is late. Aerial displays were noted commonly from 6 June.
6. The territory of the male has a sexual function of short duration. Ground displays, at least one type of aerial display, and general behavior of the male on territory are similar to those of the Pectoral Sandpiper.
7. Female White-rumped Sandpipers nested without regard to the male's territory. Males generally abandoned their territories when the females settled down to steady incubation, at which time the weak pair-bond relationship of short duration dissolved.
8. The choice nesting ground was persistently wet, well vegetated hummocks. Well vegetated hummocks on better drained slopes were marginal sites that frequently became very dry by the time the eggs hatched.
9. The precise time interval between laying of successive eggs of a clutch was not



- determined, but it was thought to be close to 30 hours. The period of incubation from laying to hatching of the last egg of the clutch was ascertained to be 22 days.
10. Some females started to lay eggs for the first time in 1966 as early as 6 June and others probably as late as 15 June. The period of egg-laying probably covered a span of 12 days (6-18 June). It may have been even longer in 1962 when egg-laying continued until 26 June. Most eggs were probably laid during mid-June of both years, however.
  11. The clutch size almost invariably was four.
  12. The female alone incubated. Adults occasionally seen with incubating females were stray females.
  13. The spread of hatching was at least 9 days (1-10 July) in 1966. Most young probably hatched during 7-12 July. Hatching probably occurred as late as 18 July in 1962.
  14. The period of hatching from first to last egg of a clutch was as much as 17 hours, indicating that steady incubation may have started some time between laying of the third and fourth eggs at certain nests. But in most cases it probably started about the time the clutch was completed.
  15. As in many scolopacids, the instinct to rid the nest of empty shells was strong. Females immediately flew off with the half shells and dropped them some distance from the nest.
  16. Some downy young left the nest when only 2.5 hours old. Others remained in the nest for at least 17 hours. One young returned to the nest having once left it.
  17. The female alone took full charge of the brood. Some females with broods remained near the original nesting site until the young fledged. Others moved into new areas when the young were about a week old.
  18. Flightless young became separated at times from the female and were seen occasionally wandering alone. Whether such young survived was not known.
  19. The fledging period was ascertained to be 16 to 17 days, after which time the female-offspring bond quickly dissolved.
  20. Young from early nestings in 1966 fledged by 17 July, those from late nestings by 26 July. Some young may have fledged as late as 3 August in 1962 when there may have been some overlapping between late hatchings and early fledgings.
  21. Most males abandoned the breeding ground by the time the eggs were all laid. Their numbers declined noticeably from mid-June. The few that were still about in late June and early July presumably were accommodating late females, but this point needs further investigation, as does the post-breeding flocking behavior of males.
  22. Females vanished from the breeding spots following fledging of young. Most left the island immediately, though a few in worn and molting feather were among the many juveniles at the marine beaches in August.
  23. Juveniles remained inland for an indefinite period following fledging. Most flocked with Semipalmated Sandpipers at the marine beaches in August when peak numbers were recorded during the first week. A few occurred inland and at the marine beaches as late as 12 August, and probably much later.
  24. Fifty-five downy White-rumped Sandpipers were banded in or near the nest on Jenny Lind Island in 1966. Ten of known age, ranging from six to 27 days, were collected for scientific specimens. Data on weights, measurements, and juvenal plumage were included in this report.

25. The breeding behavior of the White-rumped Sandpiper is remarkably similar to that of the Pectoral Sandpiper, but very different from certain other calidridine sandpipers.

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