1. James Bay, Canada
   Dr. R.I.G. Morrison, Canadian Wildlife Service, 1725 Woodward Drive, Ottawa, Ontario, Canada K1G 3Z7.
   Dye - picric acid (yellow/orange)
   Bands - yellow, light blue, metal; above and below 'knee'.

2. Surinam, South America
   Dr. A.L. Spaans, Surinam Forestry Service; present address, Research Institute for Nature Management, Kemperbergerweg 67, Arnhem, The Netherlands
   Dye - none
   Bands - orange, above 'knee'.

3. Alaska, U.S.A.
   R.E. Gill, Jr., U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503, U.S.A.
   Dye - picric acid
   Bands - various, above and below 'knee'.

4. North Dakota, U.S.A.
   D. Lank, Langmuir Laboratory, Cornell University, Ithaca, N.Y. 14853, U.S.A.
   Dye - blue and green used in 1978
   Wing tags - various colours with various markings.

5. Massachusetts, U.S.A.
   Brian A. Harrington, Manomet Bird Observatory, Manomet, Massachusetts 02345, U.S.A.
   Dye - none
   Bands - various colours in various positions.

Shorebird surveys

Since 1974, the Canadian Wildlife Service and Manomet Bird Observatory have been collaborating in organizing an international shorebird survey network in North, Central and South America and the Caribbean. Valuable data are being obtained for identifying critical shorebird resources, and some of the preliminary results will be presented at the 44th North American Wildlife and Natural Resources Conference in Toronto in March 1979. As well as providing information on critical shorebird areas and habitats, survey data are helping to delineate different migration routes and strategies used by various species. Such information is of basic importance in designing proper conservation policies. Long-term information is most useful, and it is planned to continue the surveys in 1979. Volunteers who may be able to take part either by continuing coverage of an area counted in previous years or who may be able to survey new areas would be most welcome. We are particularly interested in hearing from anyone who may be able to provide information on shorebirds in South America, or who may be able to suggest persons with whom we could get in touch in this respect. Participants are asked to adopt a study area in which the shorebirds are counted regularly during the course of the autumn migration, and/or into the winter where appropriate. Instructions and forms are provided.

Participants wishing to survey areas in Canada are asked to contact Dr. R.I.G. Morrison, Canadian Wildlife Service, 1725 Woodward Drive, Ottawa, Ontario, Canada, Canada K1G 3Z7; those wishing to cover areas in the U.S.A., Central America, the Caribbean, or South America are asked to contact Brian A. Harrington, Manomet Bird Observatory, Manomet, Mass. 02345, U.S.A.

WADER STUDIES IN SURINAM, SOUTH AMERICA

by Arie L. Spaans

Introduction

Throughout the year, the muddy coast of Surinam, northeastern South America, forms a favourite haunt for North American shorebirds. In 1970 the Nature Conservation Department of the Surinam Forest Service and the Foundation for Nature Preservation in Surinam (STINASU) initiated a long-term study on these birds. The main objective of the study was to assess the importance of this coast for waders in order to examine whether, from a nature conservation point of view, the birds would need more protection than they were receiving. I was engaged in the study from April 1970 to May 1973 and from June 1975 to May 1977. In this paper I shall summarize what was done on the subject in these years, and also give some preliminary results. The main questions we wanted to answer were: which species of shorebirds occur along the coast, in what numbers, how do the numbers fluctuate throughout the year? Where do the birds come from, where do they winter? Do they moult in the area, which habitats do they use for feeding and roosting, which are their foods, how do they feed upon them and how important is the coast for North American waders from an international point of view?

The area

The 350 km shoreline of Surinam consists of extensive tidal mudflats, covered on the higher parts with black mangrove Avicennia germinans forests. The flats alternate in space and time from an accretion to an erosion coast. Along the erosion parts of the coast, the tidal zone consists mostly of a narrow, firm and tough clay bank eroding from older deposits. During the study, 66% of Surinam's shoreline was in accretion, 24% was in erosion, 4% was stationary, while 6% was fringed with a sandy beach. The coastal

fringe is bordered by a wide zone of salt lagoons and brackish swamps. These are former mangrove forests in which the mangrove has died in situ after prolonged inundation by sea water. Like the tidal flats, the muddy, shallow lagoons and swamps form important feeding areas for North American waders; the swamps, however, act in this way mainly during the long dry season (August-December) since in the rest of the year the water level is often too high for waders. For more detailed information on the coastal habitats, I refer to Spaans (1978).

Methods

After some aerial surveys along the coast, followed by several visits by boat and on foot to parts of it, I started in December 1970 with a series of counts all the year round at Weg naar Zee, 10 km northwest of Paramaribo, as well as in the Matapica-Krofajapasi area, 50 km eastnortheast of this town. These counts gave rather good information on the status, numerical fluctuations and habitat choice of most species (Spaans 1978).

In 1970 Pieter van der Wielen started a banding study at Weg naar Zee. After his departure from Surinam in 1971, I continued the study. Birds were mist-netted from August through May, mainly on and around spring high tide days. Nets were set up over creeks and in corridors between thickets of mangroves, through which the birds were known to pass when flying to and from their high tide refuge areas at open sites behind the mangroves. From 1975-77, I also caught many waders in the lagoons near Matapica and Krofajapasi. Trapping efforts were made only during the day because mosquitoes and other biting insects hampered banding work during the night. Because of the high catching successes (a 9 m net with some tens of Semipalmated and Least Sandpipers caught in it was quite normal), most of the time only a few nets were used. After banding, as many birds as possible were weighed, measured, and examined for moulting feathers. In March-May 1976 and January-May 1977, Semipalmated and Least Sandpipers were also colour-banded with 2 orange plastic bands above the knee.

Data on food were gathered from stomach contents of birds which died during our banding operations or were killed by local hunters; only a few birds were collected under a special permit for this purpose. Many of the birds were salvaged for the Leiden Museum and the Institute for Taxonomic Zoology at Amsterdam, where they are kept as study skins. The food analyses were followed by a more detailed study on habitat preferences and initial observations on feeding behaviour.

Results

a) Abundance and numerical fluctuations

Of the 24 species and subspecies of North American waders known to occur along the Surinam coast, 20 occur regularly (Spaans 1978). During the study, maximum numbers of the Lesser Yellowlegs, Short-billed Dowitcher and Semipalmated Sandpiper were estimated by extrapolation to amount to over 100,000; of the Greater Yellowlegs, Least Sandpiper and possibly the Willet to 50-100,000; of the Semipalmated Plover, Spotted Sandpiper, Ruddy Turnstone, White-rumped Sandpiper, Stilt Sandpiper, and possibly the Black-bellied Plover and Solitary Sandpiper, to 10-50,000;of the Whimbrel and possibly the Sanderling and Western Sandpiper to 2,500-10,000; and of the American Golden Plover, Upland Sandpiper, Red Knot and Pectoral Sandpiper to less than 2,500.

All species were most numerous during the autumn migration period. Many species were also present during the northern winter, but in smaller numbers than during the autumn. For the Upland Sandpiper, Greater Yellowlegs, Willet, Short-billed Dowitcher, Red Knot and Stilt Sandpiper the numbers were very much lower. I do not have winter records of American Golden Plovers, White-rumped Sandpipers and Pectoral Sandpipers, although White-rumps and Pectorals sometimes overwinter. The main wintering areas of all these species lie clearly south of Surinam.

During the spring, peak abundances were observed in the Greater Yellowlegs, Short-billed Dowitcher, Willet and the Red Knot only. Other species showed no peak or only a very small one. Earlier (Spaans 1978), the absence of a pronounced peak in these species was attributed to a transcontinental spring migration route for the birds wintering south of Surinam, but recent data indicate that this may not be true for all species.

Although most species were regularly seen during the northern summer, only the Black-bellied Plover, Semipalmated Plover, Greater Yellowlegs, Ruddy Turnstone, Sanderling and the Semipalmated Sandpiper summered in relatively fair numbers. The large numbers of summering Semipalmated Plovers and Semipalmated Sandpipers must be mentioned especially. We got a strong indication that summering Semipalmated Sandpipers concentrate in certain areas along the coast for this purpose. Summer records are lacking for the American Golden Plover, Upland Sandpiper, Solitary Sandpiper and the Pectoral Sandpiper, and I have only one such record for the White-rumped Sandpiper (17 July 1975); White-rumps had not been recorded previously in July (Spaans 1978).

b) Habitat choice

The species use various habitats for feeding, including soft mudflats, firm and tough clay banks, sandy beaches, muddy and shallow lagoons, and also swamps when the water level is low. Especially the tidal mudflats and the lagoons and swamps can be crowded with large numbers of shorebirds. Some species, like the Red Knot, Sanderling, and the Ruddy Turnstone are mainly confined to the firm and tough clay banks. Sanderlings, however, also feed regularly on sandy beaches. The American Golden Plover and Upland Sandpiper occur mainly on the higher parts of sandy beaches where the vegetation has recently been burned. Least, White-rumped and Stilt Sandpipers are predominately birds of the muddy and shallow lagoons; Black-bellied Plovers and Willets, on the other hand, feed mainly on the tidal mudflats. Semipalmated Plovers, Lesser and Greater Yellowlegs, Short-billed Dowitchers and Semipalmated Sandpipers use both habitats intensively for feeding.

Birds feeding on the tidal mudflats roost at the higher parts of the flats during neap high tides and in the lagoons, sometimes tens of kilometers away, during spring high tides. Birds feeding on the clay banks and sandy beaches roost either higher up in these areas or in neighbouring lagoons.

c) Food

Tanaids, a small burrowing and bottom-dwelling crustacean, appear to form the staple food of the Semipalmated Sandpipers, Lesser Yellowlegs, Willets and Short-billed Dowitchers feeding on the soft tidal mudflats. On the higher parts of these flats, Semipalmated Sandpipers regularly eat ostracods and Willets and Spotted Sandpipers eat fiddler crabs (Uca spp.). Plants seeds are commonly eaten by the White-rumped and Stilt Sandpiper. The Lesser Yellowlegs on the other hand, is the only species eating water-bugs to a large extent. Larvae and pupae of aquatic flies form an important food for the Semipalmated, Least and White-rumped Sandpiper and sometimes also for the Lesser Yellowlegs. The Semipalmated Sandpiper also eats hymenoptera and small snails to some extent. Snails are also commonly found in the stomachs of Lesser Yellowlegs and Stilt Sandpipers. Greater Yellowlegs eat small fish on the soft mudflats and shrimps in the lagoons.

d) Banding results

During the study, 16,607 birds of 14 species were banded (Table 1). As in most wader-banding operations in the New World, Semipalmated and Least Sandpipers were the most numerous birds captured. The Semipalmated Plover and Spotted Sandpiper were the only other species trapped in fair numbers. A total of 7,043 Semipalmated Sandpipers and 822 Least Sandpipers was also colour-banded. From our banding records it appeared that juvenile Spotted Sandpipers are already present in early August (earliest date: 2 August) and juvenile Least and Semipalmated Sandpipers in mid-August (earliest dates: 16 and 18 August, respectively). It is interesting to note that in the Maritime Provinces (Canada) and in Massachusetts (U.S.A.) first arrivals of Semipalmated Sandpipers begin only one to two weeks ahead of those in Surinam (Morrison 1976a, Harrington 1975).

In addition to banding 16,607 waders, we had 10 controls of birds banded elsewhere. Most of them were Semipalmated and Least Sandpipers banded during the autumn migration in southeastern Canada and the northeastern U.S.A. Two Semipalmated Sandpipers had been banded in Kansas, central U.S.A., in May and September and one bird had been trapped on its nest in eastern Alaska in June. This bird was controlled 2 years later on 7 September when in active wing moult.

Table 1. Totals of North American waders ringed in Surinam, 1970-1977.

	1970	1971	1972	1973	1975	1976	1977	TOTAL
	May-Dec.	Jan.-Dec.	Jan.-Dec.	Jan.-May	July-Dec.	Jan.-Dec.	Jan.-May	
Semipalmated Plover	34	56	23	5	75	178	93	464
Ruddy Turnstone	5	6	-	-	27	16	16	70
Spotted Sandpiper	173	105	110	18	108	87	57	658
Solitary Sandpiper	-	-	-	-	13	6	3	22
Willet	-	3	-	-	1	3	-	7
Greater Yellowlegs	-	1	-	-	2	-	-	3
Lesser Yellowlegs	-	5	-	-	12	17	7	41
White-rumped Sandpiper	-	-	1	-	11	-	-	12
Least Sandpiper	17	69	20	3	862	510	822	2,303
Short-billed Dowitcher	-	3	-	-	11	34	43	91
Stilt Sandpiper	-	-	-	-	1	32	9	42
Semipalmated Sandpiper	198	2,749	559	117	552	4,523	3,839	12,537
Western Sandpiper	-	1	-	-	1	1	2	5
Unidentified Sandpiper	3	32	6	3	34	105	80	263
Sanderling	-	-	-	-	89	-	-	89
	430	3,030	719	146	1,799	5,512	4,971	16,607

Of the Semipalmated Sandpipers we banded, we received 129 recoveries and sightings from abroad up to 1 December 1978. The recoveries and sightings range from French Guiana in the southeast, to Alaska in the northwest; and from Prince Edward Island in the northeast, to Mississippi in the southwest. All recoveries from central North America but one are from the spring, whereas most recoveries from southeastern Canada and the northeastern U.S.A. are from the autumn. Northbound migrating Semipalmated Sandpipers were reported from North America between 20 May and 11 June, southbound migrating birds between 10 July and 16 September. These data suggest that Semipalmated Sandpipers migrating through or wintering in Surinam do not pass through the U.S.A. before late spring.

Of the 5,002 After Second calendar Year (ASY) Semipalmated Sandpipers colour-marked, 62 were reported during the calendar year of banding against only 3 out of 2,039 Second calendar Year (SY) (or juvenile) birds banded. In later years, 36 ASY birds were reported against 18 SY on This suggests that only a small number of juvenile birds fly back to North America for their second winter.

e) Flight feather moult

Most birds migrating through or wintering in Surinam seem to arrive from the north with all flight feathers still old. Those remaining in Surinam begin to moult these feathers some time after arrival. My data suggest, however, that birds migrating to wintering regions farther to the south do not moult these feathers before arriving in these areas.

In Surinam, as in other tropical areas, the flight feather moult of northern waders is spread over a long period. The moulting period also takes a long time for the individual bird (Table 2). From retraps of banded birds of known age, it appears that some adult Least Sandpipers renew their outer primaries twice, first during their complete postnuptial moult, and again in late winter. We have no proof that this also occurs in other small Calidris spp. wintering in Surinam.

In many species, most juvenile birds undergo a partial flight feather moult during their first winter, which involves a varying number of outer primaries and inner secondaries (Table 2). Some juvenile Spotted, Semipalmated and Least Sandpipers appear to have a complete flight feather moult. Juvenile Semipalmated Plovers do not moult any flight feathers (except sometimes the innermost secondary) before the end of their first year of life. The latter is interesting because in the closely-related palaearctic Ringed Plover, a first winter primary moult is the rule for birds wintering in tropical and southern Africa (Stresemann and Stresemann 1966).

ble 2. Timing and duration of the primary moult of North American waders in Surinam.

	moult of second-year and older birds			moult of first-year birds		
	onset	end	duration for an individual bird (months)	onset	end	number of inner primaries retained
ack-bellied Plover*	active moulting bird in July (p.m.s. 33)					
ipalmated Plover*	June-Oct.	Oct.-Febr.	ca.3½	no first winter primary moult		10
ser Yellowlegs	July-Sept.	Nov.-Jan.	ca 3½	(Oct.?)Nov.-Dec.(Jan.?)	(Dec.?)Jan.-April	2-8
ater Yellowlegs*	active moulting birds in Dec. (p.m.s. 37 and 49)					6?
itary Sandpiper	from Sept. onwards	about Febr.		from Nov. onwards	about Febr.	3-4
tted Sandpiper	Aug.-Dec.	Dec.-April	(3?)4-6	Nov.-Febr.	March-May	0-5
dy Turnstone*	active moulting birds in July (p.m.s. 3, 14 and 23) and January (p.m.s. 42)					
ipalmated Sandpiper*	July-Oct.	Sept.-Jan.	2½-3½	(Oct.?)Nov.-March(April?)	Jan.-May	0-10
tern Sandpiper	active moulting bird in Nov. (p.m.s. 27)					
st Sandpiper	Aug.-Oct.	Oct.-Febr.	(2½?)3-4	Oct.-Jan.	Jan.-April	0-9
lt Sandpiper	July-Sept.	Nov.-Febr.	< 4½	(Nov.?)Dec.-Febr.		1-7

es: - I ignored the reduced, outermost 11th primary; primary moult score (p.m.s.) may range from 0 (all 10 feathers old) to 50 (all feathers new and fully grown).

- Of the species marked with an asterisk fair numbers oversummer along the Surinam coast; most of them, if not all, are second calendar year birds.

- Some adult Lesser Yellowlegs seem to arrive in suspended moult with the inner 4-5 primaries renewed.

- Several adult Spotted and Least Sandpipers suspend their primary moult during their stay in Surinam.

- Several adult Least Sandpipers renew some of their outer primaries again in January-March.

- Some juvenile Lesser Yellowlegs, Semipalmated and Least Sandpipers also retain one or more outer primaries; juvenile Semipalmated and Least Sandpipers may also retain a few central feathers.

Discussion

a) Origin of the birds

Our banding data suggest that Semipalmated Sandpipers occurring along the Surinam coast belong to populations migrating southward through southeastern Canada and the northeastern U.S.A. (rather than to populations migrating through central North America) and that they reach Surinam by a transoceanic flight. This is corroborated by our moulting data. Adult birds arriving in Surinam from the north still have all primaries old, just as the birds migrating through northeastern North America (R.I.G. Morrison, pers. comm.). Adult Semipalmated Sandpipers captured in Kansas in July and August, however, are in full wing moult (E.F. Martinez, pers. comm.). I suggest that these birds mainly winter in Central

America and northwestern South America, and that the large numbers of Semipalmated Sandpipers passing through the central U.S.A. between mid-March and mid-May (E.F. Martinez, pers. comm.) are mainly from these wintering populations rather than from populations wintering in northeastern South America, because Semipalmated Sandpipers banded in Surinam were not recovered from North America before late May.

Moulting data of Least Sandpipers from Surinam and Kansas show the same differences as found in the Semipalmated Sandpiper, suggesting that this species also reaches Surinam by a transoceanic flight. In fact, it is believed that many species of shorebirds take this route to Surinam (Spaans 1978).

b) International importance of the Surinam coast for waders

We know roughly which numbers of North American waders may be present along the Surinam coast and that these birds belong mainly to populations migrating through northeastern North America. We do not yet have exact figures of the numbers of birds that use this eastern migration route. It may be expected that the International Shorebird Survey, jointly organized by B.A. Harrington and R.I.G. Morrison, will provide these data in the future. At my request, Morrison (pers. comm.) kindly made some preliminary and therefore very rough estimates of the numbers he believed to use this route, enabling me to assess, albeit with much caution, the importance of the Surinam coast for 5 species (Table 3).

Table 3. Rough estimates of the numbers of waders migrating through northeastern North America and Surinam during late summer and autumn

	Total numbers migrating through northeastern North America	Maximum numbers present at one day along the Surinam coast	Percentage of total numbers
Semipalmated Plover	100,000s	10,000s	over 10%
Ruddy Turnstone	100,000s	10,000s	over 10%
Red Knot	25,000	1,000s	over 4%
Semipalmated Sandpiper	5,000,000	1,000,000	over 20%
White-rumped Sandpiper	1,000,000	10,000	over 1%

The data show that for all 5 species, the Surinam coast meets the 1% norm accepted by the International Waterfowl Research Bureau as the minimum percentage of a flyway population of a wader species which an area must harbour to be of international importance. The Surinam coast appears to have nearly as many Semipalmated Sandpipers as coastal northeastern North America (cf. Morrison 1976b, 1977), emphasizing the importance of Surinam for North American waders.

c) Protection

Since 1954 most species of shorebirds in Surinam are fully protected by the Game Ordinance. Only the Whimbrel and Common Snipe may be shot during the hunting season. All small and medium-sized waders are, however, called 'snipje' (= little snipe) or 'snip' (= snipe) by the local people. As a result, many hunters are of the opinion that most wader species can be shot. To remedy this situation, the authorities suggested either also protecting the Whimbrel and Common Snipe, or putting all waders on the list of game species. Based on the results of the present study, the Nature Preservation Commission will propose to the proper Minister a designation of the Whimbrel and Common Snipe as protected species; this would mean that all waders will be fully protected in Surinam. The Surinam Forest Service has made an even stronger proposal that the whole coastal area should be designated as a 'special management area' so that the habitats of these birds can also be managed properly: a wise nature conservation policy, which many countries can take as an example!

Acknowledgements

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SHOREBIRD STUDIES IN WESTERN ALASKA, 1976-1978

by Robert Gill, Jr.

Introduction

Beginning in 1975 with the advent of oil and gas exploration over much of Alaska's outer continental shelf, the U.S. Fish and Wildlife Service and numerous other investigators initiated studies of major faunal groups and habitats likely to be adversely affected by petroleum development. Among those studies involving shorebirds was one begun in March 1976 of shorebird use of littoral areas along the Alaska Peninsula. This study (Gill et al. 1977, Gill 1978), centered at Nelson Lagoon (Figure 1), investigated habitat partitioning by post-breeding Dunlin (Calidris alpina pacifica), Western Sandpipers (C. mauri), Rock Sandpipers (C. ptilocnemis couesi), and Bar-tailed Godwits (Limosa lapponica), as well as examined turnover rates of birds in the lagoon and possible inter-lagoon movements along the Peninsula. To this end we colour-banded and marked some 1200 each of Dunlin and Western Sandpipers, and 400 Rock Sandpipers. Subsequent sightings of banded birds have been most enlightening, especially regarding fall migration routes and strategies of these species (see below).

In 1978 we shifted study sites and emphasis and began a two year investigation of the breeding ecology of the Black Turnstone on the Yukon Delta (Figure 1). Our original plans called for only limited work with other shorebird species on the Delta, but the numbers of Dunlin and Western Sandpipers found using the intertidal zone after breeding, and the comparative ease with which we were able to capture them, prompted us to begin a study similar to that at Nelson Lagoon the previous two years. We subsequently colour-marked approximately 500 each of Dunlin and Western Sandpipers after a somewhat late start and reduced effort.

In late September 1978 we returned to Nelson Lagoon to continue our work with Dunlin and their departure on fall migration.

During the summer of 1979 we will conduct intensive studies at both Nelson Lagoon and the Yukon Delta where we will concentrate on the comparative fall migration routes and strategies of areas alpina and mauri from these two areas.

Methods

Our banding at Nelson Lagoon (mid-July to early October 1977) was done with a rocket net set at high tide roosts. If birds did not return to the exact site we could usually "walk" them along the beach until they were within coverage of the net, and thereby allow us to control better the number of birds captured per firing. Given our usual crew of 3-4 people we found it best to confine our catches to around 100 birds per firing. Such a catch would usually require three hours to process. We also found it desirable to cover the net with a large sheet of light-weight black plastic immediately upon firing the net. This had a tranquilizing effect on the birds and was especially helpful in preventing injury to the wings of Dunlin and Rock Sandpipers undergoing post-nuptial moult.

Most birds were banded, colour-banded, weighed, measured, moult-scored, and dyed on the breast, flanks, and vent with picric acid. By varying placement of a split red/blue band with the metal band we were able to change banding schemes every 15 days throughout the study.