THE MIGRATORY MOVEMENTS OF CERTAIN COLONIES OF HERRING GULLS IN EASTERN NORTH AMERICA

By RICHARD JEFFERSON EATON

PART III.

THE GREEN BAY (WISCONSIN) COLONIES

IN U. S. Technical Bulletin 32, U. S. Department of Agriculture, pages 10 and 11, Mr. F. C. Lincoln has listed the following thirty-three recoveries from birds banded from 1923 to 1926 in "Green Bay Region," Wisconsin. No precise locations of the banding stations are given, although it is suspected that they were at Hat and Sister Islands, Door County, where Mr. W. I. Lyon and others have been working for several years.

THE GREEN BAY (WISCONSIN) COLONIES

Date of Banding	*Band No. of Recovery*	*Place of Recovery*	*Date of Recovery*	*Age of Gull Recovered*	*Air-Line Distance from Banding Station*[1]
7/ 8/26	377484	Manistee, Mich.	9/12/26(?)	1st year	80-E
7/11/26	377712	Arcadia, Mich.	9/12/26	" "	80-E
7/19/24	320136	Egg Harbor, Wis.	9/13/24	" "	15-S
7/ 9/26	336332	Munising, Mich.	9/17/26	" "	100-N
7/ 8/26	421118	Wainfleet, Long Beach, Ont.	9/19/26	" "	400-ESE
7/18/24	320043	Escanaba, Mich.	9/21/24	" "	75-N
7/22/26	377242	Beach Haven, N. J.	9/22/26	" "	750-SE
7/ 9/26	336486	Port Clinton, Ohio	9/26/26	" "	350-SE
7/ 6/25	336078	Two Rivers, Wis.	9/30/25	" "	80-S
7/ 9/26	336253	Orillia, Ont.	10/ 1/26	" "	375-E
7/18/24	208039	Empire, Mich.	10/ 6/24	" "	70-E
7/ 8/26	377392	Sturgeon Bay, Wis.	10/11/26	" "	30-S
7/ 8/26	377440	Green Island Light Station, Wis.	10/11/26	" "	7
7/ 8/26	377042	Algoma, Wis.	10/18/26	" "	50-S
7/20/24	320168	Baileys Harbor, Wis.	10/25/24	" "	10-S
7/18/24	320104	Au Train, Mich.	11/—/24	" "	100-N
7/ 8/26	377416	Marinette, Wis.	11/ 3/26	" "	20-SW
7/ 8/26	377392	Sheboygan, Wis.	11/20/26	" "	110-S
7/ 9/26	336195	Oswego, N. Y.	11/20/26	" "	600-ESE
7/ 9/26	336069	Put in Bay, Ohio	12/19/26	" "	350-SE
7/ 8/26	337229	San Bernard River, Texas	12/22/26	" "	1250-S
7/19/24	320120	Lumberton, Miss.	12/22/24	" "	1000-S
7/ 8/26	377254	Walnut Lake, Ark.	12/24/26	" "	850-S
7/ 9/26	336111	Newellton, La.	12/25/26	" "	950-S
7/18/24	320080	I(a)monia Lake, Fla.	12/26/24	" "	1050-S
7/ 8/26	377455	New Iberia, La.	12/26/24	" "	1100-S
6/25/24	236173	Venice, Ill.	12/31/24	" "	475-S
7/ 6/25	336043	Cape Lookout, N. C.	1/11/26	" "	925-SE
6/25/24	236184	Milwaukee, Wis.	1/13/25	" "	160-S
6/25/24	236207	Port Washington, Wis.	3/21/25	" "	135-S
7/17/24	200041	Beaumont, Texas	4/ 7/25	" "	1150-S
6/25/24	236198	New River, Tenn.	5/12/25	" "	650-SSE
7/20/24	320152	Seaside Park, N. J.	8/ 8/25	2d year	750-SE

[1]Numerals indicate miles. The letters are abbreviations of the points of the compass.

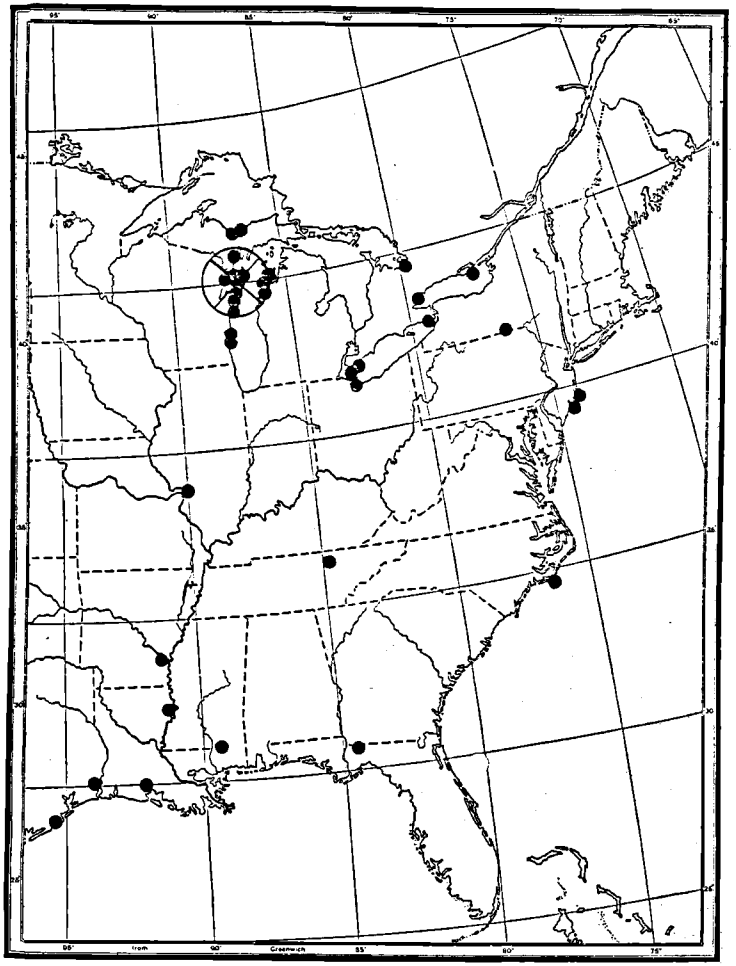


Figure 8. Map showing the distribution of first-year recoveries (and one second-year) from the Green Bay, Wisconsin, Colonies. The location of banding station is at the center of the large circle.

In addition to the foregoing recoveries, about twenty-one others dated from 1927–1930 have been published from time to time in the *Canadian Field Naturalist*. Unfortunately Canadian records only were listed, thus rendering them nearly useless for analytical purposes. Obviously the value of a relatively small amount of data as the basis of generalizations is almost entirely destroyed by the intrusion of any artificial factors such as geographical selection. By the doctrine of chances certain probable truths may be deduced from a small number of events, if such events are chosen at random. By considering *all* the reported recoveries from a given colony over a given period of time we obtain a fair random sample from which to develop a thesis.

Before we dismiss the *Canadian Field Naturalist* data, however, certain features of interest should be pointed out. If the list is a substantially complete record of all Canadian recoveries reported during a given period of time, then the proportion of first-year birds to second-year birds is of some significance. Eight out of twenty-one—more than one out of every three—recoveries were second-year birds. This ratio is abnormally high, and, in fact, more than twice as high as the average ratio of *all* first-year to second-year recoveries from all the colonies heretofore discussed. If we assume that this average ratio applies to the Green Bay colonies (and it is hard to believe that the mortality-rates would differ materially) then it follows that the second-year birds from these particular colonies are more than twice as likely to scatter into Canada than the first-year birds. Furthermore, four out of the eight birds were picked up in such widely separated regions as Newfoundland, northern Ontario, and Saskatchewan. The first-year birds confine their Canadian wanderings mainly to the Great Lakes littoral, as would be expected, although one bird did reach James Bay, P. Q., and another was recovered two hundred twenty-five miles east-northeast of the city of Quebec.

The distribution of the recoveries listed above is shown on the map (Figure 8, page 71). In general the first-year gulls from this colony scatter widely throughout the southern Great Lakes region during September with a tendency to work southward. A substantial number migrate southward down the Mississippi River valley to the Delta region, but this characteristic is by no means conspicuous. Apparently a not inconsiderable portion of the young birds winter in the Great Lakes region, some working eastward to Erie and Ontario and

thence overland to the New Jersey coast or down the St. Lawrence River valley. Obviously the Green Bay colonies are very similar to those of the Beaver group near St. James, Michigan, considered below. Neither group has inherited very definite migratory instincts such as are so conspicuous among those of the Atlantic seaboard. Furthermore, there is no evidence as yet of any marked tendency for the one-year-old birds to return to the general region of the breeding-ground during the second summer.

Because of the paucity of data no analytical graph has been prepared to show the migration-curve. Instead, the list of recoveries has been arranged chronologically according to their ages, with the air-line distance in miles from the banding station indicated in each case. By inspection the reader may gain a satisfactory impression of the complicated movements of the gulls during their first year. To judge from the number of Canadian recoveries during the years 1927 to 1930, it is apparent that there are ample data as yet unpublished from which to make an adequate analysis not only of second-year birds but presumably of older gulls as well.

THE BEAVER ISLAND COLONIES NEAR ST. JAMES, MICHIGAN

Extensive banding operations among the Herring Gulls of the so-called Beaver group of islands near the northern end of Lake Michigan have been conducted during the past ten years, chiefly by Mr. F. C. Lincoln from 1922 to 1926. He has kindly put at my disposal data obtained from the banding done in these years. No records of recoveries made later than 1930 are available.

In the following list of recoveries, arranged in chronological order according to age, the total number considered (excluding twenty juveniles less than two months old found at the banding stations) is 89, of which 67 are first-year birds, 11 are second-year, 3 are third-year, 4 are fourth-year, 3 are fifth-year, and 1 is a sixth-year bird. The locations of the first-year recoveries are shown on the map (Figure 9, page 74).

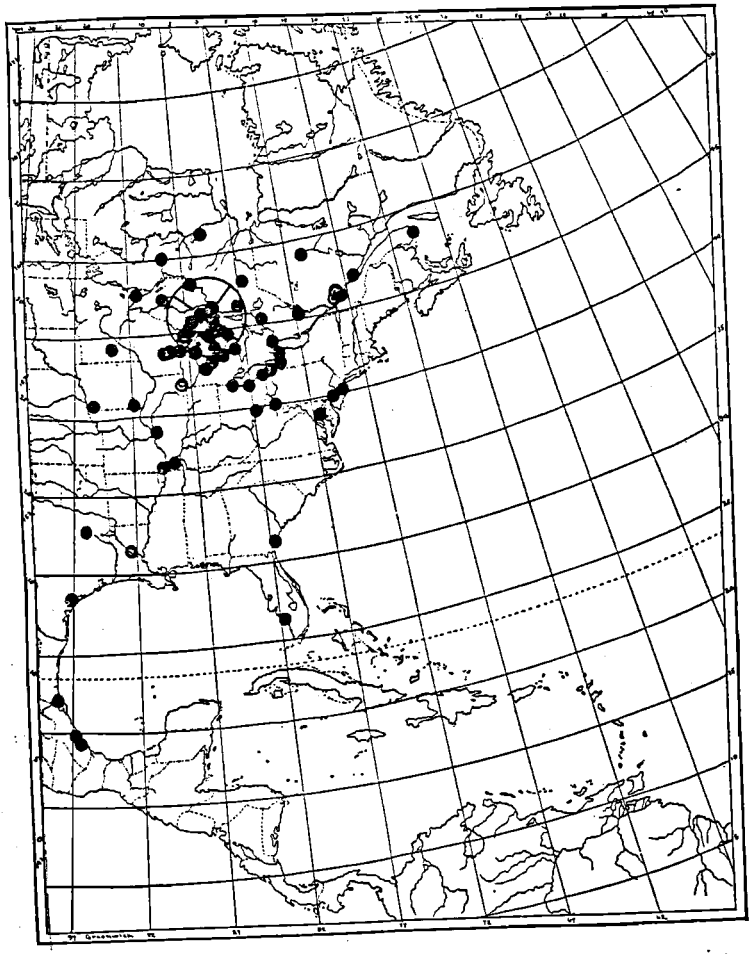


Figure 9. Map showing the distribution of first-year recoveries from colonies of the Beaver Islands Group near St. James, Michigan.

HERRING GULLS BANDED AT ST. JAMES, MICHIGAN, ON ISLANDS OF THE BEAVER GROUP, BY F. C. LINCOLN UNLESS OTHERWISE INDICATED

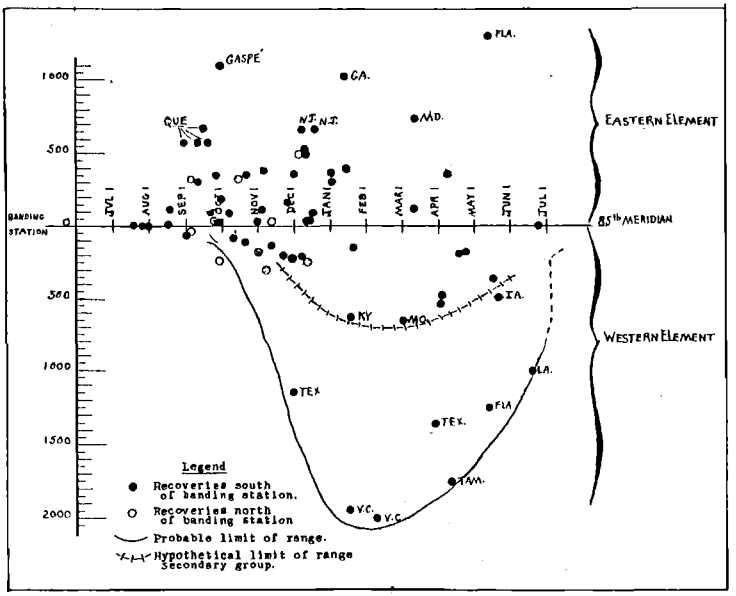
Date of Banding	*Band No. of Recovery*	*Place of Recovery*	*Date of Recovery*	*Reference*	*Age of Gull Recovered*	*Air-Line Distance from Banding Station*
7/ 8/25	386154	Alpena, Mich.	8/18/25	C	1st year	110-ESE
7/ 3/25	378049	Montreal, Que.	8/30/25	K	" "	575-E
7/22/23	236859	Northport, Mich.	9/ 1/23	C	" "	35-S
7/ 8/25	386240	Detroit Harbor, Wis.	9/ 1/25	C	" "	70-WSW
7/20/24	321138	Manistique, Mich.	9/ 4/24	FD	" "	40-WNW
7/ 2/25	385656	Tashota, Cochrane, Ont.	9/ 4/25	K	" "	300-NE
7/22/23	231393	Montreal, Que.	9/ 9/23	K	" "	575-E
7/22/23	236807	Toronto, Ont.	9/10/23	FD	" "	300-ESE
7/20/24	321148	Montmorency Vill., Que.	9/15/24	FD	" "	675-E
7/ 8/25	386086	Montreal, Que.	9/20/25	C	" "	575-E
7/22/23	236853	St. Ignace, Mich.	9/25/23	F	" "	40-ENE
6/27/25	385537	Ashtabula, Ohio	9/26/25	F	" "	350-SE
7/22/23	236861	Petoskey, Mich.	9/27/23	C	" "	35-ESE
7/25/23	237062	Port Austin, Mich.	9/27/23	FD	" "	170-ESE
7/18/24	321027	Northern shore of Lake Superior	9/29/24	FD	" "	250-NW?
7/ 7/25	378078	Rivière au Renard, Gaspé Co., Que.	Fall/25	C	" "	1100-ENE
7/24/23	236927	Houghton Lake, Mich.	10/ 7/23	K	" "	95-SE
6/27/25	385520	Washington Is., Wis.	10/11/25	FD?	" "	70-WSW
7/ 3/25	385697	Copper Cliff, Ont.	10/14/25	F	" "	325-ENE
7/25/23	237078	Manistee, Mich.	10/20/23	F	" "	105-SSW
6/27/25	385595	Mouth of Pickerel River, Georgian Bay, Ont.	10/21/25	FD	" "	350-E
7/25/23	237170	Carp Lake, one mile from Trant Lake, Mich.	10/31/23	FD	" "	40-E
7/25/23	237150	Calumet, Mich.	11/ 1/23	I	" "	180-WNW
7/24/23	236925	Alpena, Mich.	11/ 3/23	K	" "	110-ESE
7/ 3/25	385766	Renfrew Co., Ont.	11/ 4/25	FD	" "	390-E
7/25/23	236993	Gull Bay, Outpost, Lake Nipigon, Ont.	11/ 7/23	C	" "	300-NNW
7/22/23	231343	40 miles west of St. Ignace, Mich.	11/11/23	FD	" "	35-NNE
7/ 8/25	386249	Ludington, Mich.	11/11/25	FD	" "	130-SSW
7/ 3/25	385869	Lake Big Butte des Morts, Wis.	11/23/25	FD	" "	200-WSW
7/22/23	236834	Mouth Saginaw River, Mich.	11/25/23	I	" "	160-SE
7/16/22	202237**	Ennis, Texas	11/30/22	C	" "	1150-SW
7/ 3/25	385789	Sandusky Harbor, Ohio	12/ 1/25	FD	" "	360-SSE
7/ 3/25	385834	Parent, Champlain Co., Que.	12/ 4/25	K	" "	490-ENE
7/20/24	321211	Riverton, N. J.	12/ 6/24	FD	" "	660-SE
7/25/23	237013	Kenosha, Wis.	12/ 7/23	C	" "	250-SW
7/18/24	321025	Springbay, Ill.	12/ 7/24	K	" "	200-S?
7/ 3/25	385661	Jerusalem, Ohio	12/ 9/25	C	" "	500-SE
7/ 8/25	386159	Holbrook, Pa.	12/ 9/25	C	" "	525-SE
7/25/23	237047	Hovland, Minn.	12/10/23	F	" "	250-NW
7/18/24	321041	Clarlevoix, Mich.	12/10/24	K	" "	30-SE
7/22/23	23682–	East Jordan, Mich.	12/12/23	FD	" "	40-SE
7/ 3/25	385946	Raritan Arsenal, Metuchen, N. J.	12/18/25	FD	" "	660-SE
7/25/23	237022	Sugar Is., St. Mary's River, Mich.	12/—/23	FD	" "	90-ENE
7/ 3/25	385785	Presque Isle, Erie, Pa.	1/ 1/26	FD	" "	360-SE
6/24/25	312884*	Banks of Maumee River, Ohio	1/ 2/26	I	" "	300-SSE
7/16/22	202248**	Brunswick, Ga.	1/12/23	C	" "	1020-SSE
7/22/23	236829	Angola, N. Y.	1/12/24	FD	" "	390-ESE
7/ 3/25	385728	Vera Cruz, Mexico	1/17/26	K	" "	1950-SSW
7/16/22	202213**	Wickliffe, Ky.	1/18/23	FD	" "	630-S by W
7/ 7/25	378090	Two Rivers, Wis.	1/20/26	FD	" "	150-SW
7/ 3/25	385786	Alvarado, Vera Cruz, Mexico	2/10/26	K	" "	2000-SSW

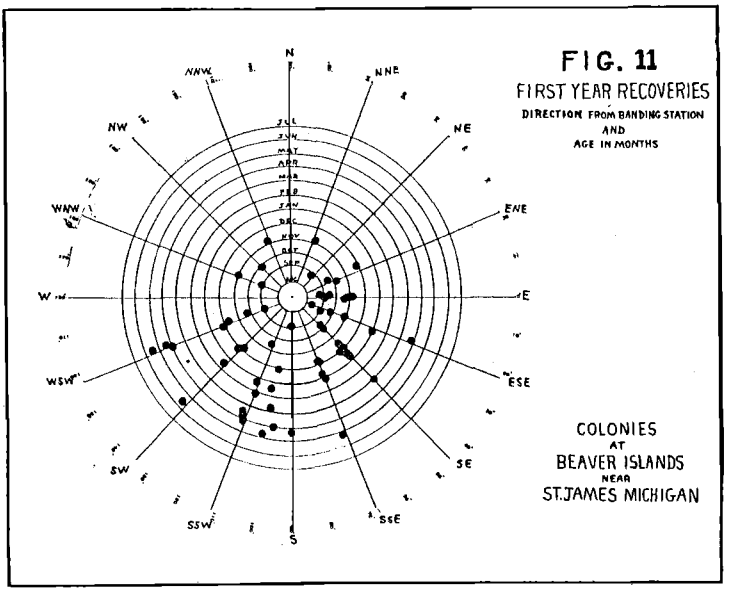
Date of Banding	*Band No. of Recovery*	*Place of Recovery*	*Date of Recovery*	*Reference*	*Age of Gull Recovered*		*Air-Line Distance from Banding Station*
7/ 8/25	386108	New Madrid, Mo.	3/ 1/26	K	"	"	660-S by W
7/ 3/25	385667	Calhoun Co., Texas	3/27/26	FD	"	"	1350-SSW
7/25/23	237035	St. Louis, Mo.; Alton, Ill.	4/ 2/24	FD	"	"	540-SSW
7/ 8/25	386047	Ottumwa, Iowa	4/ 3/26	C	"	"	480-WSW
7/ 8/25	386191	Niagara River, Youngstown, N. Y.	4/ 6/26	FD	"	"	360-ESE
7/ 8/25	386090	Hurricane Is., Ill.	4/ 9/26	FD	"	"	?-S
7/20/24	321168	Tampico, Mexico	4/10/25	C	"	"	1750-SSW
6/27/26	385506	Oshkosh, Wis.	4/19/27	FD	"	"	190-WSW
7/25/23	237151	Grand Rapids, Mich.	4/20/24	FD	"	"	190-S
7/ 8/25	386169	Muskegon Hts., Mich.	4/24/26	C	"	"	185-S by W
7/ 8/25	386199	Alto, Mich.	5/ 8/26	FD	"	"	125-SSE
6/24/25	312893*	Gasparilla Is., Fla.	5/12/26	FD	"	"	1300-SSE
7/ 3/25	378071	Waseca, Minn.	5/16/26	K	"	"	360-WSW
7/ 8/25	378095	Coin, Iowa	5/22/26	C	"	"	500-SW
7/18/24	321003	Chanderlier, La.	6/20/25	FD	"	"	1000?-SSW
7/20/24	321127	St. James, Mich.	6/26/25	FD	"	"	–
7/ 8/25	386168	Wabasha, Minn.	7/23/26	K	2d year		
7/ 7/25	378088	Outlet Macatawa Bay, Mich.	8/ 7/26	FD	"	"	
7/ 3/25	385945	Two Rivers, Wis.	8/10/26	FD	"	"	
7/ 3/25	385764	James Bay, Ont.	9/ 5/26	K	"	"	
7/18/24	321055	Nahma, Mich.	10/ 3/25	F	"	"	
6/27/25	385583	Gary, Ind.	12/24/26	K	"	"	
6/27/25	385558	Mason Co., W. Va.	12/29/26	C	"	"	
7/25/23	236950	Muskegon, Mich.	1/27/25	C	"	"	
6/27/25	385594	Honor, Mich.	2/16/27	C	"	"	
7/ 8/25	386111	Ningara on the Lake, Ont.	3/ 9/27	FD	"	"	
7/25/24	321268	Cassopolis, Mich.	3/15/26	C	"	"	
7/25/23	237119	Greenbay, Wis.	Fall/25	FD	3d year		
7/ 8/25	386031	Granville, Ill.	3/ 1/28	I	"	"	
6/27/25	385570	Muskegon, Mich.	5/25/29	FD	"	"	
7/ 8/25	386299	Alvin, Texas	12/25/28	FD?	4th year		
7/25/24	321276	St. James, Mich.	1/10/28	FD	"	"	
7/22/23	236903	Rubicon, Wis.	3/ 6/27	C	"	"	
7/22/23	–	Racine, Wis.	4/17/27	I	"	"	
7/ 3/25	378038	Naubinway, Mich.	7/17/30	C	5th year		
7/25/23	237107	Manistique, Mich.	6/12/29	C	"	"	
7/25/23	237097	Manistique, Mich.	6/19/29	C	"	"	
7/25/23	237134	Manistique, Mich.	8/18/29	C	6th year		

* Banded by W. E. Hastings.
** Banded by W. S. McCrea.

References: C—Caught; FD—Found dead; F—Found; I—Injured; K—Killed.

The movements of the first-year gulls are obviously complicated. The pattern of distribution is strikingly dissimilar to that of those other colonies previously considered concerning which there is ample data, *viz.*, Essex County, Isles of Shoals, and Saguenay County, Quebec. As would be expected, the greatest density of recoveries is in the Lake region of Michigan and Wisconsin. A substantial proportion moved eastward down the lower lakes to the St. Lawrence River as far as Quebec and beyond. One bird, 378078, was captured in the autumn somewhere in Gaspé County. A somewhat small percentage moved down the Mississippi River valley to places as far south along the Gulf Coast as Vera Cruz, Mexico. A fourth trend, perhaps, is indicated by four December-to-March recoveries from New Jersey to Georgia.





Upper Figure (No. 10). Rectilinear graph of first-year recoveries from the Beaver Group Colonies.

Lower Figure (No. 11). Polar graph of first-year recoveries from the Beaver Group showing direction from banding station according to age of the gulls.

There are several interpretations which might account for the wide dispersal throughout the eastern half of temperate and subtropical North America, the simplest being that the Beaver group colonies possess no fixed habit of migration—some individuals migrate south, others east, while still others wander indiscriminately in search of a food-supply and open water. Another possibility is that the colonies are a mixture of two or more strains possessing different migratory traits. A third suggestion is that the confusing aspect of the map is merely superficial, and may be resolved into some semblance of law and order if proper analytical methods are employed.

In order to test these several possibilities, various graphs were kindly prepared by Mr. Richard M. Hinchman whereby the changes were rung on the functions of age, distance, and direction, both in respect to all the recoveries considered as a whole and to those east and west of the eighty-fifth meridian considered separately. Although certain vague lines of demarcation were discerned, in general it must be frankly admitted that a much larger body of data is necessary before any definite conclusions may be drawn.

Lack of space precludes the publication of all but two of the various diagrams that were prepared. The following facts are derived from the rectilinear graph showing age and distance from banding station (Figure 10).

1. Many birds winter within six or seven hundred miles of the banding stations.
2. No birds were recovered north of the latitude of the banding stations after December 5th.
3. The "eastern element," *i. e.*, the birds recovered east of the eighty-fifth meridian, showed a normal distance-age curve with a maximum amplitude of seven hundred miles in midwinter. The recovery in Georgia (January) and that in Florida (May) lay outside the normal limit of range. If we assume that these two birds migrated down the Mississippi and thence eastward along the coast, then they may properly be assigned to the western element. If so, they fall within the normal limit of range for that element.
4. The "western element" appears to be split into two divisions, one of which may show a midwinter limit of range in the central Mississippi Valley region, and the other a normal Gulf Coast midwinter distribution from Texas to southern Mexico. This division may prove to be purely fictitious.

Another graph, plotted with polar coördinates, shows the relation between age and direction from banding station. This is repreduced in Figure 11. It clearly demonstrates the fact that no recoveries occurred north of the banding station after December 1 or thereabouts. It also shows the tendency, previously noted, of the eastern element to remain nearer home during midwinter than is the case with the western element.

The eleven second-year recoveries are well distributed from July to March. With the exception of 385558 in West Virginia, these birds were found in the Lake region not far distant from their breeding-grounds. It is probable that the second-year birds from the Beaver Islands colonies normally winter northward without exhibiting any noticeable migratory tendency.

The third-year and adult recoveries show a similar distribution. The gulls from these colonies show a marked homing instinct. It is particularly interesting to notice that a fourth-year bird, 386299, was found at Alvin, Texas, late in December. This is the first instance of an adult bird lingering on the Gulf Coast, in so far as this paper is concerned, and the second instance of the occurrence there of a bird older than the first winter.

In concluding these somewhat unsatisfactory observations concerning the Beaver group colonies, the writer is inclined to believe that a satisfactory analysis requires more detailed and accurate knowledge of the precise islands from which the recoveries originated. It is not impossible that a further unscrambling of the data, at present impossible, will show that the Texas and Mexican recoveries are characteristic of a single colony in the group; likewise that the eastern element is also a distinct colonial entity. In this connection, it is only fair to add that casual studies of other colonies (not to be included in this paper) appear to make this latter view somewhat improbable. It seems to be characteristic of the Herring Gulls of the upper lakes to "scatter all over the map" during the first year. The majority behave as if they were landlocked in the Lake region wherever open water and food may be found. A lesser number cross the divides between the major watersheds and follow the large river-valleys to the ocean, some to the Atlantic and others to the Gulf.

CONCLUSION

This very cursory and necessarily incomplete study of the migratory traits of certain colonies of Herring Gulls in eastern

North America appears to justify the tentative hypothesis that there are at least three major breeding populations of this species within this region, each of which is characterized by well-marked migratory idiosyncrasies. It must not be inferred that the number is restricted to three. Banding work among extralimital colonies in Labrador and elsewhere[1] may well show that a high-Canadian or subarctic population exists.

The three populations conveniently may be designated as:

1. *Atlantic:* Characterized by a breeding-range from Massachusetts (Long Island?) to New Brunswick along the coast and by a very marked habit of migration on the part of the first-year birds to the Gulf Coast during the first winter. There is some evidence that a northern element of this population migrates to an area centering on the eastern coasts of the south Atlantic states. There is strong evidence that certain individual colonies possess unique centers of first-winter distribution.

2. *Laurentian:* Characterized by a breeding-distribution along the St. Lawrence River (lower Lake region?) to the Gulf of St. Lawrence (Labrador?). This population apparently possesses no habit of true migration to a southern wintering-ground during the first winter. The movements of immature and adult birds are indistinguishable, are highly localized, and are restricted to the general region of the breeding-range and the Maritime Provinces.

3. *Lacustrine:* Characterized by a breeding-range centering on the upper Great Lakes and by a habit of wide dispersal during the first winter throughout eastern North America from southern James Bay southward to the Gulf Coast of Texas and Mexico. The largest fraction of the first-year birds appears to winter wherever open water may be found in the southern Great Lakes drainage system. A lesser fraction shows a distinct habit of migration down the Mississippi to the Gulf Coast or up the larger tributaries to favorable places in the interior. A still smaller fraction wanders eastward to winter along the Atlantic seaboard from New York to Florida.

These three populations may overlap somewhat, particularly in the Great Lakes region. However, it is very possible that future study, based on more complete data, will necessitate a revision of the foregoing conclusions. In detail the picture is

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[1] Contrary to the general impression, it is reported that Herring Gulls breed as far north as Baffin Island. See J. Dewey Soper: *A Faunal Investigation of Southern Baffin Island. Bull. Can. Dept. Mines*, Biol. Series 53, 1928.

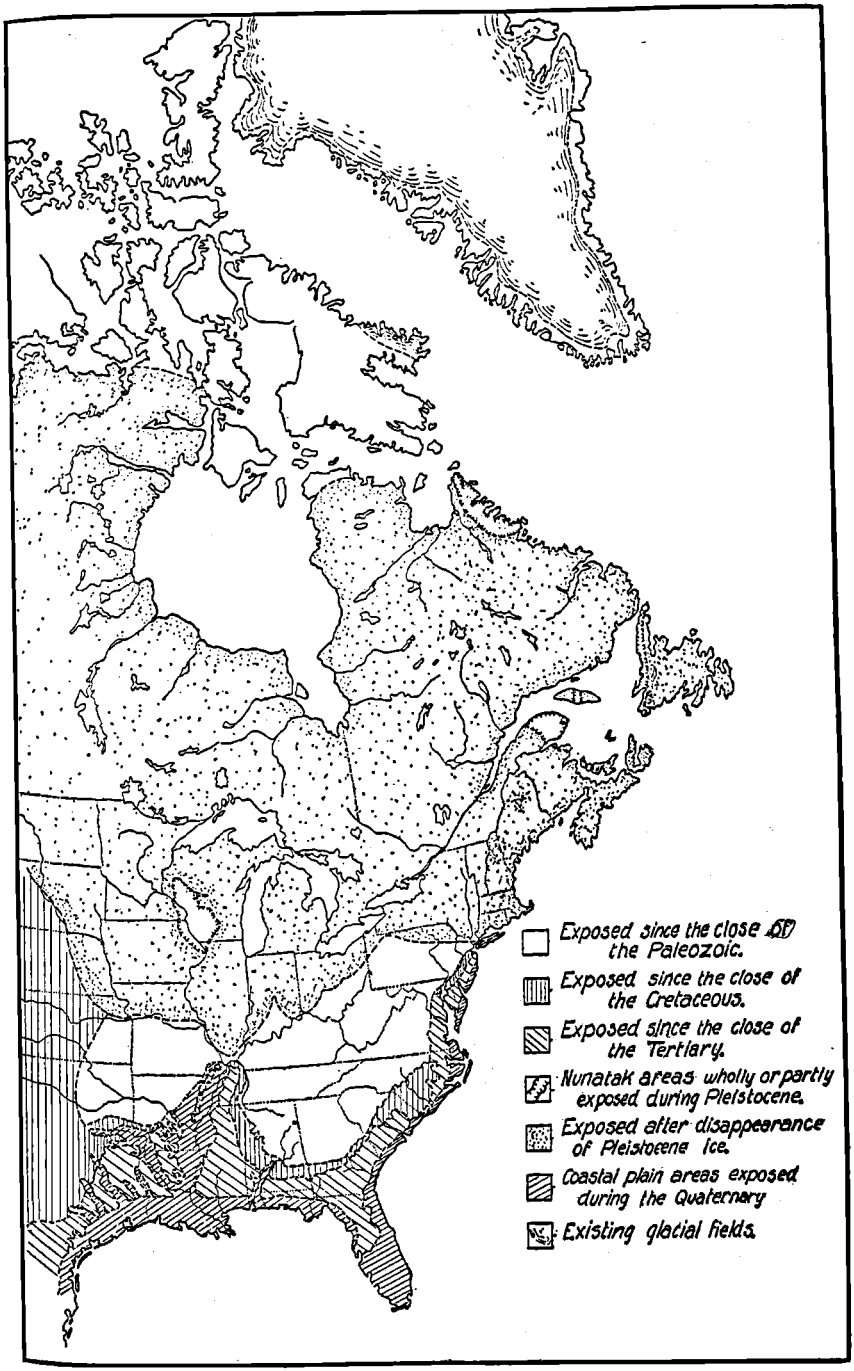

Figure 12. Periods of availability for plant-occupation of Eastern North America since the Paleozoic. (Reproduced by permission of Professor M. L. Fernald.)

hazy and doubtless inaccurate; in broad outline, suggestive of the probable truth.

It is difficult to resist the temptation to "explain" the alleged existence of these three Herring Gull populations. Any thoughtful student of biogeography necessarily must be impressed with the profound influence of the Pleistocene glaciations on the present distribution of the fauna and flora of temperate North America. That our avifauna was driven southward by the successive advances of the ice is evident. The last great invasion, known as the Wisconsin phase, is variously estimated to have reached its climax 25,000 to 40,000 years ago. It was preceded by a warm interglacial epoch believed to have lasted at least 150,000 years. The regions currently supposed to have been submerged by the Wisconsin ice-sheet are shown on Figure 12, page 81. The southern limit of the advance frequently is marked on the ground by well-defined terminal moraines. If we accept the conservative view of the older geologists that the Wisconsin ice overrode Labrador, the Maritime Provinces, and the highest mountains of New England and New York, as well as the entire basin of the Great Lakes, it is obvious that all bird-life now occupying the glaciated areas were driven far south of their present breeding-grounds.

On this view, the most northerly conceivable limit of breeding-range for the Herring Gull, for instance, would have been south of the general line Long Island-southern Ohio-southern Wisconsin. Since the Herring Gull is not an Arctic species, we should expect that the only suitable breeding-grounds during the climax stage of the Wisconsin would be found several hundred miles south of the permanent ice-front and possibly as far south as coasts of the south Atlantic and Gulf States. If so, it is entirely reasonable to suppose that the species, perhaps fundamentally non-migratory, acquired a temporary habit of frequenting the warm waters of the Gulf, and that the pronounced tendency of immature birds to spend their first winter there is a vestigial trait lost in adult birds. As the ice retreated, the gulls gradually recaptured more and more of the old territory, and finally returned to breed in the highly favorable lacustrine, estuarine, and coastal areas of the northern United States and Canada. It might be suggested that the peculiar mixture of migratory traits of gulls of the Green Bay and Beaver Island colonies, for instance, tends to strengthen the idea that they are rapidly losing their temporary urge to go south for the winter. Possibly, the ice

retreated from the Great Lakes region much earlier than from New York and New England, thus allowing the gulls to repossess their favored breeding-grounds much earlier and to progress faster than their eastern representatives in the matter of forgetting the lures of the sunny South.

However this may be, the hypothesis is plausible provided we ignore the Laurentian population, which, it will be recalled, possesses no apparent urge to migrate to the south whatsoever. In fact, the Saguenay County colony scatters east and northeastward. If the last advance of the ice was as devastating as we were led to believe, the entire lower St. Lawrence region, including the Maritime Provinces, must have been submerged to the depth of thousands of feet. Thus as the ice-front rotted and gradually retreated northward, the New England coast-line would necessarily become available for repopulation before the Laurentian area. Hence, we should naturally expect that the more northward colonies would be mere extensions or overflows from those in the south and necessarily would possess the same migratory characteristics.

This anomaly would be very puzzling were it not for the interesting fact that the foregoing picture of the Wisconsin ice-sheet is probably erroneous. It is becoming increasingly evident that the Wisconsin ice-sheet was far less devastating in the Maritime Provinces than was originally supposed. The extensive botanical researches by Professor M. L. Fernald and his associates during the past twenty years in Nova Scotia, Newfoundland, Gaspé, and Anticosti have proved the existence of an important relic flora in areas showing no evidence of recent glaciation. Coleman independently examined many of the regions explored by Fernald and has accepted the view on geological grounds that important areas in the region of the Gulf of St. Lawrence escaped Wisconsin denudation.[1] Such convincing evidence, both botanical and geological, has accumulated that the writer accepts these views without reservation.

Thus, instead of a lifeless and continuous ice-sheet in the northeast, in all probability the lower Gulf of St. Lawrence was open water and large areas of the neighboring land-masses were bare in the summer months. Granting such to be the case, there is no reason to suppose that the Herring Gull

[1] For a full discussion of these questions and for illuminating bibliographical references see Fernald, "Persistence of Plants in Unglaciated Areas of Boreal America, *Mem. Amer. Acad.* XV No. III, (*Mem. Gray Herb.* II) 295–317 (1925). Also see Fernald, "Specific Segregations, etc.," *Rhodora* 33:27, 37 (1931) (*Contr. Gray Herb. X*, CIII).

necessarily was driven south by the invasion of the Wisconsin ice. It is not at all impossible that this species continued to breed in the region throughout the climax phase of the last advance of the Pleistocene ice. Such colonies, if they existed, more likely would scatter northeastward during the winter months to the coast of the Maritime Provinces, where in all probability winter conditions were not much more severe then than now, rather than attempt to traverse the long foodless expanse of ice-front from New Brunswick to New Jersey. In any event it is difficult to believe that the summer climate of the Gulf of St. Lawrence during the Wisconsin was any less favorable to Herring Gulls than the present climate of Baffin Island, where, according to Soper, this species now breeds. It must be remembered that even the most southerly tip of Baffin Island is within four hundred miles of the permanent ice-floes of Davis Strait and within five hundred miles of the permanent Greenland ice cap. In fact, extensive permanent ice-fields occur on the eastern side of Baffin Island itself. Thus, mere proximity to glacial conditions is not abhorrent to present-day representatives of *Larus argentatus smithsonianus*. Incidentally, it may be of some significance to note that Baffin Island for the most part is considered by many competent authorities to have escaped Wisconsin glaciation.

In brief, the not unreasonable guess is hazarded that the Laurentian population of Herring Gulls may be descendants of birds that were never driven away from their breeding-territory by the Wisconsin glaciation, and acquired a degree of hardihood not demanded of the southern populations. In this connection, a study of the migratory habits of the Baffin Island Herring Gulls would be particularly interesting.

Furthermore, a critical comparison between two series of skins of breeding adults, if collected in the nesting-season at the Saguenay County and the Essex County rookeries, for instance, might show some slight differentiation between the two populations. Such evidence would go far toward substantiating the suspicions herein advanced.

As a further speculation, we may conceive of a gradual repossession of old breeding-grounds *southwest* up the St. Lawrence River. If such a recapture of territory occurred, the Laurentian overflow sooner or later must have met the outposts of the reviving Lacustrine population. Perhaps the meeting of these two hypothetical strains accounts for the peculiar mixture of migratory traits which is so perplexing in such colonies as the Beaver group near St. James, Michigan The suggestion contains a touch of plausibility.

THE END