

Figure 1. Distribution of measurements and weights of first-year Sanderlings caught on the coast of Suriname.

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Arie L. Spaans, Suriname Forest Service, P.O. Box 436, Paramaribo, Suriname; present address: Research Institute for Nature Management, Kemperbergerweg 67, 6816 RM, Arnhem, The Netherlands.

MIGRATION ROUTES AND STOPOVER AREAS OF NORTH AMERICAN RED KNOT *Calidris canutus* WINTERING IN SOUTH AMERICA

by R.I.G. Morrison, B.A. Harrington and L.E. Leddy

Introduction

The Red Knot *Calidris canutus* is a classic, long-distance migrant, breeding and wintering in widely separated areas, which for some populations are located in the Northern and Southern Hemispheres, respectively. The New World population, which comprises the subspecies *C. c. rufa*, breeds in the central Canadian arctic, migrates southwards through James Bay and the eastern seaboard of North America, and a substantial proportion moves on to wintering grounds in the southern part of South America. As such, the species is an excellent example of an internationally shared wildlife resource, and its future can clearly only be effectively guaranteed through work and protection on an international scale (Morrison and Harrington 1979). A knowledge of the distribution and ecological requirements of the Red Knot throughout its range is essential in identifying resources which are critical in its yearly cycle. This paper will review our knowledge of the status of the species and present some recent advances in our understanding of its distribution in North America obtained through the International Shorebird Survey (ISS) scheme, organised jointly by the Canadian Wildlife Service, Ottawa, Canada, and the Manomet Bird Observatory, Massachusetts, U.S.A. New information on its distribution on South American wintering grounds is presented elsewhere (Harrington and Morrison 1980).

Materials and Methods

The ISS scheme involves a network of volunteer participants extending principally throughout the Maritime Provinces of Canada and the eastern seaboard of the United States, with additional observers in the Caribbean, Central America, South America and interior areas of Canada and the United States. Counts in Canada are organised by the Canadian Wildlife Service, those in the remaining regions by the Manomet Bird Observatory. Participants select a well-defined local study area in which they regularly count shorebirds in a consistent manner throughout the migration period and into the wintering period where appropriate. Counts in Canada occur every two weeks and in remaining areas three times per month.

Distributional data are presented using results from the first five years of the surveys, 1974-1978. In Canada, the number of main survey areas covered rose from 17 to 35 during this period (Morrison and Gratto 1979a), while the number of cooperators participating in other areas rose from less than 20 in 1974 to over 200 in 1978, spread through 34 states in the U.S. and 17 commonwealths and nations (Harrington and Leddy 1979). Data are presented using the maximum count of Red Knot observed for each site during the season. Aerial surveys in James Bay and Hudson Bay were carried out in late July in 1976 and 1977 using a single engine aircraft (DeHavilland Beaver or Otter), flying at an altitude of 100-150 feet above ground level and airspeed of approximately 100 miles per hour. Surveys were timed to coincide with high tide over as much of the coastline as possible to count roosting flocks. Further distributional information was obtained through a literature search, particularly of records in American Birds.

Results

Distribution and Surveys

(1) Breeding Grounds

The breeding grounds of *C. c. rufa* appear to be rather restricted in the central Canadian arctic, and are mainly on Victoria Island and Jenny Lind Island, where they are quite common (Bernard 1921, Parmelee et al. 1967). The subspecies also breeds on Southampton Island (Snyder 1957). Arrival generally occurs about the end of the first week of June (Parmelee et al. 1967), but by the latter part of July the birds have completed nesting activities and are well on their way south again.

(2) James Bay

In the autumn, the west coast of James Bay appears to be the first migration area of major importance for the Red Knot. In 1976 and 1977, totals of 7,308 and 6,958 Red Knot were recorded on aerial surveys of the Ontario coasts of James Bay and Hudson Bay (Table 1). These figures include only birds positively identified as Red Knot, and in view of the difficulties of identification of all shorebird species under the varying conditions (e.g. weather, flight path, tide height etc.) encountered during surveys, must be regarded as minimum totals for the areas concerned. The majority of birds were found along coastlines characterised by wide coastal marshes or by 'high energy' coasts with extensive beach ridge systems; such areas were found in the northern and southern parts of James Bay (Martini, Morrison, Glooschenko and Protz 1980). Few Red Knot utilised the central part of the James Bay coastline, where a different type of marsh characterised by loose, unconsolidated sediments and dominated by longer vegetation is found.

On ground surveys, up to 5,000 and 2,500 birds have been observed at Longridge Point and North Point, on the southwest coast of James Bay. These figures are generally much larger than those recorded at individual sites on ISS counts on the east coast of North America; it may also be noted that the aerial survey totals in James Bay are remarkably similar to the ISS maximum count totals on the east coast (see below, Table 2) for the years 1976 and 1977.

Table 1. Aerial surveys of Red Knot in James Bay, 1976-1977.

<u>Ontario coastline only</u>			
	27/7/76 northwards	28/7/76 southwards	27-28/7/77 combined
JAMES BAY			
South	4252	1042	2420
Central	345	3	20
North	1428	5494	3189
	(6025)	(6539)	(5629)
HUDSON BAY			
East	449	-	98
West	834	-	1231 *
	(1283)		(1329)
	<u>7308</u>		<u>6958</u>

* plus possible 1700 on Pen Islands on 28/7/77
Totals include only birds identified positively as Red Knot

(3) Atlantic seaboard of North America/ISS counts

Totals of maximum counts recorded at International Shorebird Survey sites on the Atlantic seaboard of North America during the period of autumn migration (July to October) ranged from 3,841 in 1974, when 23 sites at which Red Knot were present were counted, to 9,045 in 1977, when 49 such sites were covered (Table 2). Sites on the Atlantic seaboard held most of the birds recorded during the autumn ISS counts. A limited number of sites was covered in other areas, the only one with significant numbers to date being on the Gulf coasts of Florida and Texas.

The most significant feature demonstrated by the counts on the Atlantic seaboard was that most of the birds were concentrated at only a few stopover areas (Table 2). In most years, Massachusetts and New Jersey contained approximately 80% or more of the Red Knot, the only exception being 1977, when large numbers were reported in Virginia (Table 2). In fact, in all years of the surveys, the top five sites accounted for over three quarters (75-84%) of the birds on the Atlantic coast. i.e. over 75% of the birds occurred at only 10-14% of the sites at which Red Knots were recorded. In Massachusetts, the most important sites were in the Cape Cod area, particularly Monomoy Island and Scituate, and in New Jersey, including the Brigantine area and Great Egg Harbor. The counts clearly demonstrate that Red Knot concentrate in large numbers in relatively few areas, which thus assume particular importance in their yearly cycle.

Another feature suggested by the counts was that although only a handful of sites was of major importance each year, their relative use by the birds could vary in different years. Thus, the proportion of birds in different sections of the coast (e.g. New Jersey, Massachusetts, Bay of Fundy) varied from year to year. A similar phenomenon occurred on a more local level, with Red Knot using a complex of sites within one section of the coast. For instance, although the total number of Red Knot using the Cape Cod/Plymouth Bay complex remained relatively constant from 1974 to 1978 at 4-5,000, the proportion using the outer Cape varied widely between years (Figure 1). This suggests that Red Knot are fairly mobile within a given stopover area and that they may be able to respond better to a variable food resource by adopting this strategy. Birds of the nominate race (*C. c. canutus*) show a similar mobility between sites on the wintering area of the Wash on the east coast of Britain, probably for the same reason (Prater 1979).

A similar pattern of distribution was evident from autumn counts of Red Knot reported in American Birds. The only reported concentrations of more than 100 birds came from Massachusetts (11 reports in the period 1951 to 1978, mostly from Monomoy and Scituate, ranging from 700 (1962) to 7300 (1969) birds, with most in the range 1-3,000 (average 2,800)), New York, New Jersey and Virginia.

Table 2. Principal stopover areas and distribution of Red Knot at sites on the Atlantic coast of North America from International Shorebird Survey autumn (July to October) counts, 1974-1978, using maximum recorded counts.

	1974	1975	1976	1977	1978
Total: Atlantic seaboard	3841	6630	7763	9046	7730
Canada	248 (6.5%)	571 (8.6%)	505 (6.5%)	842 (9.3%)	1393 (18.0%)
U.S.A.	3593 (93.5%)	6059 (91.4%)	7258 (93.5%)	8204 (90.7%)	6337 (82.0%)
% birds in Massachusetts	36.4%	60.5%	53.7%	55.1%	67.4%
% birds in New Jersey	46.7%	26.8%	33.5%	5.3%	9.4%
% birds in Virginia	(-)	(-)	(-)	24.0%	(-)
% birds in Bay of Fundy	(-)	(-)	(-)	(-)	14.1%
	83.1%	87.3%	87.2%	84.4%	90.9%
% of birds present at top 5 sites	75.2%	79.5%	77.3%	75.9%	84.3%
(and total no. of sites at which Red Knot were present)	5/23 (21.7%)	5/36 (13.9%)	5/39 (12.8%)	5/49 (10.2%)	5/43 (11.6%)

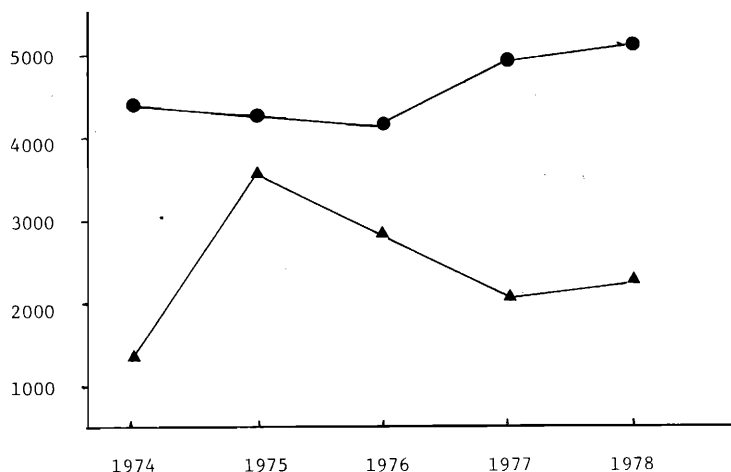


Figure 1. Numbers of Red Knot using Cape Cod/Plymouth Bay complex of sites (circles) and numbers using sites on outer Cape Cod (triangles), 1974-1978.

(4) Northern South America

Red Knot appear to be generally uncommon or rare in the Caribbean (ISS unpublished data, e.g. Bond 1971) and eastern Venezuela (McNeil 1970) in the autumn. Their route southwards appears to pass further east on the northern coast of South America through the Guianas, where many make landfall after an apparent non-stop flight across the Atlantic Ocean. Spaans (1978) reported that 'small numbers' (defined as 500-2500) passed through Suriname mostly in mid August and early in September (and see Spaans 1979). In September 1978, 600-900 Red Knot were observed near Krofajapasi on the coast of Suriname, including three birds colour-marked only 23 days previously in James Bay (Morrison and Spaans 1979). Suriname would thus appear to be a stopover area of considerable importance.

(5) Southern South America

After departure from Suriname, it seems clear that Red Knot are headed for southern South America, though early accounts provide very little information on their distribution or status (e.g. Hudson 1920, Wetmore 1926, 1927). The most significant report of large wintering concentrations is that of Devillers and Terschuren (1976) who found 3-5,000 near Rio Grande, Tierra del Fuego, in January. Results of recent surveys confirming and extending these observations are presented elsewhere (Harrington and Morrison 1980).

Banding Returns

The small number of banding returns or sightings of colour-marked Red Knot which have been obtained illustrate the migration route from arctic Canada to South America described above. From James Bay, there has been one band recovery and a total of 7 bird-days of sightings of colour-marked birds in Massachusetts (Morrison 1977, 1978, unpublished data). Another bird was sighted in Ottawa, Ontario, along the flight path between James Bay and Cape Cod. The most spectacular sightings involved three birds colour-marked in James Bay on 20 August 1978 and seen 3,500 miles away 23 days later on the coast of Suriname (see above, Morrison and Spaans 1979, Morrison and Gratto 1979b). Recoveries of Red Knot banded in Massachusetts have included three birds on the coast of the Guianas (two in Guyana and one in French Guiana) and a recovery in Brazil. One bird banded on Sable Island, Nova Scotia, was sighted in Suriname (McNeil and Burton 1973).

The Spring Route Northward

(1) South America and the Caribbean

The route northward to the breeding grounds is only sketchily known in South America. The only area currently recognised to be important to the Red Knot is the coast of the Rio Grande do Sul, Brazil, where William Belton (manuscript, pers. comm.) has described large flocks of several thousand birds on northward migration in April. Similar numbers were not noted during southward migration in September and October, or during the 'wintering' period, though quite large numbers (up to 1000) were observed in late May in 1971 and probably involved birds which would remain in their non-breeding quarters.

The passage northward may be retraced through Suriname, where a spring peak occurs in early May (Spaans 1978). Knot are again reported as uncommon in the Caribbean; records there (e.g. Bond 1971, Holland and Williams 1978) and for instance on Trinidad and Tobago (French 1976) are generally in late April and May.

(2) North America

The possibility of a trans-ocean route from South America to the east coast of North America is suggested by the large numbers of Red Knot reported in spring from many parts of the east coast of the U.S.A., from Florida to around Massachusetts. Information from selected literature sources is presented in Table 3, from which it may be seen that a spring movement of Red Knot, often involving thousands of birds, may be traced up the east coast as far as Massachusetts: north of Massachusetts Red Knot are relatively uncommon in spring. Mean dates of sightings tend to become later as one moves northward up the coast.

From Chesapeake Bay (and the Massachusetts/Cape Cod) area, the spring route appears to strike inland to James Bay, where substantial numbers have been seen arriving in late May and early June (Morrison, unpublished data). Evidence for the route between the Atlantic seaboard and James Bay includes sightings of up to 1500 and 2000 birds on spring migration in late May at Prince Edward Point and Presqu'ile Provincial Park, Lake Ontario, (D. McRae pers. comm., Strahlendorf 1980).

Table 3. Summary of counts of Red Knot (involving more than 100 birds) reported in American Birds and other selected literature for areas on the Atlantic seaboard of the U.S.A. and Canada during spring migration.

Area	Numbers	Dates	
Georgia	Several thousand, moving north	Early to mid May Mean: 11 May (2 reports)	American Birds
S. Carolina	350-400	Early to mid May Mean: 17 May (2 reports)	American Birds
Virginia	up to 2,000	Mid to late May Mean: 23 May (5 reports)	American Birds
Maryland/D.C.	fairly common	Mean 24 May for high counts	Stewart & Robbins 1958
New Jersey	up to 3,000	9 May - 7 June Mean: 30 May (4 highest counts)	Urner & Storer 1949
	up to 10,000	Mid to late May Mean: 18 May (6 reports)	American Birds
New York	very common, maximum 2,000	Arrival mid to end May Maximum 30 May 1945	American Birds
Massachusetts	Maximum 10,000	Mean: 30 May (5 counts)	American Birds
Maine	Rare	-	Palmer 1949
Maritime Provinces of Canada	Uncommon	-	e.g. Tufts 1951

Discussion

Several important points emerging from this work indicate that Red Knot should be a cause for conservational concern. Firstly, the survey results show that *rufa* are nowhere numerous, and suggest that the total population may only number several tens of thousands - perhaps only 30,000. The race appears once to have been very numerous and most authors agree that it was heavily reduced in the days of market hunting late last century and early this century (e.g. Bent 1927). Legal protection has allowed considerable recovery, though it seems unlikely that *rufa* has regained its former abundance (e.g. Bull 1974). The current estimated population is very small when compared with other populations of knot. For instance, the nominate race *canutus* wintering in Europe has been estimated at 400,000-600,000 (Prater 1976) and spring migrants belonging to the Pacific population (*C. c. canutus* (A.O.U.) or *C. c. rogersi* (see Conover 1943)) have been estimated at 100,000 plus on spring migration in southern Alaska (Islieb 1979).

The survey data also show clearly that in autumn, Red Knot concentrate in large numbers in only a few areas, which are of critical importance as stopover areas where the birds accumulate large fat reserves to enable them to make a long flight over an 'ecological barrier' (Morrison and Harrington 1979). For many shorebirds, including Red Knot, this involves a non-stop flight from the eastern seaboard to North America to northern South America. The characteristic habits of knot - concentrating in relatively few stopover areas, showing relatively specialised food requirements, undertaking long flights and being rather sensitive to disturbance - suggest that they are likely to be particularly at risk from coastal developments. In North America, schemes likely to affect estuaries and stopover areas include tidal power projects, port facilities, hydroelectric projects, pollution, land reclamation, oil and gas projects and direct disturbance from human recreational use.

For such highly migratory birds, responsibility for their future conservation must lie with the many nations whose coastlines the birds use during the year. Knowledge of where they go and why they are there throughout their range is essential for their conservation, and such knowledge can only be achieved effectively through work on an international scale.

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R.I.G. Morrison, Canadian Wildlife Service, 1725 Woodward Drive, Ottawa, Ontario, Canada K1G 3Z7,
B.A. Harrington and L.E. Leddy, Manomet Bird Observatory, Manomet, Massachusetts 02345, U.S.A.

The similarities in migration patterns becoming apparent between Old World and New World Knots are striking. For information on the former see the references listed below - Eds.

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