THE AUK

A QUARTERLY JOURNAL OF

ORNITHOLOGY

VOL. 72 JULY, 1955 NO. 3

LAND BIRDS OVER THE WESTERN NORTH ATLANTIC[1]

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LAND birds are regularly reported migrating over such great stretches of water as the Gulf of Mexico, the Mediterranean, and the North Sea. The Golden Plover may cross a thousand miles and more of ocean without sight of land. The Greenland Wheatear travels from Arctic America to the European coast every year, and Snow Buntings are found not infrequently flying far out at sea. Particularly during the fall months, any ship in the North Atlantic, even hundreds of miles offshore, may be visited by land birds of many different species. Most of the published references to such encounters are scattered in short notes on single occurrences or lie buried among extensive data on sea birds. In a few cases they have been given special attention, however, as by Helms (1897), Trumbull (1904, 1905), Jesperson (1930), Nicholson and Nicholson (1931), and Allison, Barras-Smith, Darlington, and Romer (1951).

For a number of years a record of biological observations has been kept on expeditions in the North Atlantic from the Woods Hole Oceanographic Institution, and notes on the birds sighted at sea form the major part of this record. Dr. A. C. Redfield began the series of observations in 1933 and 1934, and used them to determine the distribution of petrels in the Gulf of Maine in relation to the abundance of plankton (1941). The observations which Dr. Redfield started were continued by Mr. Harold Backus and Mr. Dean F. Bumpus, with contributions by Mr. Alfred H. Woodcock and Mr. Frank J. Mather III. In 1951 Dr. Hilary Moore undertook an extensive analysis of the records, and from this data as well as his own presented a detailed picture of the seasonal distribution of oceanic birds in the North Atlantic, which has contributed greatly to knowledge of the migration patterns of petrels, shearwaters,

[1] Contribution Number 773 from the Woods Hole Oceanographic Institution.

phalaropes, and jaegers. The work of assembling the material on land birds observed during the Oceanographic expeditions has been undertaken at Dr. Redfield's suggestion, to see whether these occurrences at sea could be related to season, migratory routes, or weather conditions. In this analysis birds which habitually light on the water, such as ducks and geese, have not been included in the category of land birds.

Material.—The data were gathered during cruises in the years 1933 and 1934, 1936 through 1941, and 1949, most of them on the research vessel "Atlantis," with a few on the "Caryn." The area covered in this investigation extended from about 44° north latitude south through the West Indies, and from the coast of North America eastward to about 51° west longitude. The locations of all land birds recorded are given in figure 1, and all observations have been plotted on the maps in figures 2 and 3, according to month or season of the year.

Although every month is represented by notes from some section of this area, the extent of sea traversed and the number of observations made in each month vary considerably. Nevertheless for limited sections and periods, the data are sufficient to indicate prevailing seasonal conditions.

In plotting the data on the seasonal maps each time of entry in the biological notes was considered as one observation, regardless of whether land or sea birds or no birds at all were reported. In many cases one entry gives the total list of birds for one day. In other cases fairly regular watches were kept, and for one day there may be three or four entries made at different times. If only one entry was made per day the position of the point on the map is generally the ship's noon position; if there were several entries per day the positions may be somewhat closer to the actual location of observations.

Many of the birds seen were unidentifiable from the ship, but if they were clearly recognized as land birds they have been entered as such on the maps. Birds reported while the ship was in harbor or very close to shore have been omitted. A list of the species seen during these cruises, with their approximate distances from shore, is given in table 1, along with a number of records made by others in the same general area.

SEASONAL DISTRIBUTION

Winter, December–March (figure 2).—Through December and January practically no land birds were seen, and in February and

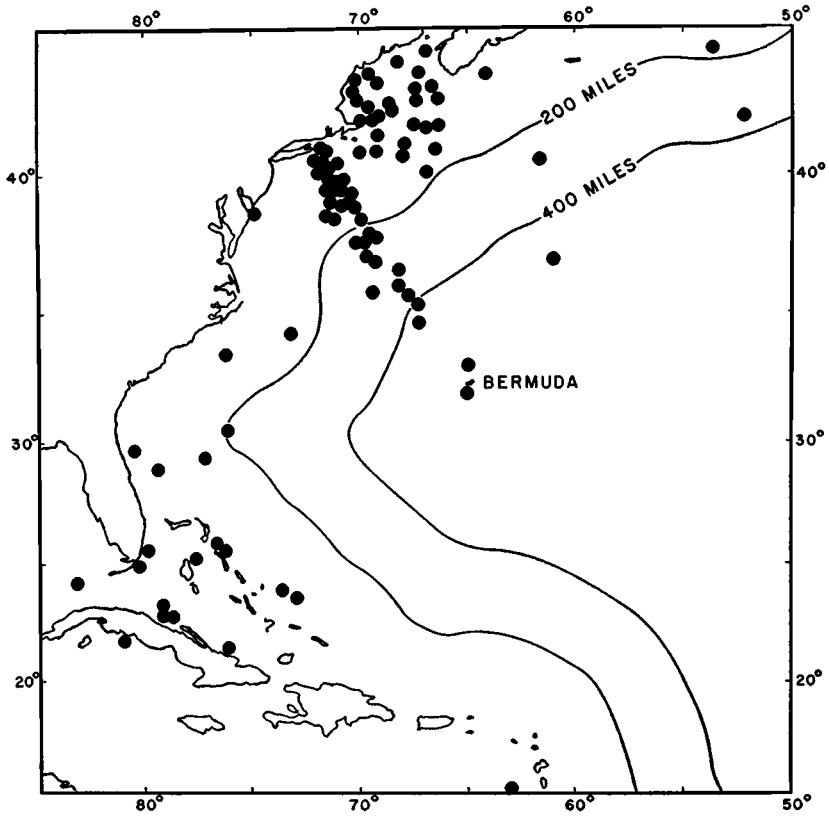

FIGURE 1. Positions of land birds seen from the Atlantis. Lines are drawn approximately 200 miles and 400 miles offshore; from these the distances from land were estimated for Table 1.

March there were only a few reported from southern waters. In fact, during this period entries in the notes frequently mention a complete absence of bird life of any kind for several days, even as long as a week at a time, in waters both to the north and south of Bermuda, to the east of the West Indies, and right among the West Indies themselves.

Spring Migration, April–May (figure 2).—Migratory activity during April and May is clearly reflected on the maps.

Off the coast of Florida and through the West Indies the movement appeared to be strongest around the middle of April, diminishing during the last week. Late in the month (April 27, 1952), however, at Bimini in the Bahamas, Mr. Marshall B. Bishop of the Lerner

TABLE 1

SPECIES OF LAND BIRDS OBSERVED AT SEA, WITH APPROXIMATE DISTANCES FROM SHORE.[1]

	Within 200 miles	*200 to 400 miles*	*Beyond 400 miles*	*Occurrence on Bermuda*[2]
Great Blue Heron (*Ardea herodias*)	5	8	1	F
Black-crowned Night Heron (*Nycticorax nycticorax*)	1	–	–	F
Sharp-shinned Hawk (*Accipiter striatus*)	5	–	–	A
Gray Sea Eagle (*Haliaeetus albicilla*)[3]	1	–	–	–
Osprey (*Pandion haliaëtus*)	6	–	–	A
Duck Hawk (*Falco peregrinus*)	1	–	–	A
Virginia Rail (*Rallus limicola*)	1	–	–	A
Semipalmated Plover (*Charadrius hiaticula*)[4]	2	–	–	F
Wilson's Plover (*Charadrius wilsonia*)	1	–	–	–
Ruddy Turnstone (*Arenaria interpres*)	2	–	–	F
Wilson's Snipe (*Capella gallinago*)	1	–	–	F
Whimbrel (*Numenius phaeopus*)[5]	1	–	–	–
Hudsonian Curlew (*Numenius hudsonicus*)	1	–	–	A
Baird's Sandpiper (*Erolia bairdii*)	sev.	–	–	–
Least Sandpiper (*Erolia minutilla*)	1	–	–	F
Semipalmated Sandpiper (*Ereunetes pusillus*)[6,7]	–	1	1	F
Sanderling (*Crocethia alba*)[4]	3	–	–	F
Domestic Pigeon (*Columba livia*)	–	2	1[8]	F
Barn Owl (*Tyto alba*)	1	–	–	A
Burrowing Owl (*Speotyto cunicularia*)[9]	1	–	–	–
Long-eared Owl (*Asio wilsonianus*)	1	–	–	F
Chimney Swift (*Chaetura pelagica*)	1	–	–	A
Belted Kingfisher (*Megaceryle alcyon*)	1	–	1	F
Flicker (*Colaptes auratus*)	4	–	1	A
Gray Kingbird (*Tyrannus dominicensis*)	2	–	–	A
Phoebe (*Sayornis phoebe*)	1	–	–	A
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	1	–	–	–
Least Flycatcher (*Empidonax minimus*)	–	1	–	–
Olive-sided Flycatcher (*Nuttallornis mesoleucus*)	1	–	–	A
Horned Lark (*Otocoris alpestris*)[10]	sev.	–	–	F
Bank Swallow (*Riparia riparia*)[8]	–	–	1	A
Barn Swallow (*Hirundo rustica*)	6	1[8]	sev.[7,8,11]	F
Red-breasted Nuthatch (*Sitta canadensis*)	5	–	–	A
Robin (*Turdus migratorius*)	2	–	1[8]	F
Golden-crowned Kinglet (*Regulus satrapa*)	1	–	–	A
Cedar Waxwing (*Bombycilla cedrorum*)	5	1	–	F
Starling (*Sturnus vulgaris*)	3	2	–	A
Black and White Warbler (*Mniotilta varia*)	1[12]	1	–	F
Nashville Warbler (*Vermivora ruficapilla*)[13]	–	–	1	A
Parula Warbler (*Parula americana*)	2	–	–	A
Yellow Warbler (*Dendroica petechia*)	2	–	–	A
Cape May Warbler (*Dendroica tigrina*)	1	–	–	A
Black-throated Blue Warbler (*Dendroica caerulescens*)	–	1	–	A
Myrtle Warbler (*Dendroica coronata*)[14]	sev.	–	–	F
Yellow-throated Warbler (*Dendroica dominica*)	1	–	–	–
Black-poll Warbler (*Dendroica striata*)	1	1	–	A
Pine Warbler (*Dendroica pinus*)	6	–	–	F
Prairie Warbler (*Dendroica discolor*)[14]	–	1	–	A
Palm Warbler (*Dendroica palmarum*)	5	–	–	F
Oven-bird (*Seiurus aurocapillus*)[13]	–	–	1	A
Water-thrush (*Seiurus noveboracensis*)[15]	1	–	–	F
Yellow-throat (*Geothlypis trichas*)	1	1[16]	–	F
Yellow-breasted Chat (*Icteria virens*)	–	1	1	–
Wilson's Warbler (*Wilsonia pusilla*)	1	–	–	–
American Redstart (*Setophaga ruticilla*)	4	–	1[13]	A
Meadowlark (*Sturnella magna*)	1	1	–	–

TABLE 1—*Continued*

	Within 200 miles	*200 to 400 miles*	*Beyond 400 miles*	*Occurrence on Bermuda*[2]
Red-wing (*Agelaius phoeniceus*)	2	–	–	–
Baltimore Oriole (*Icterus galbula*)	1	1[17]	–	F
Cowbird (*Molothrus ater*)	2	–	–	A
Dickcissel (*Spiza americana*)	1[4]	1	–	–
Purple Finch (*Carpodacus purpureus*)	1	–	–	–
Pine Siskin (*Spinus pinus*)[10]	sev.	–	–	A
Goldfinch (*Spinus tristis*)	1	–	–	A
Crossbill (*Loxia curvirostra*)[18]	–	1	–	F
Savannah Sparrow (*Passerculus sandwichensis*)	2[19]	4	2	A
Slate-colored Junco (*Junco hyemalis*)	3	1	–	A
White-crowned Sparrow (*Zonotrichia leucophrys*)	–	1	–	–
Golden-crowned Sparrow (*Zonotrichia coronata*)[20]	–	1	–	–
Fox Sparrow (*Passerella iliaca*)[19]	1	–	–	A
Swamp Sparrow (*Melospiza georgiana*)[12]	sev.	–	–	A
Song Sparrow (*Melospiza melodia*)	1	–	–	A
Snow Bunting (*Plectrophenax nivalis*)	1[21]	6	–	F

[1] Species listed according to The A.O.U. Check-List of North American Birds, Fourth Ed., 1931, and supplements.

[2] According to Bradlee, Mowbray, and Eaton, 1931. F = Frequent or regular; A = Accidental or rare.

[3] Crandall 1915. [4] Rand 1929.
[5] Brewster 1909. [6] Nicholson and Nicholson 1931.
[7] Murphy 1915. [8] Jesperson 1930.
[9] Bent 1938. [10] Helmuth 1920.
[11] Dahl 1892. [12] Furlong 1933.
[13] Moore 1941. [14] Bent 1953.
[15] Penard 1926. [16] Robbins 1901.
[17] Butler 1926. [18] Brown 1896.
[19] Trumbull 1905. [20] Riney 1946. [21] Smith 1901.

Marine Laboratory listed 21 species of migratory birds which arrived, both in flocks and singly, after a period of high winds. The birds stayed a few days and then disappeared. According to residents of Bimini this influx after storms is a regular occurrence at about the same time every year, and Wetmore (1927) also mentions observations of flocks of migratory birds in the Bahamas in April and early May. Our list in May of birds observed in the vicinity of the Bahamas and West Indies is considerably smaller than in April.

To the north there were no land birds in the Gulf of Maine after the first week of May.

Summer, June–July (figure 2).—One Barn Swallow (*Hirundo rustica*) on June 1 constitutes the only land bird record, and it might perhaps better be added to the spring observations. The ocean in midsummer appears to be as barren of land birds as in midwinter. Nicholson and Nicholson (1931) and Allison, Barras-Smith, Darlington, and Romer (1951) have also reported that July was a poor month for non-oceanic birds at sea.

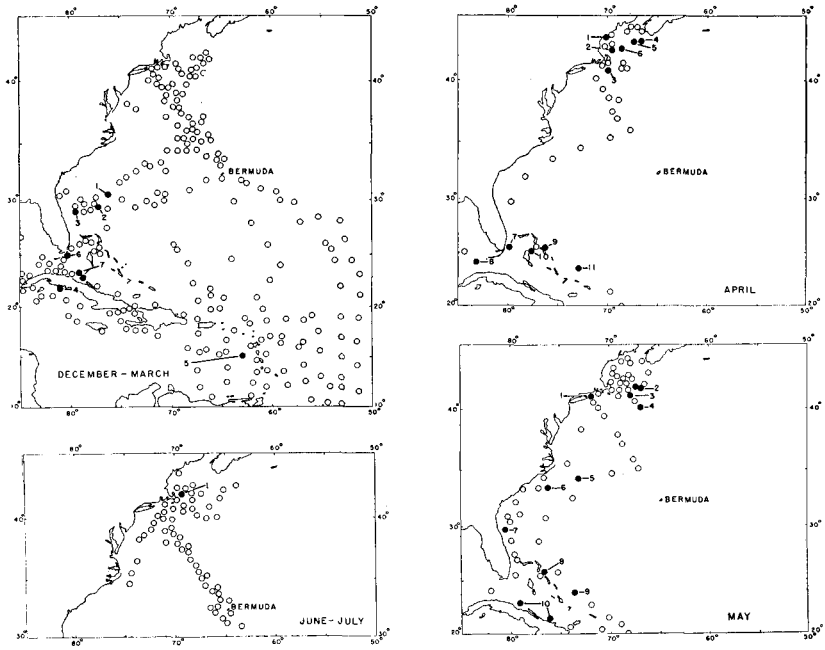

FIGURE 2. Observations during the winter, spring and summer. Dark circles indicate the positions of land birds; open circles show observations where no land birds were seen. Each circle usually represents from 1 to 3 observations, or as many as 10 in congested areas. The total number of observations, as well as the number of different years in which they were taken, is given below for each month. The land birds are listed under numbers corresponding to those on the map. An asterisk indicates that the bird landed on board or was caught.

December, 24 observations, between Cape Cod and Bermuda only, three years.

January, 179 observations, five years. 1. Domestic Pigeons.*

February, 132 observations, six years. 2. Wilson's Snipe ("lost"). 3. Landbird. 4. Yellow Warbler.* 5. Swallow.

March, 145 observations, six years. 6. Virginia Rail*; nuthatch. 7. Gray Kingbirds.* There were also, in March, 14 observations in the Gulf of Mexico not shown on the map. Five herons were recorded.

April, 140 observations, five years. 1. Landbirds. 2. Song Sparrow.* 3. Barn Swallow.* 4. Flicker; Palm Warbler. 5. Hawk; landbird. 6. Sharp-shinned Hawk. 7. Yellow-bellied Flycatcher*; Palm Warbler; Sharp-shinned Hawk*; Red-breasted Nuthatch*; landbirds. 8. Hawks; landbirds. 9. Pine Warbler. 10. Redstarts; Kingfisher; Palm Warbler; Cape May Warbler; finches; warbler. 11. Warbler. There were also 8 observations in the Gulf of Mexico in April, with 2 herons and 2 flocks of unidentified birds reported, all on southerly winds.

May, 132 observations, seven years. 1. Turnstones*; Red-wing; nuthatch; warbler; landbirds; all on one day after a storm in the vicinity of New York the day before. 2. Red-wing; Barn Swallow.* 3. Pine Warbler. 4. Barn Swallows. 5.

Fall Migration, August–November (figure 3).—In the last week of August the picture is different, and the first two weeks of September reflect a high point of activity in the Gulf of Maine. In October particularly, the presence of land birds is striking, especially if we make the reasonable assumption that the records obtained between Cape Cod and Bermuda constitute a representative cross section of large parts of the ocean. In November, land birds were reported during the first three weeks and not thereafter.

According to this reflection at sea of the migratory periods of land birds, the movement is under way in the spring from early April to early May. The much more striking southward movement is already well discernible in the last week of August, it increases markedly in early September, and may continue at this rate through October. In November the drop in numbers is pronounced, and the season is evidently over in this area by the end of November.

Warblers make up a considerable number of the birds reported from southern waters in the spring, and hawks were present there in the middle of April, with two records in April in the Gulf of Maine at a slightly later date. Five of the records in April and May were Barn Swallows, mainly from the waters off Cape Cod, or a little to the south. Swallows were seen again in August, but no later. The Cedar Waxwings (*Bombycilla cedrorum*), hawks, Red-breasted Nuthatches (*Sitta canadensis*), and Flickers (*Colaptes auratus*) seem to travel in August and September, and September is the only month in which sandpipers are mentioned. Warblers and flycatchers were also evident throughout September and October, and ducks (not recorded on the maps) were increasing in October, even considerably offshore. Starlings (*Sturnus vulgaris*), sparrows, Juncos (*Junco hyemalis*), Snow Buntings (*Plectrophenax nivalis*), and Great Blue Herons (*Ardea herodias*) are most conspicuous in October and November.

Weather conditions associated with the occurrence of land birds at sea.—In many cases, weather data were set down in the Atlantis records at the same time as the birds' appearance, and this information could be easily checked and supplemented by the ship's log. In table 2 the observation area has been divided into four regions from north to south, and the numbers of land birds are given for each region under the wind direction with which they were associated.

If the land birds seen at sea have been blown from their normal

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Barn Swallow. 6. Chimney Swift. 7. Landbird. 8. Redstarts. 9. Black-poll Warbler; hawk. 10. Parula Warblers.

June, 142 observations, five years. 1. Barn Swallow.

July, 70 observations, five years.

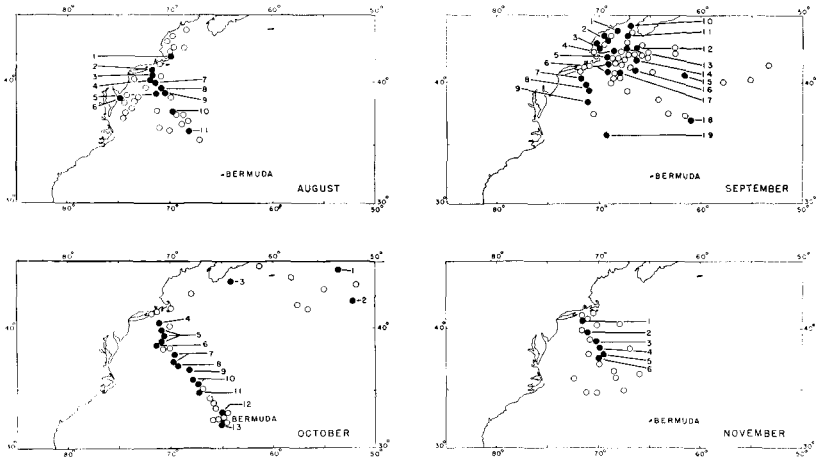

FIGURE 3. Observations during the fall.

August, 135 observations, six years. 1. Landbird. 2. Pine Warbler.* 3. Cedar Waxwing; landbirds. 4. Black-crowned Night Heron*; swallows. 5. Olive-sided Flycatcher*; landbirds. 6. Ospreys. 7. Warbler. 8. Landbird. 9. Cedar Waxwings.* 10. Swallow. 11. Cedar Waxwing.*

September, 120 observations, six years. 1. Least Sandpiper*; Cedar Waxwing*; Palm Warbler.* 2. Sandpipers; Long-eared Owl*; landbird. 3. Hudsonian Curlew; Yellow Warbler*; sandpipers; landbird. 4. Wilson's Warbler.* 5. Sandpipers. 6. Flycatcher; landbirds. 7. Red-breasted Nuthatch*; Flickers*; Ospreys; landbirds. 8. Cedar Waxwing*; Baird's Sandpipers, in a flock, one caught in the rigging; sandpipers. 9. Goldfinch; Pine Warbler*; Phoebe.* 10. Sharp-shinned Hawk. 11. Hawk. 12. Red-breasted Nuthatch. 13. Yellow-throat.* 14. Red-breasted Nuthatch; Palm Warbler*; landbirds. 15. Yellow-breasted Chat. 16. Baltimore Oriole. 17. Red-breasted Nuthatch. 18. Flicker.* 10. Least Flycatcher.*

October, 137 observations, five years. 1. Pine Warbler. 2. Snow Buntings.* 3. Duck Hawk; Flicker; landbirds. 4. Landbirds. 5. Cowbirds; Robin; Starlings; Golden-crowned Kinglet*; Yellow-throated Warbler*; warblers*; landbirds; a storm at sea may have accounted for the occurrence of 10 of these birds. 6. Wilson's Plover.* 7. Landbirds. 8. Great Blue Herons; Meadowlark; Starling; landbirds. 9. Landbird. 10. Starling; Black-poll Warbler*; White-crowned Sparrow*; Dickcissel*; Black and White Warbler*; Black-throated Blue Warbler*; Savannah Sparrows*; Slate-colored Junco*; flycatchers; Great Blue Herons; landbird. 11. Kingfisher; landbird. 12. Yellow-breasted Chat*; Savannah Sparrows. 13. Great Blue Heron.

November, 42 observations, three years. 1. Pine Warbler. 2. Slate-colored Juncos; landbird. 3. Purple Finch*; Meadowlark; Great Blue Heron; landbirds; all seen on one day after a storm recorded at Nantucket the day before. 4. Barn Owl; Robin; Great Blue Herons; landbirds; all these came on one day with wind NW 6. 5. Snow Buntings. 6. Great Blue Heron; landbird.

course, one would expect to find them associated chiefly with winds blowing offshore. This was generally true for the land birds seen from the Atlantis. It was also true that these winds were generally the prevailing winds of the region where the birds were seen, which may cloud the issue somewhat. In the three northern sections listed on table 2, the prevailing winds are the Westerlies, with a northeast component in the fall. In general the nearest land would lie to the west or north. Most of the land birds came on winds from these directions.

TABLE 2

NUMBER OF BIRDS IN RELATION TO DIRECTION OF WIND AT TIME OF BIRDS' APPEARANCE.

	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
1. *Latitudes from southern Nova Scotia to southern Cape Cod*									
Spring (Apr. and May)	1	1	1	1	4	2	0	0	0
Fall (Aug. thru Oct.)	4	8	9+	11+	1	0	0	2	0
Total (Jan. and Mar. thru Oct.)	5	9	15+	12+	5	3	0	2	0
2. *Latitudes from southern Cape Cod to Bermuda*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Spring (Apr. and May)	0	2	0	9+	0	0	0	1	0
Fall (Aug. thru Nov.)	4	9	10	48+	17	37+	5	1	5+
Total (Jan. thru Dec.)	4	11	10	57+	17	37+	5	2	5+
3. *Latitudes from Bermuda to West Indies*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Total (Jan. thru June, Oct. and Dec.)	0	7	0	1	0	0	0	3	1
4. *Latitudes from West Indies to coast of South America*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Total (Jan. thru May)	1	0	0	1	0	7	19+	5+	0

Among the West Indies in the spring, the Northeast Trades are the prevailing winds, and it will be seen that in the southernmost section on table 2, all the land birds but one appeared on easterly winds. Since land occurred in almost every direction, its position in relation to the wind could not be considered.

A check of coastal weather conditions in the Daily Weather Maps for the two northern sections in table 2 indicated that offshore winds generally prevailed for the areas and times in which land birds were seen at sea. At least 140 out of about 195 birds during the spring and fall came in periods of offshore winds.

If it is assumed that the land birds observed from the Atlantis came almost directly from the nearest shore, the journey over the sea for most of them would have been well within 200 miles (table 1). This is a minimum estimation, and moreover it may not apply at all to the situation in the fall between Cape Cod and Bermuda, where almost as many birds were accompanied by winds from the north or northeast as by the west or northwest winds from the nearest

land. If these birds actually came from land to the northeast, they might have been traveling for 400 miles or more, although in table 1 they might still appear in the category of 200 miles from shore. In the month of October only 26 birds appeared to be from the nearest land, whereas 34 apparently came from farther eastward. Of the latter group an unusually large proportion, 15, landed on the ship. In summary, it can be said that out of the total number of birds, some 240, reported from the Atlantis, about 128 were definitely associated with winds directly from the nearest land, and about 54 came in the fall when winds were blowing which might have carried them a considerably greater distance from the north or east.

When the wind was directly from the east, however, it is clear from table 2 that land birds were very rarely seen at sea north of the West Indies, and a number of the days and periods of easterly winds during the winter, even among the West Indies, were marked by a complete absence of both land and sea birds. Out of a total of 36 such days, which occurred in stretches of from two days to over a week, 25 had easterly winds.

Bad weather and the force of the wind, as well as its direction, might be expected to have some effect on the numbers of land birds over the sea, but in the Atlantis records this was not generally striking. Throughout the year most of the birds were recorded on days of fair weather in all areas, and the winds with which they came were in the majority of cases light to gentle, ranging between 1 and 3 on the Beaufort scale, or approximately 2 to 13 miles an hour. Between Cape Cod and Bermuda during the fall months, however, where birds were most frequently seen at some distance from shore, there seems to be some correlation between numbers and the force of the wind (table 3A); and in the month of October, it appears that the presence of a fair proportion of the birds could be attributed to ocean gales or storms in the vicinity (table 3B). This result is hardly surprising in a month which reflects not only the increasing storminess of the season but the height of the migration period as well. That the storms encountered in November were so few in table 3B is undoubtedly due to the comparatively small number of observations taken during the month. Except in the month of October there seems to be no marked relation between storms and numbers of land birds at sea. Out of the whole period only three of the many days which could be called outstanding for land bird occurrences (with more than five birds reported) could possibly be associated with storms either on land or sea. (These days are noted under the maps for May, October, and November, figures 2 and 3.) Williams

(1950) stated that night migration along the Gulf of Mexico ceased when strong winds were blowing, and Allison, Barras-Smith, Darlington, and Romer (1951) reported that a gale in September produced a marked cessation in the movements of birds at sea. In general birds must be able to cope with stormy weather, or avoid it; the fate of those that fail, on the other hand, is nowhere more evident than over the sea.

TABLE 3

A. NUMBER OF BIRDS IN RELATION TO THE FORCE OF THE WIND (BEAUFORT SCALE) BETWEEN CAPE COD AND BERMUDA DURING THE FALL.

Force	*Calm-1*	*2–3*	*4–5*	*6–7*
September	7	10+	5	1
October	3	23+	44+	1
November	2	6	10	7+

B. NUMBER OF BIRDS IN RELATION TO STORMS AT SEA OR ALONG COAST DURING SPRING AND FALL.[1]

Month	*Number of years*	*Total number of birds observed*	*Number of storms in vicinity of observation area*	*Number of birds observed in storm vicinity*
April	3	27+	7	1
May	3	13+	5	6+
August	4	18+	3	6
September	4	39+	8	3
October	5	79+	8	30
November	2	13+	3	3

[1] Storm data from Monthly Weather Review, 1933–1940.

Discussion.—The seasonal pattern of land birds over the North Atlantic is similar to that of the oceanic birds described by Moore (1951), allowing for differences in numbers and range. Periods of greatest activity and in many cases areas of concentration correspond rather closely. There are however at least two outstanding differences. For the oceanic birds, the migratory movement in the spring seems to be generally just as pronounced as in the fall. This is not true of the land birds. In addition it is evident in the numbers and behavior of the birds which Moore discussed that they are following a definite course over the sea. In the case of the land birds reported from the Atlantis there is nothing to suggest that they are flying over a normal route. The majority of records are of individual birds, seldom more than two of a kind during a month. There are only one or two references, in the fall, to migrating flocks. A comparatively large number of the birds landed on the ship, or were caught, and many of the smaller birds, particularly warblers, were either found dead or died shortly after landing, which would point to a rather common state of exhaustion, and probable disorientation.

In the case of Snow Buntings, occurrences over the Atlantic may be more than accidental, however. Three in October constitute the most easterly of the Atlantis land bird records, and they have been found by many others at much greater distances from shore. Helms (1897) mentions them with the Wheatears as the only birds seen regularly in the North Atlantic. A Snow Bunting banded in New York was recaptured a few months later in a flock west of Iceland (Cooke 1945), and Allison, Barras-Smith, Darlington, and Romer (1951) recorded 20 in September at a weather ship station west of the British Isles.

Swallows also appear rather often in lists of land birds at sea. Our records were not very far offshore, but Dahl (1892) and Murphy (1915) reported a number of Barn Swallows east of Bermuda, which were assumed to be on migration to South America. Murphy's record was made 360 miles from land, and Jesperson (1930) found them as much as 600 miles off shore. Both Snow Buntings and Barn Swallows are frequent visitors on Bermuda.

In view of the number of land birds southeast of Cape Cod in the fall, it was of interest to see how many of the species recorded there are known also from Bermuda (table 1), which lies near the eastern limit of most of the Atlantis observations, some 600 miles from the North American coast. According to the checklist of Bradlee, Mowbray, and Eaton (1931) 11 species of land birds are resident in Bermuda, four species are given as present during the winter, and 84 species appear fairly frequently or regularly during the migration seasons. By far the greatest number (138) are only occasional or accidental visitors. These include most (25) of the species seen in the region from the Atlantis. Of the four species recognized as winter residents on Bermuda, the Great Blue Heron, the Belted Kingfisher (*Megaceryle alcyon*), and the Black and White Warbler (*Mniotilta varia*) were seen from the Atlantis, as well as 13 of the species described as not uncommon in Bermuda in the fall. Only the Great Blue Herons and possibly the sandpipers appeared in any numbers which might suggest a regular migratory route. Several of the species seen at sea, in view of their location on the Atlantis maps, could well be expected in Bermuda, although they do not appear on the checklist of 1931. In comparison with the total list of species from Bermuda, the Atlantis list is meager. For a bird traveling over the ocean the chance of making a landfall on an island group some 200 square miles in area is considerably greater than the possibility of finding a ship at sea, and the list of Bermuda species is a compilation of the observations of nearly 100 years.

In October, fall migration in Bermuda is at its height; the spring migration is less noticeable, and the number of birds there is lowest in June and July (Bradlee, Mowbray, and Eaton 1931). The same general pattern appears also in the Atlantis records. There are many references to the effect of storms on the migratory bird population of Bermuda, and the presence of most of the species recorded on the island has been attributed to unfavorable winds which blow the birds off their regular courses (Reid 1884, Bradlee, Mowbray, and Eaton 1931). On Bermuda, as on the Atlantis, the appearance of land birds would seem to depend largely on wind conditions along the American coast.

There are many conflicting reports as to whether migratory flight is associated with certain wind directions, or proceeds regardless. These are mainly based on local observations of the arrival of migrant birds. In the two northern sections included on table 2, no clear seasonal difference in wind directions can be seen which might be associated with a seasonal difference in migration direction, but these birds at sea cannot be taken as representing the normal pattern. If a broader point of view is taken of the course of migration in relation to the pattern of prevailing winds, it appears that correlations may exist, as has been suggested by McMillan (1940), Landsberg (1948), and Lowery (1951). An easterly wind is a determining factor in the appearance of southbound migrants in the British Isles (Williamson 1952), and Bradlee, Mowbray, and Eaton (1931) found that the prevailing winds, from the south and southwest, were related to the preponderance of southern North American species among the "accidentals" on Bermuda.

All but 15 of the 248 land birds reported from the Atlantis came while the prevailing winds were blowing in the region where they were seen. In the spring the prevailing westerly or northerly winds along the Atlantic coast would be of little help to a northbound migrant, and the comparative scarcity of records at sea in the spring may indicate that at this season the main stream of migration does not pass along the coast, but farther inland. In the fall however, the prevailing north or west winds along the coast would correspond somewhat better to the direction of migration, and the numbers of land birds over the sea seem to indicate that the coastal route is much more popular at this season than it is in the spring. It is also evident that, although a fall migrant might derive some advantage from tail winds which would help it eastward to the coast and southward, it would have to pay the price of running special risks, such as overshooting the land in darkness, or blowing out to sea with the

strong winds characteristic of the season. Whether or not the prevailing wind may be a factor in determining the course of migration along the coast in the fall, the vulnerability of such a route at that season is clearly illustrated in the Atlantis records of land birds at sea.

Summary.—A record of the birds observed in the western North Atlantic was kept for eight years by members of expeditions from the Woods Hole Oceanographic Institution. The data on land birds have been assembled from these notes and entered on a series of seasonal maps. Fifty-four species of land birds were identified from the ship. Most of them were within 200 miles from shore, but some were more than 400 miles from the nearest land. Only during the migration seasons were land birds found on the sea in any numbers, some in the spring and many more in the fall. Their appearance could generally be associated with winds blowing from the direction of land, and since a relatively large number lighted on the ship, exhausted, there seems to be little doubt that these birds at sea were blown off course and victims of the same conditions which determine the long list of "accidentals" on Bermuda. In the fall their numbers seemed also to have some correlation with the force of the wind, as well as with storms in October. From a comparison of spring and fall records it seems that the main course of migration may pass farther inland in the spring and nearer to the coast in the fall, where it would be particularly vulnerable to the stress of weather conditions.

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