

Dendroica aestiva—YELLOW WARBLER.—Common in June at the mouth of the Taltson River. Breeding in Basile Bay.

Dendroica coronata—MYRTLE WARBLER.—Common and regularly distributed throughout the area.

Dendroica atricapilla—BLACK-POLL WARBLER.—Noted at the mouth of the Taltson River in June.

Penthestes hudsonicus—HUDSONIAN CHICKADEE.—Common and regularly distributed throughout the area.

Hylocichla guttata pallasi—EASTERN HERMIT THRUSH.—Regularly distributed but not abundant east of Resolution.

Planesticus migratorius—ROBIN.—Common and usually nesting in small spruce trees. Absent from the area around Snowdrift after August 1. The migratory route is apparently south along the main rivers as the birds were very abundant there during September.

BRITISH AND AMERICAN GROUSE CYCLES

By ALDO LEOPOLD AND JOHN N. BALL

THINKERS about game conservation have usually been skeptical about the feasibility of applying management to American grouse, especially American prairie chickens. It has been assumed that the violent fluctuations experienced by all species of grouse made the potential crop uncertain, and efforts to produce a crop correspondingly unattractive. The average sportsman has probably not reasoned the matter out in exactly these terms, but when he speaks of prairie chickens, as “hopeless” or the ruffed grouse supply as beyond human control, he probably means much the same thing.

The authors recently read for the first time the monumental work of the British Committee of Inquiry on “The Grouse in Health and Disease.”¹ If more American sportsmen and ornithologists would read these volumes carefully, they would soon be convinced, as we were, that the management of cyclic grouse is anything but hopeless. That property in grouse which causes them to fall ready victims to disease epidemics is apparently offset by a corresponding facility in recovering their normal numbers, provided only the environment be favourable and the shooting on each parcel of range under strict and intelligent control. The British success in increasing and stabilizing grouse is an obvious fact, backed by a century of experience, and is not altered by any like or dislike for their methods of harvesting the crop, once it has been produced. The latter question is not here under discussion.

A digest of the Grouse Report, comparing British and American grouse from the viewpoint of management, has been published by the authors in a separate paper.² It is here desired to present a companion study comparing their respective fluctuations. The data available to us are summarized on the accompanying chart, consisting of three sets of American curves and two sets of British curves.

SOURCES OF DATA

A. NORTH AMERICAN GROUSE AND RABBITS.—This curve is the summation of some 540 reports gathered during the Game Survey³ on the status of grouse and rabbits, by species, in various states and provinces, during particular years. The data become scattered behind 1909, and very thin behind 1898, hence the curve stops there. Some of the 540 reports are from the game and ornithological literature, but most were made to Leopold verbally or in correspondence by sportsmen, game wardens, and naturalists, totalling nearly 200 persons. It is regretted that this number is so large as to preclude individual acknowledgments.

The geographic distribution of the reports and the species to which they pertain, are as follows:

Region	Ruffed Grouse	Other Grouse	Snow-shoe Hares	Cotton-tail Rabbits	Total
Far North.....	5	20	20	..	45
Southern Canada	60	44	48	..	152
Northern U.S. and Rocky Mts.	143	61	26	9	239
Central U.S.....	7	15	..	40	62
Southern U.S....	24	18	..	..	42
	239	158	94	49	540

The vertical ordinate has no numerical validity, Curve A simply connecting the *most frequent* of five grades of abundance reported for each particular year. The spread or dispersion of the remainder of the reports is indicated by the hatched zone, which covers 90 per cent of the total reports for each year.

The number of reports of course decreases as the dates recede. The time-distribution is:

1926-1930....	135 reports	1911-1915....	56 reports
1921-1925....	131 “	1906-1910....	47 “
1916-1920....	94 “	1901-1905....	35 “

These data are separate and distinct from those entering the Wisconsin curves (C-1 and C-2),

although obtained and compiled in the same manner. They are also separate from both the B curves. The source and exact locality of each report is available in Leopold's records.

Curve A is heretofore unpublished, although the graphed data for the separate states have been circulated privately in the form of a blue-print entitled "Cumulative History of Game Cycles in North America."

B. CANADIAN GROUSE AND RABBITS.—B-1 (sharptail) and B-2 (ruffed grouse) were published by Norman Criddle⁴ in *The Canadian Field-Naturalist* for April, 1930. They represent the numbers of grouse on his place at Aweme, Manitoba, as estimated by his father and himself. His original graph contains a curve for grasshoppers, and a rainfall record, which are here omitted. As in my own curves, Criddle's vertical ordinate has no numerical validity, but is based on a judgment-comparison between years, but since these comparisons have been all made by one man from his own field observations, they are doubtless superior to mine in accuracy.

B-3 is the Hudson Bay Company's purchases of rabbit skins, as published by Ernest Thompson-Seton in "The Arctic Prairies,"⁵ page 102. Seton's curve goes back to 1821, but the section behind 1850 is here omitted. The number of skins in the section here reproduced runs up to 150,000 in the high year 1865, but the numerical scale is omitted for simplicity.

C. WISCONSIN GROUSE AND RABBITS.—C-1 (pinnated and sharptail) and C-2 (all grouse and rabbits) were published by Leopold in the Game Survey, Chart 8, page 142. They are summations calculated in exactly the same manner as A, from similar data. The spread of the data for C-2 is here added for comparison with the spread in A, the hatched zone including 90 per cent of the total reports for each year.

A much more accurate and thorough study of grouse fluctuations covering a longer period is now being made by Ralph T. King, of the University of Minnesota, under a fellowship of the Sporting Arms and Ammunition Manufacturers' Institute.

D. SCOTCH GROUSE KILL.—D is the kill of red grouse from four moors as follows:

Moor	Period Covered	Author
1. Douglas Castle (Lanarkshire).	1858-1909	Malcolm & Maxwell "Grouse and Grouse Moors," ⁶ p. 278.
2. A moor in Inverness-shire.	1897-1909	British Committee, "Grouse in Health and Disease," p. 474.
3. A Scotch moor.	1866-1886 1894-1904	Same, p. 456.
4. Carron Moor (Moray-shire).	1897-1909	Same, p. 388.

The kill on each moor for each year was first computed as a per cent of its own average. The average of all the percentages available for each year was then calculated and plotted. Hence the curve represents the departure from average (100 per cent) for all four moors collectively, during each year. The rising trend of the curve represents the increasing success of management.

E. SCOTCH GROUSE DISEASE (INVERTED).—E-1 is the frequency of reports of red grouse disease, as mapped by years in Vol. II of the "Grouse in Health and Disease." The dots on these yearly maps representing the number of localities reporting disease (these maps occur in the limited edition only) were counted, and plotted as per cent departures from the average number, but the vertical scale was *inverted*, so that any parallelism with the kill curve (D) could be the more readily visualized. Since E-1 is inverted, its peaks represent disease-free years, and its troughs years of numerous disease reports.

E-2, which occurs in numerous fragments, is a compilation by Leopold of the textual references to high and low red grouse crops, high and low kills, record bags, and disease years occurring in the Grouse Report, in Malcolm and Maxwell's book, and in MacIntyre's paper on "Cycles of Game Birds,"⁷ appearing in "Game and Gun," June, 1930, page 286. The vertical ordinate is an arbitrary judgment (in three abundance classes) on the consensus of textual references available for each year. Usually where more than one reference was available, they all agreed.

E-3 (Black Game) consists of a few fragments of textual references by Malcolm and Maxwell, and by MacIntyre, graphed in the same manner as E-2. Both of these writers consider this species as synchronizing with red grouse in its fluctuations, hence its admission here.

INTERPRETATION OF DATA

AMERICAN FLUCTUATIONS.—There is an incapable parallelism between A, B, and C.

The low of 1927 shows on all three, except that in the North American curve (A) it falls in 1926 or 1928. Interpreted in the light of the hatched zone, 1928 appears to be the preferable date for the all-American low, as compared with 1927 for Wisconsin and Ontario.

The high of 1923 is apparent in all three curves as a broad flat-topped "mesa" of four years' duration, beginning in 1920 or 1921, and falling off in 1924 or 1925.

The low of 1918 is apparent in all three, except that in Wisconsin it came a year late (1919) except in prairie chickens, which followed the all-American date, 1918.

The preceding high shows the first blur. The years 1910 to 1915 are all relatively high in all three curves. The all-American curve shows a major peak in 1910 and a lower one in 1912-13. Criddle peaks in 1912, 1913, or 1914, with ruffed grouse peaking later and falling later than sharp-tail. Wisconsin shows peaks in 1909, 1912, and 1915 both for pinnated and all species, the ruffed grouse (being the heaviest component of all species) again lagging behind in the final drop. Taking everything together, the years 1912 or 1913 would seem to be the mean high.

The preceding low Criddle and Seton fix at 1907, with the projection of the all-American curve in agreement, although now so meagre as not to be given great weight. The Wisconsin curve, interpreted with due weight for the hatched zone, would indicate 1905 or 1906. The year 1906 may be taken as a rather blurred median date for this low.

We now climb back to a pronounced high in about 1902, unanimous except for Seton's Hudson Bay rabbits. Again we have the flat-topped "mesa" 2-4 years in duration, with a doubt as to its true centre. Criddle would have it 1903 or 1904 in both grouse; Wisconsin 1901 in both prairie chickens and all species. This time ruffed grouse show no lag in any of the curves, but click with the other species.

Preceding this is a pronounced low, but with Criddle and Wisconsin at variance as to its date. Criddle says 1897 or 1898, Wisconsin 1899.

Wisconsin, backed by Seton, climbs back to a high in 1896 or 1897, while Criddle is still low. The number of observations in the Wisconsin curve has by now become meagre, whereas Criddle and Seton are presumably as well-supported as ever. Since they conflict, the date of this low must be left unresolved.

To sum up, the available data on North American grouse (but possibly not rabbits, especially Hudson Bay rabbits) substantially synchronize in their fluctuations back to the high of 1902, at which point the data become too meagre for further comparisons. The periods and intervals are as follows:

NORTH AMERICAN GROUSE CYCLE			
Interval	10 or 11		10 or 11
High	1902.....	1912 or 3.....	1923.....
Low	1906.....	1918.....	1927.....
Interval	14		9

Evidently $2\frac{1}{2}$ periods have elapsed between 1927 and 1902, which gives an average of a fraction over 10 years, as compared with the 9-year figure arrived at by Leopold in the Game Survey for Wisconsin.

Seton likewise deduced a 10-year period from B-3, plus his corresponding curves for other furbearers. He says (p. 109) "The high points for each species are with fair regularity 10 years apart." This independent conclusion for an earlier period carries the extremely important inference that the period of the American cycle is not growing shorter, as MacIntyre claims it is in the British Isles.

It is not here intended to imply that the American cycle has a uniform period, or that it has not. An average is in any event needed for prediction in game management and administration.

BRITISH FLUCTUATIONS.—There is parallelism between the various British curves comprising D and E. It is apparently greater than would occur by chance alone.

A certain lag between D (kill) and E-1 (disease frequency) is to be expected. The literature makes it clear that heavy kills are often made during the first year of an outbreak of disease, the heavy population being assumed to induce the outbreak. Accordingly E ought to precede D in both trough and peak. This will be called the "anticipated lag."

The British curves for 1909-1929 are too meagre to support conclusions. It is hoped that some British author will compile and publish the kill since 1910 on the four moors covered by the Grouse Report and Maxwell up to that date.

There are possible highs about 1923 and 1915, and lows about 1929 and 1914.

There is a partially substantiated high about 1909 and a low about 1908.

Beginning now with the full data, there is a clear high in the kill for 1907, E-1 showing the anticipated lag to the left, to the extent of two years.

There is an unanimous low in 1903.

There is a clear high in the kill for 1901, E-1 showing the anticipated 1-year lag to the left.

There is a low about 1897, E-1 lagging one year to the left as anticipated.

There is a clear high in 1894, E-1 lagging one year to the left as anticipated.

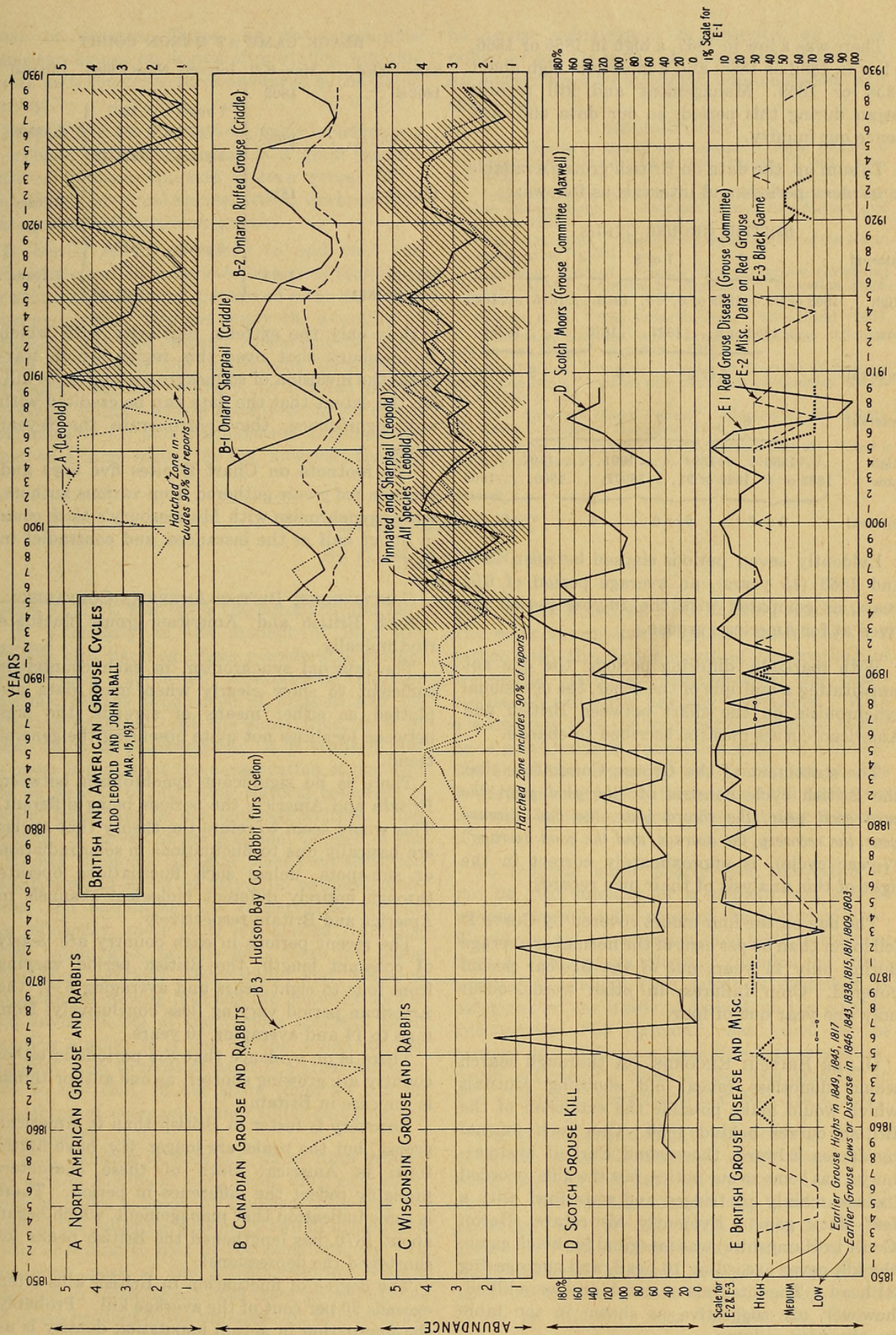
There is a blurred low in 1889 or 1891.

There is a clear high in 1886, E-1 lagging 1-2 years to the left as anticipated.

There is a low in 1883 or 1884, a unanimous high in 1882, and a low in 1878, but contradicted by E-2, which shows a high.

There is a high in 1876, and a unanimous low in 1873.

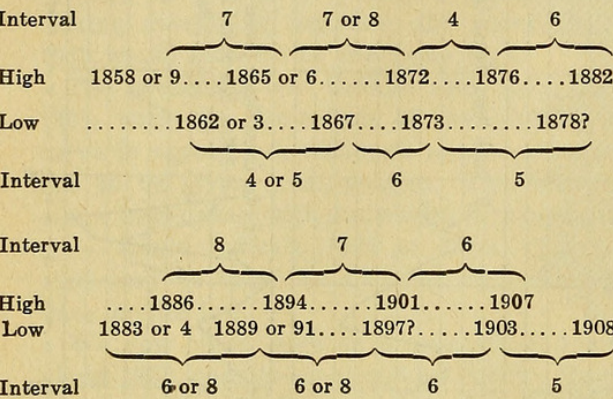
By all the literature and tradition, 1872 was a record-breaking year.



There was a low in 1867, a high in 1865 or 1866, a low in 1862 or 1863, and a moderate high about 1858 or 1859. Management and kill records began during this period, so our data end, and hence our inquiry.

To sum up, the data on British grouse available to us show periods and intervals as follows:

BRITISH GROUSE CYCLE



Evidently seven periods elapsed between 1908 and 1863 (45 years), an average period of 6½ years, as compared with the 10-year period arrived at for American grouse.

With markedly differing periods, the one not constituting a multiple of the other, the occasional synchronism on the chart between British and American curves must be ascribed to chance.

The statement of the Grouse Committee that the British cycle consists of "the good year, the very good year, the record year, the bad disease year, the recovery, the average, and the good average" (7-year cycle), is approximately correct in the light of this analysis of their own records.

The bag on the four moors covered by Curve D fell lower than 50 per cent of the normal or average during only 14 years out of the 51-year period covered. Crop failures, in other words, occur only one year out of four.

OLDER BRITISH RECORDS.—A thorough search would doubtless reveal old shooting journals which would make possible the extension of the British curves behind 1850. One such journal by James Edward, the second Earl of Malmesbury,⁹ has come to our notice, but the kills recorded include mainly partridges and waterfowl, with a few black game. Evidently his estate (Heron Court in Hampshire) was marginal for black game, the kill never exceeding 10 head, and aggregating 81 head. The intervals at which any were killed, however, are suggestive, as shown in the table in the next column.

BLACK GAME AT HERON COURT

Some Killed	Max. Kill	Interval	None Killed	Interval
1802-6.....	1802	7 years	1807	5 years
1808-10.....	1809		1811-12	
1813-17.....	1814	8 years	1818	6 years
1819-24.....	1822		1825-26	
(except 1821)				7 years

It is only the extreme regularity with which Malmesbury shot over this region which warrants the inclusion of so meagre an aggregate kill. To the extent that the data can be credited with any significance, they corroborate the 6-year cycle.

The footnote on Chart E cites five lows and highs in *red grouse* gathered from various authors, which synchronize with Malmesbury's *black game* in about half of the instances, and contradict in half.

CONCLUSIONS; BRITISH-AMERICAN COMPARISON.—Both British and American grouse fluctuate rhythmically.

The internal synchronism in each country is sufficient to show clearly when mass data are plotted as either means or spreads, the lags between localities not quite obscuring the general trend.

There is no significant synchronism between Britain and America, the periods being different. This would seem to refute the theory that cycles are basically due to fluctuations in solar radiation or sun-spots, unless such fluctuations operate through entirely different biological channels in America and Britain respectively.

The recent periods in each country are nearly of constant length, the British period varying from four to eight years and averaging 6½; the American period varying (less conclusively) from nine to 14 and averaging 10 years.

There is no evidence that the periods in either country are growing shorter, as one author thinks is the case in Britain.

Recovery is faster in British than in American grouse, but the peaks are longer (*i.e.* have flatter tops) in America. Both of these characters probably reflect the difference in period. There is some indication that management, which began about 1870, has lengthened the British peaks (or shortened the depressions).

The degree of fluctuation in British kills often exceeds 90 per cent of the average kill. Probably the fluctuation in actual population density is as

great or greater. There are no comparable American figures on degree of mortality, but this agrees with the conjectures advanced in the Game Survey.

In spite of these fluctuations, game management as applied to British grouse is a great success with no undue proportion of lean years. Why then should not equal success attend the hoped-for management of American grouse?

It hardly seems necessary to add that the development of an American biological technique for grouse management, patterned after the European experience, does not imply the adoption of European laws and customs concerning the utilization of game or the distribution of shooting privileges. On the contrary, as pointed out in the Game Policy,⁸ grouse usually occur on cheap land suitable for public acquisition and management on a large scale. So far, however, there is

no grouse management in America, on either public or private land. It presents a virgin field for pioneer work by biologists, administrators, and sportsmen.

BIBLIOGRAPHY

¹"The Grouse in Health and Disease." Final Report of the Committee of Inquiry on Grouse Disease. 2 vols. London, 1911.

²LEOPOLD, ALDO, and BALL, J. N., "British and American Grouse Management." *American Game*, July-August and Sept.-Oct., 1931.

³LEOPOLD, ALDO. "Report on a Game Survey of the North Central Region." 1931.

⁴CRIDDLE, NORMAN. "Some Natural Factors Governing the Fluctuations of Grouse in Manitoba." *Canadian Field-Naturalist*, 44: 79, April, 1930.

⁵SETON, E. T. "The Arctic Prairies." New York. 1923.

⁶MALCOLM, GEORGE, and MAXWELL, AYMER. "Grouse and Grouse Moors." London. 1910.

⁷MACINTYRE, DUGALD. "Cycles of Increase of Rodents and Game Birds." *Game and Gun and the Country Estate* June, 1930, p. 286.

⁸"An American Game Policy." Adopted by the American Game Conference, December, 1930.

⁹MALMESBURY, JAMES EDWARD, Second Earl of. "Half a Century of Sport in Hampshire." New York, 1905.

DUCK-BANDING

By C. W. PALMER, Jr.

TO ONE who loves the outdoors, and particularly to the student of bird life bird banding offers considerable attraction. It is an all-absorbing outdoor pastime, always productive of unusual and interesting incidents. At the same time, it is of great value to conservation. It is realized now as never before, that the conservation of our wild life as well as of our other natural resources is vitally important to our national welfare. Just recently, a survey of the National Council of the National Economic League placed conservation twenty-first in a list of fifty-four national problems. To administer the conservation of wild life efficiently, more facts are needed regarding their habits and, to this end, there are being established various fellowships and research programmes delving into the life histories, habits and environments of the various species. Each banding station is a cog in the wheel of this research, and, to most of us, it is a great satisfaction to feel that, in our spare time, we can do something of economic value while enjoying the out-of-doors.

"Bird banding in America, dates from around the time of Audubon, who, about 1803, used silver wire to mark a brood of Phoebe. He was rewarded the following season by two of his marked birds returning to nest in the same vicinity. In the early part of the present century several banding or marking schemes were projected, one of which resulted in the organization in December,

1909, of the American Bird Banding Association. The work accomplished by that association, together with the development of the method of systematic trapping, demonstrated the possibilities of extensive banding operations. With a realization that the information obtained would be of great value in connection with the administration of the migratory-bird treaty act of July 3, 1918, the Biological Survey in 1920 took over the work of the American Bird Banding Association."

To indicate more clearly how interesting it can be, just suppose for a moment you had at various times banded some of the following birds. Would you not experience a keen thrill in learning that a "Swainson's Hawk," (banded by you), wearing a celluloid ring, which is described as being red on the inside and black on the outside, and marked "50 Canada", was killed in the western part of Buenos Aires Province, Argentine, South America?" Such a case was reported in *The Canadian Field-Naturalist* for April, 1931.

One of the longest flights on record is that of an Arctic Tern, No. 548,656, which was banded when less than five days old by Oliver L. Austin, Jr., at Red Island, Turnevick, Newfoundland Labrador, on July 22, 1927. Records of *The Canadian Field-Naturalist* show that this bird was found dead October 1, 1927, just seventy days after the date on which it was banded, on the Greve de Marsilly, near La Rochelle, France.



Leopold, Aldo and Ball, John N. 1931. "British and American Grouse Cycles." *The Canadian field-naturalist* 45(7), 162–167. <https://doi.org/10.5962/p.339292>.

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