

By 27 September the bushes were nearly stripped of ripe berries. On that day the migrants turned to foraging in atypical fashion on or near the ground. One Ruby-crowned Kinglet, 2 Magnolia Warblers, 1 female Black-throated Blue Warbler (*D. caerulescens*), 1 immature Yellow-rumped Warbler (*D. coronata*) and 3 Bay-breasted Warblers crept through the lawn, apparently plucking tiny arthropods off the undersides of grass blades and violet leaves. Simultaneously 2 female or young American Redstarts were observed plucking grass seeds (*Setaria* and *Digitaria*) from their stalks while 10 other American Redstarts foraged clumsily within 2 m of the ground on the trunks of large cottonwoods (*Populus deltoides*) and pin oaks (*Quercus palustris*).

Apparently the species listed above rarely practice frugivory in North America. Bent (1942, 1953, U. S. Natl. Mus. Bull. 179, 203) comments on their food habits as follows: Least Flycatcher (*Empidonax minimus*), fruits 2% of diet or less; Ruby-crowned Kinglet, "6% of stomach contents . . . were fruits and seeds" (in California); Tennessee Warbler, "berries in small quantities; . . . punctured grapes"; Chestnut-sided Warbler, "a few seeds and berries when hard-pressed," and Audubon saw them eating grass seeds in a May snow; Bay-breasted Warbler, no actual records ("perhaps a little fruit"); Blackpoll Warbler, "a few seeds and berries in the fall"; Ovenbird, "a few seeds and small wild fruits"; and American Redstart, "berries and seeds on rare occasions," although Wetmore found that in Puerto Rico wintering American Redstarts consumed "100% animal food."

The most likely explanation for our observations is that the unusually early onset of cool temperatures prematurely reduced populations of arboreal arthropods that normally comprise the major portion of the diet of fall migrant warblers, kinglets, and flycatchers. Our mosquito population offered circumstantial evidence to support that idea. Mosquitos were insufferable before 14 September, numerous until 21 September, and declined very rapidly thereafter until virtually none could be found by the 27th. Beginning on 23 September the birds turned to eating berries, which could be procured with low energy expenditures. They resorted to atypical (and therefore probably energetically costly) foraging for arthropods on the ground and on tree trunks only when fruits were no longer available.—ELLIOT J. TRAMER AND FLORA E. TRAMER, *Dept. of Biology, Univ. of Toledo, Toledo, OH 43606. Accepted 11 Dec. 1975.*

Southbound migration of shorebirds from the Gulf of St. Lawrence.—In a previous study, McNeil (L'Oiseau et R.F.O. 40:185–302, 1970) has shown that most North American shorebird species departing from northeastern Venezuela in northward spring migration have enough energy reserves to reach the southern United States by a non-stop flight over the Caribbean Sea (lower part of route B in Fig. 1). Flight-range capabilities average some 2240 km. Then most shorebirds must reach their breeding grounds by flying either along the Atlantic coast or through the Mississippi flyway.

However, for most species, the fall migration route seems to differ from that used in spring. Many literature references suggest that in fall migration several North American shorebird species deviate in a southeasterly direction. This explains their presence in greater numbers in fall than in spring on the Canadian Atlantic coasts, and their occurrence in fall, but almost total absence in spring over the Atlantic (e.g. in Bermuda: See McNeil 1970; McNeil, *Can. J. Zool.* 47:525–536, 1969).

Furthermore, some species of shorebirds have higher flight energy reserves for fall migration south from the Gulf of St. Lawrence than for spring migration north from northern South America (McNeil and Cadieux, *Naturaliste Can.* 99:589–605, 1972; Berthiaume, M.Sc. thesis, Univ. of Montreal, 1974). They have enough reserves to fly

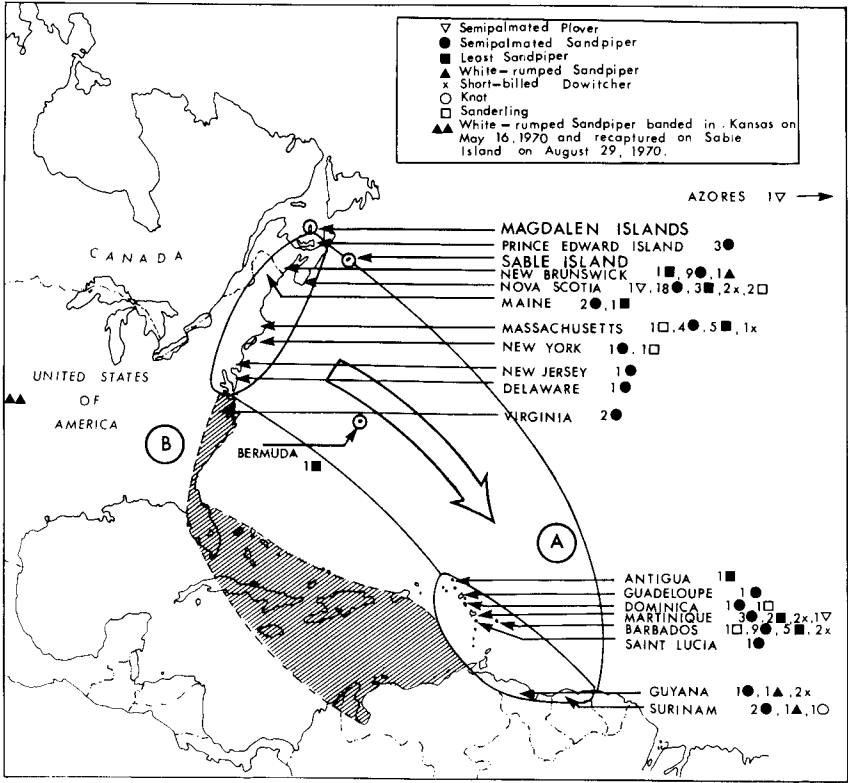


FIG. 1. Dispersal of banded color-marked shorebirds away from the Magdalen and Sable islands in the falls of 1970, 1971 and 1972. The arrow represents the over-sea route (A) apparently used by several species of North American shorebirds in southbound migration from the Canadian Atlantic and New England coasts to the Lesser Antilles and northern South America. The hatched area represents the alternative southbound route (B).

non-stop over the Atlantic in fall from Nova Scotia and the New England states to the Lesser Antilles and northern South America (Route A in Fig. 1).

Thus, knowing the flight-range capabilities of shorebirds passing through the Canadian Atlantic provinces on southward migration, we undertook an intensive program of marking and recovery of shorebirds to verify whether or not they would use the migration route described above.

Two localities were selected for the capture and marking of fall migrating shorebirds: the Magdalen Islands and Sable Island (Fig. 1). The archipelago of the Magdalen Islands is located in the Gulf of St. Lawrence, between 47°14' and 47°39' N and 61°23' and 61°01' W, about 290 km from Gaspé, 110 km from Prince Edward Island and 90 km from Cape Breton Island. Sable Island lies 160 km east of the Nova Scotia coast. Intensive bird-banding activities were undertaken on these islands from 1970 to 1972 (in 1972,

TABLE 1
NUMBERS OF SHOREBIRDS CAPTURED AND RELEASED IN 1969, 1970, 1971, AND 1972

Species	Magdalen Islands				Sable Island		Total
	1969	1970	1971	1972	1970	1971	
Semipalmated Plover (<i>Charadrius semipalmatus</i>)	7	149	176	203	81	65	681
Killdeer (<i>Charadrius vociferus</i>)		1	1	1			3
American Golden Plover (<i>Pluvialis dominica</i>)				3	2	2	7
Black-bellied Plover (<i>Pluvialis squatarola</i>)		1	4	4	29	41	79
Ruddy Turnstone (<i>Arenaria interpres</i>)		3	2	6	20	11	42
Common Snipe (<i>Capella gallinago</i>)		28	17	15			60
Whimbrel (<i>Numenius phaeopus</i>)					1	1	2
Spotted Sandpiper (<i>Actitis macularia</i>)		5	8	7	7	1	28
Solitary Sandpiper (<i>Tringa solitaria</i>)			7	5			12
Willet (<i>Catoptrophorus semipalmatus</i>)						1	1
Greater Yellowlegs (<i>Tringa melanoleucus</i>)	1	6	12	22	16	4	61
Lesser Yellowlegs (<i>Tringa flavipes</i>)		16	13	8	23	25	85
Knot (<i>Calidris canutus</i>)					11	7	18
Pectoral Sandpiper (<i>Calidris melanotos</i>)		5	5	54	3	2	69
White-rumped Sandpiper (<i>Calidris fuscicollis</i>)	7	291	505	593	62	135	1593
Least Sandpiper (<i>Calidris minutilla</i>)	73	755	1036	703	129	50	2746
Dunlin (<i>Calidris alpina</i>)		4	4	6			14
Short-billed Dowitcher (<i>Limnodromus griseus</i>)	1	46	164	99	20	38	368
Stilt Sandpiper (<i>Micropalama himantopus</i>)			1		1	1	3
Semipalmated Sandpiper (<i>Calidris pusillus</i>)	139	2124	2917	2894	694	198	8966
Sanderling (<i>Calidris alba</i>)		6	4	3	108	123	244
Total	228	3440	4876	4626	1207	705	15,082

Magdalen Islands only). Some 228 birds were marked on the Magdalen Islands in 1969 when experimental capture and marking techniques were tested. The banding activities on Sable Islands were carried on by Jean Burton (Ph.D. thesis, Univ. of Montreal, 1974). Capture and color-marking techniques have already been described in detail (McNeil and Burton, *Carib. J. Sci.* 13:257-278, 1973).

Collaboration for reporting sightings of color-marked shorebirds and/or band recoveries was requested from over 250 bird watchers and members of bird clubs and other regional natural history associations. The geographical distribution of collaborators covers the Canadian Atlantic provinces, the New England states, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, Florida, Bermuda, the Greater and Lesser Antilles, and northern South America.

The results obtained from 1969 to 1971 and already published (McNeil and Burton 1973) are here completed by further data obtained in 1972. A total of 15,082 birds representing 21 species were captured, banded and color-marked from 1969 to 1972 (Table 1). Eight species were sighted or recovered away from the banding locations in the fall of 1970, 1971 and 1972 (Fig. 1): Semipalmated Plover (*Charadrius semipalmatus*), Black-bellied Plover (*Pluvialis squatarola*), Knot (*Calidris canutus*), White-rumped Sandpiper (*Calidris fuscicollis*), Least Sandpiper (*Calidris minutilla*), Short-billed Dowitcher (*Limnodromus griseus*), Semipalmated Sandpiper (*Calidris pusilla*), and Sanderling (*Calidris alba*). A total of 11 birds was reported in 1970 as compared to 61 in 1971 and 28 in 1972. The higher number of recoveries in 1971 as compared to 1970 was obtained because of an increased number of birds color-marked (5581 as compared with 4647; Table 1), but also because of a higher number of bird watchers informed about our color-marking and recapture program.

The percentage of sightings and/or band recoveries away from banding locations is much higher in 1971 and 1972 than in 1970; there were none in 1969 because bird watchers were not advised about the project that year. The increased recoveries and/or sightings in 1971 and 1972 are likely related to the use of leg streamers. Shorebirds observed in 1973 and 1974 are considered as being color-marked in 1972.

The 100 color-marked individuals sighted or recovered away from the banding locations during the fall migration were in 2 areas 3200 km apart: a northern area including Prince Edward Island, New Brunswick, Nova Scotia, and the New England states south to Virginia; a southern area including the Lesser Antilles, Guyana and Surinam (Fig. 1). In addition, 1 Least Sandpiper was sighted in Bermuda and one Semipalmated Plover was recaptured at the Azores.

The 7 additional observations that were obtained during other months of the year are: 1 Black-bellied Plover at sea, 480 km S of Nova Scotia on 22 May 1972; 1 Least Sandpiper in North Carolina on 28 April 1972; 1 Semipalmated Sandpiper in New Jersey on 22 May 1973, 1 at Churchill, Manitoba, on 10 June 1973, and another 1 in New York on 7 June 1974; and 1 Sanderling in Florida on 31 May 1972.

The conclusions drawn from our previous studies (McNeil 1970, McNeil and Cadieux 1972, McNeil and Burton 1973) are maintained and reinforced by the 1972 results. While a great number of the species mentioned above appear to migrate mainly by an off-shore route to reach South America, most birds must complete their journey to the breeding grounds by passing across the Caribbean (lower part of route B in Fig. 1), then through the interior of the United States (Mississippi Valley) or along the Atlantic coast.

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Burton on Sable Island. We thank several students and others who helped with the field work on the Magdalen Islands. Finally, we thank the amateur and professional ornithologists who reported observations or recoveries of our marked shorebirds; without their collaboration, most of these results would have not been obtained. We are grateful to Marlène Valcin and France Guimont for helping with preparation of the manuscript.—RAYMOND McNEIL and JEAN BURTON, *Centre de Recherches écologiques de Montréal, 4101 est, rue Sherbrooke, Montréal, Québec, H1X 2B2, Canada. Accepted 14 April 1976.*

Flocking and foraging behavior of Brown Jays in northeastern Mexico.—The flocking and foraging behavior of the Brown Jay (*Psilorhinus morio*) was studied from 29 December 1975 to 9 January 1976. Observations were made in a climax evergreen forest along the Río Corona and the Río Pilon, Tamaulipas, and a tropical deciduous forest at El Salto, San Luis Potosí, Mexico.

Brown Jays live in family groups (Sutton and Pettingill, *Wilson Bull.* 54:213-214, 1942; Brown, *Am. Zool.* 14:63-80, 1974). At all 3 study sites, the Brown Jay was the first bird species seen or heard each morning. The daily activity of the family groups began about 30 min before sunrise with a seemingly spontaneous burst of calling and rapid flight through the canopy. These flights were interrupted by short (5 sec to 2 min) intervals of complete silence during which the jays hopped about, poked at one another, and preened, but did not forage. These activity patterns were similar to the morning "rallying" as described for a Piñon Jay (*Gymnorhinus cyanocephalus*) flock by Balda et al. (*Auk* 94:in press), who felt that these activities may serve to attract group members and play a role in social cohesiveness.

Foraging began after the initial rallying of a Brown Jay group, with groups ($n = 9$) ranging from 8 to 15 individuals. Adults and juveniles, distinguishable by bill color (Skutch, *Auk* 52:257-273, 1935; Selander, *Auk* 76:385-417, 1959), separated by mid-morning. Significant differences in group size, reflecting this break-up (Fig. 1), were shown using Duncan's New Multiple Range Test (Steel and Torrie, *Principles and Procedures of Statistics*, McGraw-Hill, Inc., N.Y., 1960). Morning (08:00) and evening (18:00) group sizes were significantly different from the mid-morning size ($P < .05$), and highly significant from later (12:00, 14:00 and 16:00) group sizes ($P < .01$).

During late mornings and afternoons, single adults were observed foraging, preening, and resting quietly. When disturbed by human activity, the adults either seemed to ignore the disturbance, or moved silently away. The juveniles, however, were never observed alone, but would remain in 1 or 2 groups (4-6 individuals), flocking throughout the day. Between periods of foraging and general body maintenance, the juvenile Brown Jays would move through the canopy loudly calling. As sunset approached, the adults and juveniles rejoined; this is reflected in the increase in group size (Fig. 1). Pre- and post-roosting activities were similar, with loud calling (by all members) and a diminishing number of flights as night approached and roost sites were selected. All group members roosted in the canopy of the same or adjacent trees.

By spending the morning and evening with the more experienced adults, the juveniles may be greatly increasing their survival chances by direct observance of adult behavior. In the absence of adults, these juvenile groups may afford increased predator protection and foraging success in contrast to a juvenile foraging alone. This may imply a greater dependence on learning in Brown Jays as compared to jays that do not remain with their parents for extended periods, such as the Blue (*Cyanocitta cristata*) and Steller's (*C. stelleri*) jays (Brown op. cit.). Cully and Ligon (*Auk* 93:116-125, 1976) considered