As permanent residents the Cardinal (*Cardinalis cardinalis*) and the Tufted Titmouse (*Baeolophus bicolor*) may be cited. Both southern forms common in the southern portion of the State, have persistently pushed the boundaries of their range northward, until today the once rare Cardinal is very common if not abundant, and the formerly accidental Tufted Titmouse is a not uncommon permanent resident in restricted parts of the area. These cases however are not examples of changes in migration route, and hence are not so important to our subject as the first mentioned.

Now then to sum up. If we believe that instinct is the only factor influencing bird migration, how can we account for such instances as the above? Shall we not rather say that instinct without doubt is the motivating impulse in the idea of migration in general, but that the change of specific migration route, though brought about by chance, is in many cases preserved and continued by reason of learning, until it again appears in later generations as instinct.

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ARRIVAL OF BIRDS IN RELATION TO SUNSPOTS.

BY RALPH E. DE LURY.

THE time of arrival of a migrating bird at a given place will differ from its noraml time of arrival there by an amount which depends on the numbers of birds, their physiological condition, their food, their enemies and many other factors which vary with the weather. Local weather conditions affect birds with results often too terribly obvious, but the influence of long general pulses and periodic changes in the weather become apparent only from long series of observations of their migrations and numbers. In this connection the records of the weather and of the arrivals of birds kept by Victor Chandon and his family at Montdidier, France, from 1784 to 1869, are extremely interesting. (Annales du Bureau Central Météorologique de France, 1899.) These records are discussed herewith in relation to the 11.5 year

sunspot cycle which has been associated with many terrestrial phenomena.

The Montdidier records give the dates of arrival of the Swallow and the dates of the first song of the Cuckoo and of the Lark, the averages being for the years 1784 to 1869, April 10.0, 18.3, and 15.5 respectively. The records also include measurements of pressure, temperature, rainfall, and the numbers of days of rain snow, hail and thunder. Of these, the rainfall and the number of days of precipitation appear to have a relationship to the sunspot cycle. The rainfall records for the months of March and April are selected as likely to have a more direct relationship to the dates of arrival of the birds in April; and all of these are grouped in sunspot cycles commencing with years of minima of spots,—a table of the latter being also given.

In the following tables the first column contains the years in which sunspots were at minimum, the second column contains the records for those years, the third for the first years after these, the fourth column for the records of the second years after minima, and so on. Means are given at the ends of the columns, and underneath these means smoothed values are given obtained from them by the formula, 0.25 (a + 2b + c), where b is the mean for the column in question and a and c are the means of the columns preceding and following this one.

TABLE I

APRIL DATES OF FIRST SONG OF CUCKOO AT MONTDIDIER, FRANCE.

Year	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
1784	21	14	18	13	16	20	10	12	12	14	18	10	11	12
1798	12	23	17	20	20	5	25	25	31	27	18	—		
1810	16	11	23	—	37	—	—	—	21	—	13	33	—	
1823	—	—	—	—	—	—	—	37	13	—				
1833	—	—	—	21	—	32	—	18	18	22				
1843	15	15	—	—	21	26	26	11	14	20	12	17	16	
1856	13	18	14	26	26	17	19	10	17	16	10			
1867	15	21	10											
Means	15.3	17.0	16.4	14.8	30.0	25.0	20.0	18.8	18.0	19.8	14.2		16.5	
	16.0	16.3	16.2	19.0	25.0	25.0	21.0	18.9	18.7	18.4	16.2		15.6	

TABLE II

APRIL DATES OF FIRST SONG OF LARK AT MONTDIDIER, FRANCE.

Year	+0	+1	+2	+3	+4	5	+6	+7	+8	+9	+10	+11	+12	+13
1784	19	17	18	6	18	18	15	5	7	16	21	12	16	19
1798	9	23	12	16	20	13	21	15	17	13	14	22		
1810	19	7	20	12	30	20	—	—	10	—	8	20	—	
1823	13	17	19	14	10	12	15	8	9	9				
1833	10	15	19	20	23	12	19	19	19	22				
1843	5	15	8	11	20	16	25	17	14	14	12	13	16	
1856	14	18	14	16	26	18	22	14	15	17	12			
1867	18	21	22											
Means	13.4	16.6	16.5	13.6	21.0	15.6	19.0	13.0	13.0	15.2	13.4		16.9	
	15.1	15.8	15.8	16.2	17.8	17.8	17.0	14.5	13.6	14.2	14.7		15.2	

TABLE III

APRIL DATES OF ARRIVAL OF SWALLOWS AT MONTDIDIER, FRANCE.

Year	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
1784	−5	11	20	−3	12	17	20	15	9	15	17	8	12	27
1798	5	15	22	18	16	5	18	9	19	14	6	23		
1810	16	3	2	10	11	11	—	—	10	—	2	10	10	
1823	7	15	6	7	5	9	12	−4	8	9				
1833	7	7	2	11	2	9	15	5	17	22				
1843	3	15	3	1	12	3	13	5	7	7	6	6	14	
1856	11	10	8	7	6	10	8	6	6	5	5			
1867	5	7	7											
Means	6.1	10.4	8.8	7.3	9.2	9.2	14.5	6.7	10.9	12.0	7.2		13.8	
	9.1	8.9	8.8	8.2	8.7	10.5	11.1	9.5	9.8	10.5	10.1		10.2	

TABLE IV

MARCH RAINFALL IN MILLIMETERS AT MONTDIDIER, FRANCE.

Year	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
1784	54	7	54	70	70	48	13	18	52	34	38	37	19	10
1798	9	13	12	45	33	10	31	18	56	18	14	25		
1810	46	4	53	18	31	57	59	59	77	23	30	66	30	
1823	31	45	24	14	68	50	24	15	38	20				
1833	31	7	56	73	21	46	42	4	25	44				
1843	13	46	31	61	17	52	12	18	88	26	21	15	56	
1856	31	18	35	17	33	36	52	20	34	34	34			
1867	57	32	42											
Means	34.0	21.5	38.4	42.6	39.0	42.7	33.3	21.7	52.9	28.4	27.4		32.3	

APRIL RAINFALL IN MILLIMETERS AT MONTDIDIER, FRANCE.

Year	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
1784	39	12	37	52	23	73	70	79	43	10	41	29	11	37
1798	10	66	69	9	27	36	83	60	21	43	17	48		
1810	23	49	66	41	24	59	39	3	51	45	33	46	24	
1823	41	40	40	32	27	56	87	55	44	19				
1833	25	10	29	45	100	23	31	32	44	29				
1843	49	8	31	70	36	83	51	56	75	12	68	21	11	
1856	61	30	33	52	73	7	18	25	11	12	40			
1867	45	48	43											
Means	36.6	32.9	43.5	43.0	44.3	48.1	54.1	44.3	41.3	24.3	39.8		28.4	

MARCH + APRIL MEANS.

70.6	54.4	81.9	85.6	83.3	90.8	87.4	66.0	94.2	52.7	67.2		60.7	

MARCH + APRIL MEANS, SMOOTHED.

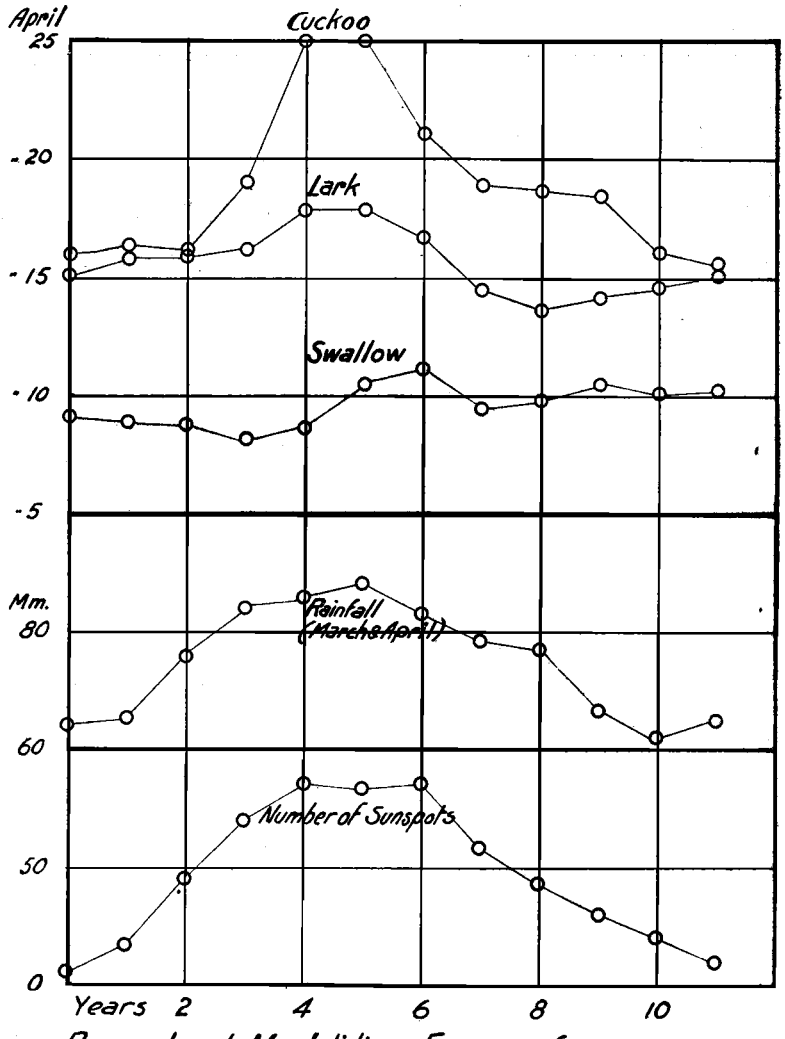
64.1	65.3	76.0	84.1	85.8	88.1	82.9	78.4	76.8	66.7	62.0		64.8	

TABLE V

SUNSPOT "NUMBERS".

Year	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
1784	9	30	80	131	134	115	86	70	58	49	35	24	15	5
1798	4	8	18	37	55	72	70	48	24	12	6	3		
1810	0	1	5	12	20	32	48	41	30	23	15	6	2	
1823	2	8	17	34	52	60	68	64	50	27				
1833	8	13	59	127	141	105	78	68	39	23				
1843	12	20	40	59	102	122	91	69	61	51	35	20	7	
1856	6	22	60	90	96	80	58	47	41	31	14			
1867	7	38	92											
Means	6.0	17.5	46.4	70.0	85.7	83.7	85.6	58.1	43.9	30.9	21.0		10.3	

From the means and smoothed means in the above Tables it appears that there is a periodicity in the arrivals of the birds and in the rainfall in agreement with the sunspot period of about 11.5 years. The chart shows the smoothed mean dates of arrival for the Cuckoo, the Lark, and the Swallow, the smoothed mean rainfall for March + April and the mean Sunspot "Numbers." The Cuckoo exhibits the relationship quite clearly, the Lark to a less degree, while the Swallow appears to be only slightly influenced by the meterological changes traceable to the 11.5 year cycle in the sun. The times of arrival of Cuckoo, Lark and Swallow are 9 days, 3 days and 1 day later at maxima than at minima of sunspots, as appears from the charts. This is shown also by



Records at Montdidier, France, from 1784 - 1869 of Dates of Arrival of Birds, and of Rainfall compared with Sunspot Cycle for the same years

taking the differences between the mean dates of arrival in years of maxima and minima of Sunspot "Numbers", thus:

Cuckoo,	Max., April	23.3,	and	Min., April	15.3,	Diff.,	8.0	days.
Lark,	"	"	18.3	"	"	"	13.4	"	5.4	"
Swallow,	"	"	7.7	"	"	"	6.1	"	1.6	"

In considering these differences in arrivals it is, of course, impossible to estimate to what extent, if any, systematic error may be present in the records owing to the progressive change in the weather throughout the sunspot cycle and the effect this may have had on the observers' habits of observation.

It may be reasonably stated that some birds exhibit in their migratory movements relationship to the 11.5 year solar and meteorological variations. Living things like birds and trees may indeed reveal changes in the integrated conditions called the "weather" in a way that the records of meterological elements fail to disclose. Undoubtedly the American records of 30 or 40 years' duration would be exceedingly valuable in this connection. Long series of records of the movements and numbers of birds are likely to be of great value outside of their ornithological bearing.

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A NOTE ON THE ECONOMIC STATUS OF THE BALD EAGLE IN ALASKA.

BY EDWARD D. CRABB.

ALASKA, with her 590,884 square miles, an area which equals that of Great Britain, Ireland, France, and Spain combined, and is about two and one-fourth times as large as the State of Texas; and with a resident population of 63,592 in 1900, which has probably decreased considerably by now, should be a veritable sanctuary for the Bald Eagle. For her mountain tops, cliffs, and craigs are very conspicuous, and high rugged headlands fringe most of her ragged southern and southwestern coasts. These natural fortresses were formerly the homes of thousands of Bald Eagles that reared their young on jutting shelves and pin-