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No. 1

MIGRATION OF CASPIAN TERNS BANDED IN THE GREAT LAKES AREA

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THE Great Lakes have long supported colonies of Caspian Terns. These have been more or less systematically banded since 1924. The largest colony nests on Shoe Island which lies in the northern part of Lake Michigan at the north of Beaver Island. Gravelly Island, Wisconsin, and Gravelly Island, Michigan, near the Wisconsin-Michigan state line have also borne moderate size colonies. There have been small colonies in Georgian Bay off the Ontario shore. Systematic banding was done by the late William I. Lyon in the Lake Michigan colonies from 1924 through 1937. Banding by our banding station was begun on Shoe Island in 1934 and has continued progressively through 1940.

The Caspian Tern is found generally throughout the Great Lakes region during the summer months. The breeding adult birds are found near the nesting colonies from May until August. Non-breeding adults and young birds that have not attained adulthood are found, generally, alone or in pairs over the entire Great Lakes area. In 1929 and 1930 the nearest nesting colony of Caspian Terns to Saginaw Bay was Shoe Island in Lake Michigan. During those two years twelve Caspian Terns were taken as specimens, and all and all of these were non-breeding birds. These specimens were taken at a large Common Tern colony during banding operations in Saginaw Bay.

The nesting areas of the Caspian Terns are widely separated, and are some distances from the mainland. Banding operations are made much more difficult because of the great distances we have to travel to get to the colonies. Consequently, our banding is done on one trip to the island or, at the most, two trips. We then have to plan to be at the island when the maximum number of young are hatched and available for banding. We have found that the first three or four days of July usually offer the best banding dates for the Caspian Terns. However, some years, when there is a late season, these birds fail to hatch before the middle of July.

When going into a Caspian Tern colony we often see an awesome sight. All the adult Caspian Terns fly close to the ground and circle directly overhead. Occasionally two or three of the adult birds will attempt to drive you off the island by flying down in a swoop

towards your head. Their bright contrasting plumage and the reddish-orange bill extended towards your head makes you duck repeatedly. The young Caspians hide amongst the stones, and often times swim away from the island as we go about our banding. The adult birds keep the young birds from getting too far away from the island. Later, after we have left the colony, the adult birds drive the young back to shore.

Occasionally there are a few Herring Gulls nesting on Shoe Island which bears the largest colony of Caspian Terns. If the young Herring Gulls get into the Caspian Tern colony the adult Caspians will immediately kill the young birds by scalping them. In a like manner the young Caspians, if they get out of bounds, may be similarly treated by the adult Herring Gulls. Scalping of the young birds is practiced by these species to a larger degree when large numbers nest close together. In 1929 Shoe Island was under water and the Caspians moved to Hat Island about one-half mile to the north. The large colony of Herring Gulls on Hat Island had many a fight with the adult Caspians, and mortality among the young of both species was very high. However, as a general rule, the birds stay segregated in their respective colonies.

Table No. I shows the banding records of those birds banded by William I. Lyon. In 1924 and 1925 there are no available banding records to show the number of birds banded. After 1926 complete banding records were kept by the Bureau of Biological Survey, and those records were supplied by them. During Mr. Lyon's banding experience some 4,068 Caspians were banded as immature birds. From this number banded there have been 67 returns to date. This equals 1.64 per cent returned from the number of birds banded.

TABLE NO. I
CASPIAN TERNS BANDED BY WILLIAM I. LYON

<i>Year</i>	<i>Number Banded</i>	<i>Number Returns</i>	<i>Per Cent Returned</i>
1924.....	...	7	...
1925.....	...	5	...
1926.....	239	7	2.93
1927.....	599	11	1.76
1928.....	146	3	2.03
1929.....	324	5	1.54
1930.....	231	6	2.59
1931.....	509	9	1.76
1932.....	460	7	1.51
1933.....	323	4	1.24
1934.....	346	2	0.57
1935.....	365	1	0.27
1936.....	425	0	0.00
1937.....	117	0	0.00
14 Years.....	4,068	67	1.64

Table No. II shows the banding data on the Caspian Terns that we have banded on Shoe Island in the past seven years. The total number banded is 3,957, from which we have received 43 returns. This is an average of approximately 1.18 per cent.

TABLE NO. II

CASPIAN TERNS BANDED BY F. E. and C. C. LUDWIG

<i>Year</i>	<i>Number Banded</i>	<i>Number Returns</i>	<i>Per Cent Returned</i>
1934.....	592	6	1.00
1935.....	648	8	1.25
1936.....	782	11	1.41
1937.....	654	16	2.44
1938.....	537	1	0.18
1939.....	347	1	0.28
1940.....	397	0	0.00
7 Years.....	3,957	43	1.18

Combining the two sets of records we find that there have been 8,025 young Caspian Terns banded by Mr. Lyon and the Ludwig Banding Station. There have been 110 returns, with a gross percentage of 1.41 per cent returned up to date. There will undoubtedly be additional returns from these banding records.

The relation of returns to the year banded and subsequently figured to show the length of life is perhaps one of the most interesting studies of the bird banding work. The records from the Caspian Terns bear out the findings with the other birds in relation to mortality figures. The largest mortality occurs in the first year of life. In fact, the largest mortality appears in the first six months of life, followed closely by the mortality in the first calendar year after banding. Natural selection plays a big part in the life of these birds, and if they survive for two and one-half years they are apt to have a fairly long life. Table No. III gives the distribution of these returns in relation to their length of life. The oldest record in this series is a twelve-year bird which was banded by Mr. Lyon in 1927, and recovered in 1939 in England. (From the *Auk*, October, 1940.) This is thought to be the only authentic record of the American form of the Caspian Tern to have been recovered in Europe. A twelve-year record is a good record but the Caspians have been known to live up to twenty years. Additional records later in this series may help to set other longevity records as new returns come in to the Biological Survey.

TABLE NO. III

<i>When Returned</i>	<i>Number Returned Lyon</i>	<i>Number Returned Ludwig</i>	<i>Totals</i>
Year Banded.....	24	20	44
First Calendar Year After Banding.....	21	10	31
Second " " " "	9	9	18
Third " " " "	2	2	4
Fourth " " " "	2	0	2
Fifth " " " "	3	1	4
Sixth " " " "	2	1	3
Seventh " " " "	1	0	1
Eighth " " " "	2	0	2
Twelfth " " " "	1	0	1
Totals.....	67	43	110

Beginning with the third year after banding the returns are fairly well distributed over the next six-year period. The majority of these returns are from the states bordering upon the Great Lakes; and these adult birds were undoubtedly going away from or coming to the nesting areas.

The accompanying map shows the general distribution of all returns recovered to date. The open circled spots are those returns on birds banded by Mr. Lyon. The closed circles are those banded by the Ludwig Banding Station. The most interesting return cannot be shown on this map which is the previously mentioned return in England. Other returns which are very interesting are the four from Colombia, South America, all of which were banded by the Ludwig Station. All of these Colombia returns came from the same area, Barranquilla. One of our birds was also found dead in Cuba at Nipe Bay. Mr. Lyon had another bird recovered from Haiti. This bird was recovered November 5, 1939 at Port-Au-Prince, and is the first record of this species for Haiti.

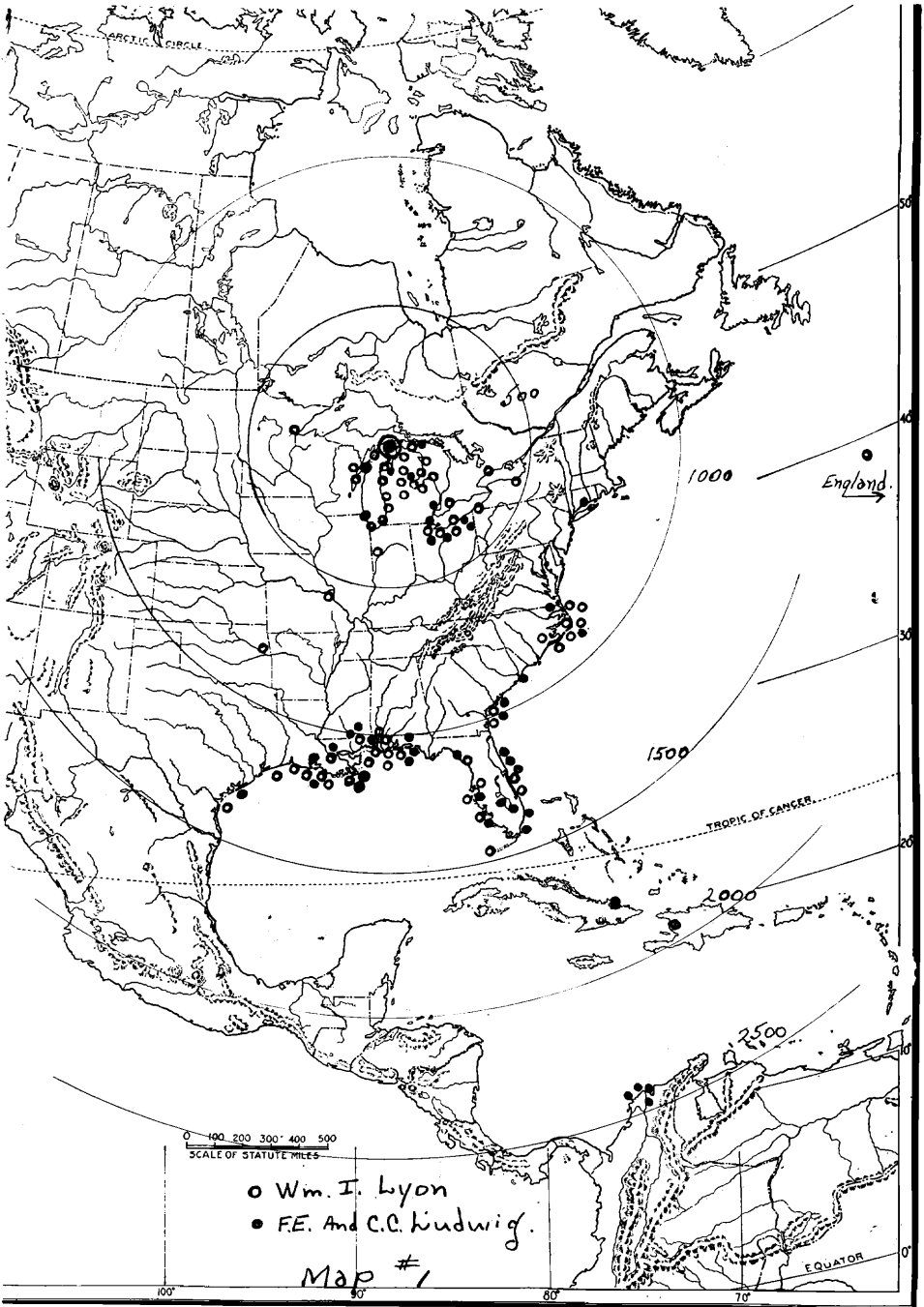
There are twenty-four states or countries represented by these return records. Most of the returns come from the southern states, and those states bordering upon large bodies of water near the nesting areas. Table No. IV is a detailed breakdown by states and countries of these return records. Only 38 of the 110 returns are from the Great Lakes Area. Of this number 26 were returned in the first six months following banding. The other twelve return records were from one year birds or adults which have returned to nest later on.

TABLE NO. IV

<i>State or Country</i>	<i>Number Returned Lyon</i>	<i>Number Returned Ludwig</i>	<i>Totals</i>
Alabama.....	5	3	8
Connecticut.....	..	1	1
Florida.....	8	10	18
Georgia.....	2	2	4
Illinois.....	3	..	3
Indiana.....	1	..	1
Louisiana.....	9	4	13
Michigan.....	14	6	20
Minnesota.....	1	..	1
Mississippi.....	1	3	4
Missouri.....	1	..	1
New York.....	1	..	1
North Carolina.....	7	2	9
Ohio.....	4	4	8
Oklahoma.....	1	..	1
Pennsylvania.....	1	..	1
South Carolina.....	..	1	1
Texas.....	1	1	2
Wisconsin.....	3	1	4
Colombia, South America.....	..	4	4
Cuba.....	..	1	1
Ontario.....	2	..	2
Haiti.....	1	..	1
England.....	1	..	1
24 States or Countries.....	67	43	110

The map shows very well the general winter range of the Caspian Tern. From Texas to North Carolina there are many records of these birds. There are three records in April, one in May, two in June, two in July, and two in August of one or two year birds which have been returned from North Carolina to Colombia during the summer months. However, the majority of the southern returns occur from September to March.

The summary of the distance in miles of these returns recorded by years gives us some idea as to [the period in the Caspian Tern's life when he travels the most. Table No. V gives those figures showing the average number of miles for each return recovered in any one year. In the first six months many of the young terns are killed near the nesting area. During the first year after banding, and the second year after banding each bird traveled more on an average than in the other years. The third, fourth, sixth and eighth years after banding the average distance away from the nesting areas is somewhat smaller. Many of the returns during those years came from close by the nesting areas. The fifth, seventh and twelfth year birds average farther away due to the far flights of one or two birds. From this, the general conclusion is that the third year after banding the Caspians return to the nesting areas and can be considered



adult birds from then on. The first calendar year after banding and the second calendar year after banding can be considered the travel period and the non-nesting period in this bird's life. It is entirely possible that some of the older birds fail to nest and become wanderers such as the seventh and twelfth year records in this series.

TABLE NO. V

Year	DISTANCES OF FLIGHT	
	Number Returns	Average Distance in Miles
Year Banded.....	44	581
First Calendar Year After Banding.....	31	1,033
Second " " " ".....	18	1,277
Third " " " ".....	4	825
Fourth " " " ".....	2	575
Fifth " " " ".....	4	1,050
Sixth " " " ".....	3	233
Seventh " " " ".....	1	1,900 (Haiti)
Eighth " " " ".....	2	625
Twelfth " " " ".....	1	3,500 (England)

The distribution of the returns by months gives an excellent picture of the activity of the Caspian Tern throughout the year. July is the usual month when the birds are nesting. In August many of those birds die near to the nesting colony. In August the average mileage away from the banding area is 265 miles. The fall months through February show a gradual increase to 1,414 miles average away from the banding area. March, April, May and June the birds begin to filter back northward, and the average distances are less than those for the winter months. April shows an average somewhat higher than the other spring months because one of the return records in this month was from Colombia, a total of 2,500 miles away from the banding area.

TABLE NO. VI

DISTRIBUTION OF RETURNS BY MONTHS

Month	Number Average Mileage	
	Returns	from Banding Area
July.....	6	475
August.....	13	265
September.....	17	444
October.....	9	844
November.....	14	1,040
December.....	10	1,305
January.....	15	1,303
February.....	7	1,414
March.....	4	900
April.....	4	1,200
May.....	5	460
June.....	5	600
	109 Returns	

There are a number of interesting banding records which bear repeating in this series. Those records are listed in Table No. VII. These are chosen to show, mainly, the rate of dispersion of some of these birds from one section of the country to another. Also, these records show in detail the most interesting and distant records of the Caspian Terns in this series.

TABLE NO. VII

<i>Band No.</i>	<i>Date Banded</i>	<i>Bander</i>	<i>Date Returned</i>	<i>Place Returned</i>	<i>D.istance (Miles)</i>
....	July 9, 1932	Lyon	Nov. 5, 1939	Port-Au-Prince, Haiti	2,100
....	July 15, 1927	Lyon	1939	York County, England	3,500
34-525080	July 7, 1934	Ludwig	Jan. 10, 1939	Barranquilla, Colombia	2,500
34-415908	July 2, 1935	Ludwig	April 1, 1936	Barranquilla, Colombia	2,500
34-415946	July 2, 1935	Ludwig	Dec. 15, 1935	Barranquilla, Colombia	2,500
37-638609	July 3, 1937	Ludwig	Feb. 26, 1939	Barranquilla, Colombia	2,500
34-514749	July 2, 1935	Ludwig	Nov. 5, 1935	Nipe Bay, Cuba	1,600
A-564484	July 2, 1933	Lyon	Oct. 21, 1933	Manteo, N. C.	850
565411	July 8, 1927	Lyon	May 19, 1932	Port Clinton, Ohio	400
565656	July 8, 1927	Lyon	Nov. 1, 1927	Bayou La Batre, Ala.	1,100
706243	July 6, 1928	Lyon	Sept. 18, 1929	Tybee, Ga.	1,000
34-529934	June 25, 1934	Lyon	Sept. 2, 1934	Oak Harbor, Ohio	450
565957	July 14, 1927	Lyon	Aug. 7, 1935	Petosky, Mich.	50
B-608973	July 18, 1931	Lyon	Sept. 1, 1931	Wilmington, N. C.	1,000
34-415390	July 2, 1935	Ludwig	Sept. 14, 1935	Marion, Ala.	1,100
34-525411	July 7, 1934	Ludwig	Oct. 20, 1934	Beaufort, N. C.	1,000
37-638118	July 3, 1937	Ludwig	Oct. 19, 1937	Cape Hatteras, N. C.	875
36-654072	July 1, 1936	Ludwig	Sept. 12, 1936	Cleveland, Ohio	400

The dispersion of the Caspian Tern is rapid during the first few months of the bird's life. Notable among the records is the bird banded on July 2, 1935 and recovered in Colombia, South America in December 15, 1935, a distance of 2,500 miles in five months and thirteen days. Another bird from that same flock was killed in Cuba on November 5, 1935, a total of four months and three days after banding. Another bird from the July 2, 1935 banding was killed September 14, 1935 at Marian, Alabama, a distance of 1,100 miles. A fourth record banded on July 2, 1935 was recovered in Colombia on April 1, 1936. We have these four records to illustrate an unusual circumstance in relation to the Terns. All other years the banding records are more leisurely scattered throughout the country. In 1935 this particular flock of birds flew great distances in a short time, and were recovered in steps from Alabama to Cuba to Colombia. To date this is the only year amongst our records showing this pattern. However, in some unpublished work with the Common Tern I have found the same factor exhibited in two widely separated colonies. Birds from the 1931 Common Tern banding traveled rapidly to Peru, a distance of 3,600 miles in ten months. Why certain flocks of Caspian Terns and the Common Terns travel farther and faster I cannot say. The 1935 banding of Common Terns did not fly as far as the 1931; and did not follow the 1935 flock of Caspian Terns. This problem will be followed in detail in the following years to see if there is any correlation between these two species and the distances which they travel.

SUMMARY

1. Caspian Terns nest on three islands in Lake Michigan and two or three islands in Georgian Bay.
2. Nesting is done in compact colonies, and is seldom done in association with other species, such as the Herring Gull.
3. Banding and return records of the late Mr. William Lyon with those of the Ludwig Banding Station have been reviewed in detail.
4. 8,025 young Caspian Terns have been banded with 110 returns recovered.
5. The largest mortality appears in the first six months of life.
6. 24 states or countries are represented in this series of returns.
7. The winter range of the Caspian Tern extends from the southern United States to the West Indies, Central and South America.
8. The Caspian Tern travels more during the first three years of life.
9. The Caspian Terns probably do not nest until the third year of life.

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MEASUREMENTS OF TARSAL CIRCUMFERENCES
FROM LIVING RAPTORIAL BIRDS

BY ROBERT M. STABLER AND NELSON D. HOY

INTRODUCTION

IN a recent note, Pough (1939) gave a series of measurements made on museum skins of the circumferences of the tarsi of a group of hawks, kites, eagles and vultures. Also listed were suggested band sizes for these birds. Completely lacking were measurements from living birds, for, as Pough pointed out, such data have not been extensively collected.

Inspired by this note and its plea for the accumulation of such measurements, the writers began the collection of data on all available living or freshly killed raptores. It was felt that information on 245 individuals, representing 28 species, was significant enough for publication.

The Pennsylvania Game Commission permit held by one of us (R. M. S.), allowing the handling of the protected species, is gratefully acknowledged.

MATERIAL

We were careful to measure no birds prior to the minimum banding age (about three weeks). The measurements were taken as follows: a light cotton thread was knotted snugly around the tarsus midway between the foot and the tibio-tarsal joint. The thread was