NEW FORMS OF NORTH AMERICAN *CHORDILES*.

BY ELLIOTT COUES.

EXAMINATION of material in the American Museum of Natural History, in company with Mr. Allen and Mr. Sennett, shows that there are four subspecies of *Chordiles popetue* in the United States. The mistake has hitherto been that we have called all the light Western forms *C. henryi*, and have ignored the distinction of the Florida bird. The four forms are:

1. **Popetue**, large, glossy black predominating on the upper parts, and underparts fully barred with blackish and white in about equal amounts, the rufous tints being slight on any part of the plumage. *Hab.* Eastern North American Province of Baird, the breeding range exclusive of the Gulf States.

2. **Sennetti**, large, silvery grayish-white predominating above, the white below greatly in excess of the narrow, irregular or broken, dark bars, and little or no rufous anywhere. *Hab.* Dakota to Texas, in any treeless country. Types 65,490, Mus. Smiths. Inst., formerly 3301, Mus. E. C., 50 miles west of Pembina, Minn., July 16, 1873, and 4927, Coll. George B. Sennett, Wharton Co., Texas, May 27, 1887.

3. **Henryi**, large, rufous tints everywhere prevailing, dark lines on underparts about equal in amount to the tawny white interspaces. *Hab.* Western North America; geographical distribution not yet fully worked out.

4. **Chapmani** (Sennett's MS.), small, wing half an inch less than in *popetue*, with which the coloration agrees. Hab., Florida to Texas. Type No. 847, Coll. Frank M. Chapman, to which accomplished young ornithologist the new form is dedicated by Mr. Sennett, taken May 19, 1887 at Gainesville, Florida.

OBSERVATIONS ON THE NOCTURNAL MIGRATION OF BIRDS.

BY FRANK M. CHAPMAN.

MR. W. E. D. SCOTT's papers on this subject (Bulletin Nuttall Ornithological Club, Vol. VI, pp. 97, 188) have not to my knowledge been followed by any of a similar character, and, the facts to be determined being of such vital interest, I feel urged to present the results of my own observations, limited though they

be, as a slight contribution to the larger amount of data we must amass before arriving at any strictly accurate conclusions concerning every phase of the nocturnal journey of migrating birds.

The following notes were obtained with the assistance of my astronomical friend, Mr. John Tatlock, Jr., on the night of September 3, 1887, at Tenafly, New Jersey, about three miles west of the Hudson River, Mr. John F. Paulison most courteously having placed his observatory and 6½-inch equatorial telescope at our disposal.

The most important facts to be determined in observations of this nature are, of course, the height at which these flights occur, and also the number of birds which cross the field of view at any given time.

The method adopted was the same as that used by Mr. Scott, the telescope being pointed at the full moon, which served as a background, showing with wonderful distinctness the birds as they crossed, the observer calling to the recorder as each bird came into view, the latter noting the time.

These observations appear in the following table, where also are given the apparent altitudes of the moon computed at ten minute intervals during the period of observation.

From the altitudes are computed the heights at which the birds in the field at that time were probably flying.

The problem of determining this height exactly is not, so far as we can now judge, capable of definitive solution, for the reason that we have no means of ascertaining the distance of the bird from the observer.

In this case, therefore, we are compelled to resort to an hypothesis of the probable distance at which a bird was visible, and we thus assumed that the least distance from the observer at which a bird could be seen was one mile, the greatest five miles, feeling sure that, in accepting these limits, we do not overestimate the greater distance.

In this connection the appearance of the birds as they crossed the field is of great importance, those which passed more slowly being obviously the ones at the greater distance; and in this class are included the few possessing some marked characteristic of flight which rendered indentification possible; these were as follows: at 8.34 a Grackle, at 9.22 a Carolina Rail, at

9.26 two Carolina Rails, at 9.30 a large Snipe, at 9.33 a Carolina Rail, at 10.15 a Carolina Rail, and at 10.44 a Duck.

The major portion, however, passed at what may be termed the middle distance, or, in other words, too rapidly for us to more than distinguish that they were birds. During the first half hour of observation a number of birds were seen flying upward, crossing the moon, therefore, diagonally, these evidently being birds which had arisen in our immediate neighborhood, and were seeking the proper elevation at which to continue their flight, but after that time the line of flight was parallel to the earth's surface, the general direction being south.

In the appended table the figures given in the vertical columns headed 1, 2, 3, etc., are the numbers of birds observed per minute, the time being found by adding to that of the left-hand column the desired number at the head of the column following; to the right appear the totals and altitudes.

In conclusion I desire to express my thanks to Mr. Paulison for so courteously permitting us to use his observatory, and especially to my friend Mr. Tatlock, who, in preparing its astronomical portion, deserves entire credit for whatever value this paper may possess.

TABLE SHOWING TIME AND APPROXIMATE HEIGHT AT WHICH THE BIRDS OBSERVED FLEW.

Time	0	1	2	3	4	5	6	7	8	9	Total No. Birds	Moons app. alt.	Height, inf. limit.	Height, sup. limit.
H.M.												° ′	FT.*	FT.*
8.00	1	...	...	...	...	...	...	...	...	...	1	7.0	600	3,200
8.10	1	...	...	...	...	...	...	...	...	...	1	8.8	800	4,000
8.20	...	...	...	...	1	...	...	...	...	...	1	10.6	1000	4,900
8.30	2	...	...	...	1	2	...	...	...	1	6	12.4	1100	5,700
8.40	1	2	1	...	1	1	2	4	7	1	20	14.2	1300	6,500
8.50	1	1	1	2	4	3	...	2	7	3	24	16.0	1500	7,300
9.00	...	1	...	2	...	...	...	2	2	3	10	17.7	1600	8,000
9.10	5	1	2	2	4	...	3	...	2	2	21	19.5	1800	8,800
9.20	7	...	6	5	4	1	7	4	5	5	44	21.2	1900	9,500
9.30	4	1	5	6	6	4	3	1	2	2	34	22.8	2000	10,200
9.40	...	2	2	...	1	4	2	2	1	1	15	24.5	2200	11,000
9.50	...	1	1	...	1	1	...	...	...	...	4	26.1	2300	11,600
10.00	3	...	...	1	...	...	4	3	4	1	16	27.6	2400	12,200
10.10	1	...	1	1	1	3	1	1	2	1	12	29.2	2600	12,900
10.20	3	...	5	1	...	...	1	1	1	1	13	30.8	2700	13,500
10.30	...	...	4	...	1	1	3	2	...	...	11	32.1	2800	14,000
10.40	...	...	1	1	1	3	1	4	2	5	18	33.6	2900	14,600
10.50	...	2	1	1	1	...	2	...	1	3	11	34.8	3000	15,100

*Calculated to nearest 100 feet.