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Deer Inventory Studies In Minnesota

Gordon Fredine

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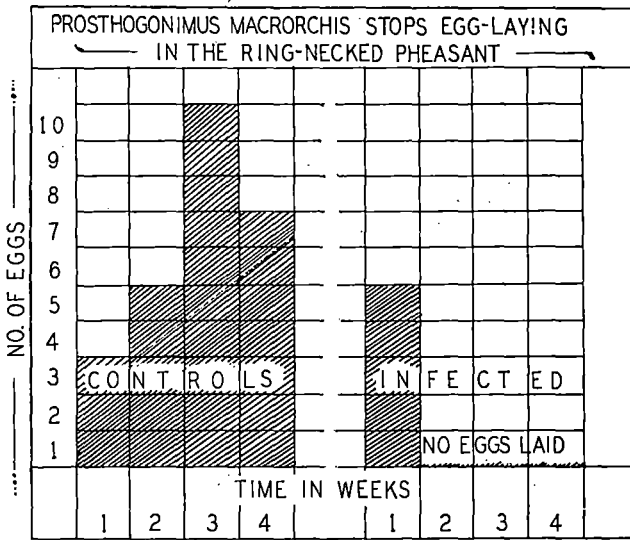
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after feeding to a laying ring-necked pheasant 14 dragonfly naiads of the genus *Tetragoneuria*, presumably containing cysts of *Prosthogonimus macrorchis*, no flukes were found in the birds. One of two additional pheasants to which he fed six and seven naiads respectively yielded a single worm. The other was negative. Egg production was not effected. He concluded that the pheasant is highly refractive to infection by *P. macrorchis*, at least in the oviduct of the laying female.

Gower's conclusions are based on a small amount of evidence, as he realized. Other than the presence of one fluke in a pheasant there is no positive evidence that his birds received cysts of *P. macrorchis*.

In conclusion, the present experiment shows that ring-necked pheasants are fully as susceptible to infection with *Prosthogonimus macrorchis* as the chicken, and that egg laying is greatly reduced by the presence of this parasite in the oviduct.

* * *

DEER INVENTORY STUDIES IN MINNESOTA

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Considerable attention has been focused in recent years on deer problems throughout the country. A variety of problems exists, ranging from deer scarcity to over abundance, and the importance of deer from the standpoint of hunting and recreation has stimu-

lated the study of conditions affecting deer. In Minnesota, the Virginia white-tailed deer is the most abundant big game animal, and the welfare of this resource is of great significance.

Since deer in this region depend almost entirely on woody plants for their sustenance during the winter months, it is important to emphasize the fact that browse-eating animals can and often do destroy their own range while seed-eating animals do not. In regions where deer are forced, because of deep snow, to concentrate during the winter months in a relatively small portion of their total range, the effect they have in controlling their source of winter food by browsing in these limited areas is usually the factor which limits their abundance. Any given range has a capacity for supporting deer which, if exceeded, is known to decline rapidly due to the effect on the food species by over-browsing. It is important, therefore, not to allow deer to increase to a point where the carrying capacity of the range is exceeded. Experience of this nature in the Arizona Kaibab Forest, in Pennsylvania, and more recently in Michigan, has shown dramatically the devastation that is brought about when this carrying capacity is exceeded even over a relatively short period of time. There is reliable evidence that in many parts of Minnesota, deer have exceeded the carrying capacity of the range, and the recognition of this fact has stimulated investigations to determine the size and trend of the deer population, the winter food supply and carrying capacity of the range, and the effect of hunting on the deer herd.

The white-tailed deer was originally restricted in range to the hardwood forests and prairie lands of the southern portion of the state.¹ The cutting of the hardwood forests, the development of agriculture and hunting which followed the rapid settlement of southern Minnesota, were largely responsible for the depletion of deer in that area. By the year 1880 deer became quite rare in their original range. Up to about the year 1860 deer were not common in the coniferous forests of the north central and northeastern portions of Minnesota. Under the big timber that existed in this area, there was very little undergrowth to serve as food and cover for deer. After the year 1860 extensive logging operations in northern Minnesota created openings in the forest in which low growing shrubs produced an abundance of suitable deer food. As conditions became more favorable deer increased rapidly. In the year 1900 the game laws of the state provided an annual twenty day deer hunting season and allowed a bag limit of five deer of either sex for each hunter. Hunting restrictions were gradually increased, so that by the year 1911 the bag limit was reduced to one deer per hunter, but the annual twenty day season continued until 1922. The first closed season on deer in Minnesota followed in 1923, and in that year the state legislature provided an open season on deer of either sex and

¹ Surber, Thaddeus, 1932. "The Mammals of Minnesota." Game and Fish Department, St. Paul, Minnesota.

of any age in even numbered years only. Apparently deer needed additional protection at that time, and quite possibly the deer herd had decreased due to extensive forest fires which made conditions for deer temporarily unfavorable. With the advent of improved forest fire control methods, and because of the additional protection afforded by law, deer again began to increase in numbers in the northern part of the state, indicating that the hunting did not control the herd. Indications of a heavy mortality among deer during the winter months, and over-browsed deer yards, were noticeable by the year 1930.

The establishment of the Civilian Conservation Corps stimulated forest improvement work and furnished an abundant source of labor in both the state and national forests. Recognition of wildlife values in these areas brought the attention of wildlife managers to various game problems, and in particular the growing deer problem in Minnesota. In 1935 deer census counts were carried out on forty-five census areas in the northern part of the state. These counts were made in the Superior National Forest, the Chippewa National Forest, and various state forests using the facilities of the Civilian Conservation Corps and the supervision afforded by the U. S. Forest Service and the Emergency Conservation Work. These counts have been continued annually, and the data obtained are now reaching significant proportions.

Deer counts are made by surrounding with men an area selected to represent average conditions over a large block of range. The counts are made in the fall after the leaves have fallen and before the hunting season, when the deer are still generally distributed throughout the range. The men are well trained, and on three sides of the area, which is usually one square mile, the men are stationed to act as counters. On the fourth side the men are lined up and instructed to march through the area abreast so as to drive the deer through the counting lines or to count any deer that break through the driving line. By this method all of the deer on a given area can be counted, and by adequately training the men and preparing guide lines through the area the counts can be accomplished with precision. Approximately one hundred men are required to make each count.

The census areas are well scattered through the northeastern and the north central portions of the state, and since the counts are taken for the most part on the same areas each year, the results yield valuable information. At present it cannot be assumed that the total deer population in the entire deer range can be accurately determined by this method, for the reason that the sample included in the census areas is not adequate, but the information is becoming increasingly valuable as time goes on in indicating whether or not deer are increasing or decreasing throughout the region represented by the counts, and it is felt that the results reflect the trend of the population throughout the greater portion of northern Minnesota.

Tables I, II, and III show the results of the individual counts on the various state forests, the Superior National Forest and the Chippewa National Forest. The information contained in the tables includes the location by townships of each count, the size of the area counted, the number of deer counted, the apparent sex ratio, and the number of deer per square mile. Experience has shown that the figures representing the total number of deer counted on each census area are reasonably accurate, but there is some question as to the reliability of the data obtained on the sex of the deer seen. It is reasonable to assume that the deer herd is overbalanced in favor of females since hunting statistics show that during the open hunting season a greater number of males are taken than females. Since it is difficult for the counters to distinguish easily between young males with small antlers and does, it is quite possible that a number of errors occur, and consequently the sex ratio as shown by the deer counts may not be exactly as it appears.

The listing of the individual deer counts shows a great variance in abundance of deer in the different localities. Since deer are relatively mobile, a comparison of individual counts from year to year may not yield significant information, but by considering the rather large number of counts, all taken in the same manner, an average is obtained which is considered to be significant. Table IV summarizes the deer counts taken in 1939 on the Superior and Chippewa National Forests and the seven state forests. The forty-five counts taken on fifty-one square miles of deer range yielded a total of 700 deer or an average of 13.76 deer per square mile.

In addition to the deer counts shown in the tables, special counts are made in Itasca State Park. The counts in that area consistently show an average deer population far in excess of the average throughout the rest of the state. In 1939 three counts conducted in Itasca Park showed an average population of seventy-five deer per square mile. In 1937 the average was seventy-four deer per square mile, and in previous years the average was only slightly lower. The high winter mortality of deer in Itasca State Park, which has been known to reach twenty dead deer on one square mile, is another indication that this area is dangerously overstocked with deer. Studies on the vegetation in the park reveal that there is very little conifer reproduction, since deer are so abundant that young trees and shrubs are destroyed by browsing before they can grow beyond their reach.

Comparative data since 1935 are contained in table V. This table shows the number of census areas counted each year, the total area, number of deer counted, the apparent sex ratio, and the average number of deer per square mile. A decline in the deer population of approximately three deer per square mile since 1935 is indicated.

Studies have been conducted in an effort to determine the cause of this decline. Attempts have been made to determine the effect of hunting on the deer herd by means of so-called hunting check studies. This work has been conducted by the U. S. Forest Service in the

TABLE I. MINNESOTA STATE FOREST DEER CENSUS, FALL 1939

| State Forests | Location Twp. Rge. | Acres | Bucks | Does | Fawns | ? | Total | Sex Ratio F : M | Deer per Sq. Mile |
|------------------------|-----------------------|-------|-------|------|-------|----|-------|--------------------|----------------------|
| Cloquet Valley | 55—14 | 1,280 | 9 | 25 | 5 | 4 | 43 | 74:26 | 21.5 |
| Kabetogama | 65—19 | 467 | 2 | 2 | 0 | 1 | 5 | 50:50 | 6.9 |
| Kabetogama | 65—18 | 640 | 8 | 7 | 0 | 1 | 16 | 47:53 | 40.0 |
| Kabetogama | 68—21 | 860 | 13 | 17 | 0 | 2 | 32 | 57:43 | 23.8 |
| George Washington..... | 60—21 | 1,550 | 6 | 15 | 0 | 0 | 21 | 71:29 | 8.67 |
| George Washington..... | 60—25 | 800 | 4 | 15 | 3 | 0 | 22 | 79:21 | 17.6 |
| George Washington..... | 62—24 | 640 | 2 | 1 | 1 | 1 | 5 | 33:67 | 5.0 |
| White Earth..... | 143—37 | 918 | 11 | 29 | 18 | 1 | 59 | 73:27 | 41.3 |
| Land-O-Lakes | 139—26 | 800 | 3 | 3 | 2 | 0 | 8 | 50:50 | 6.4 |
| Miss. Headwaters | 146—34 | 960 | 4 | 5 | 1 | 0 | 10 | 56:44 | 6.6 |
| Pine Island | 67—27 | 960 | 6 | 11 | 3 | 0 | 20 | 65:35 | 13.3 |
| Totals..... | | 9,875 | 68 | 130 | 33 | 10 | 241 | 66:34 | 15.62 |

TABLE II. SUPERIOR NATIONAL FOREST DEER CENSUS, FALL 1939

| Superior N. F. | Location Twp. Rge. | Acres | Bucks | Does | Fawns | ? | Total | Sex Ratio F: M | Deer per Sq. Mile |
|--------------------------|-----------------------|---------------|--------------|------------|-----------|----------|------------|-------------------|----------------------|
| Range Unit | 61N — 17W | 562 | 4 | 7 | — | — | 11 | 64:36 | 12.5 |
| | 59N — 19W | 640 | 2 | 8 | — | — | 10 | 80:20 | 10.0 |
| | 60N — 20W | 560 | 7 | 8 | — | — | 15 | 53:47 | 17.1 |
| | 60N — 21W | 550 | 7 | 6 | — | — | 13 | 46:54 | 15.1 |
| | 57N — 14W | 450 | — | 4 | — | — | 4 | 100: 0 | 5.7 |
| | 58N — 14W | 635 | 3 | 5 | — | — | 8 | 62.5:37.5 | 8.0 |
| | Total | | 3,397 | 23 | 38 | — | — | 61 | 62:38 |
| Wilderness Unit | 64N — 12W | 524 | 4 | 4 | — | — | 8 | 50:50 | 9.8 |
| | 65N — 14W | 301 | 2 | 2 | 1 | — | 5 | 50:50 | 10.6 |
| | 66N — 16W | 575 | 5 | 5 | 2 | — | 12 | 50:50 | 13.4 |
| | 63N — 15W | 530 | 3 | 10 | 4 | — | 17 | 77:23 | 20.5 |
| | 63N — 9W | 291 | 2 | 8 | 1 | — | 11 | 80:20 | 24.1 |
| | 61N — 10W | 719 | 3 | 7 | 2 | — | 12 | 70:30 | 10.7 |
| | 62N — 11W | 751 | 4 | 15 | 3 | — | 22 | 79:21 | 18.7 |
| | 64N — 1W | 342 | — | 1 | 1 | — | 2 | 100: 0 | 4.0 |
| Total | | 4,033 | 23 | 52 | 14 | — | 89 | 69:31 | 14.1 |
| North Shore Unit | 56N — 11W | 460 | 2 | 2 | 3 | — | 7 | 50:50 | 9.7 |
| | 57N — 10W | 940 | 4 | 10 | 11 | — | 25 | 71:29 | 19.7 |
| | 60N — 9, 10W | 517 | 3 | 3 | — | — | 6 | 50:50 | 7.4 |
| | 59N — 9W | 640 | 3 | 8 | — | — | 11 | 73:27 | 11.0 |
| | 60N — 6W | 526 | 5 | 2 | — | — | 7 | 29:71 | 8.5 |
| | 60N — 4W | 715 | 3 | 7 | 2 | — | 12 | 70:30 | 10.7 |
| | 60N — 4W | 602 | 2 | 3 | — | — | 5 | 60:40 | 5.3 |
| | 62N — 1, 2E | 625 | 5 | 8 | 1 | — | 14 | 62:38 | 14.3 |
| Total | | 5,025 | 27 | 43 | 17 | — | 87 | 61:39 | 11.1 |
| Grand Total | | 12,455 | 73 | 133 | 31 | — | 237 | 64.5:35.5 | 12.2 |

TABLE III. CHIPPEWA NATIONAL FOREST DEER CENSUS, FALL 1939

| Ranger District | Location | | Acres | Bucks | Does | Fawns | ? | Total | Sex Ratio F. : M. | Deer per sq. mile |
|--------------------------------|----------|-------|--------|-------|------|-------|----|-------|----------------------|----------------------|
| | Twp. | Rge. | | | | | | | | |
| Bena | 145N | — 27W | 1,280 | 3 | 6 | 1 | 0 | 10 | 67:33 | 5 |
| Blackduck — Area A* | 147N | — 29W | 640 | 6 | 15 | 3 | 0 | 25 | 71:29 | 24 |
| Blackduck — Area B | 147N | — 30W | 640 | 9 | 6 | 2 | 0 | 17 | 40:60 | 17 |
| Cass Lake | 144-5N | — 29W | 1,280 | 9 | 19 | 12 | 5 | 45 | 68:32 | 22.5 |
| Cut-foot Sioux — Area A | 147N | — 27W | 1,690 | 10 | 15 | 4 | 0 | 29 | 60:40 | 11 |
| Cut-foot-Sioux — Area B* | 147N | — 28W | 836 | 9 | 12 | 9 | 0 | 30 | 57:43 | 23 |
| Marcell — Area A | 59N | — 27W | 704 | 6 | 14 | 2 | 0 | 22 | 70:30 | 20 |
| Marcell — Area B* | 59N | — 26W | 607 | 3 | 5 | 6 | 4 | 18 | 62:38 | 19 |
| Remer — Area A* | 141N | — 27W | 640 | 2 | 2 | 0 | 0 | 4 | 50:50 | 4 |
| Remer — Area B | 142N | — 25W | 640 | 3 | 11 | 3 | 0 | 17 | 79:21 | 17 |
| Walker — Area A* | 141N | — 31W | 640 | 0 | 1 | 0 | 0 | 1 | | 1 |
| Walker — Area B | 141N | — 30W | 640 | 2 | 1 | 1 | 1 | 5 | 33:67 | 5 |
| Totals | | | 10,239 | 62 | 107 | 43 | 10 | 222 | 63:37 | 13.87 |

* New census areas established in 1939

TABLE IV. MINNESOTA DEER CENSUS SUMMARY, 1939

| Location | No. of Counts | Sq. Miles | Bucks | Does | Fawns | ? | Total | Sex Ratio F. : M. | Deer per sq. mi. |
|--------------------------------|------------------|--------------|-------|------|-------|----|-------|----------------------|---------------------|
| Superior National Forest | 22 | 19.43 | 73 | 133 | 31 | — | 237 | 65:35 | 12.20 |
| Chippewa National Forest | 12 | 16.00 | 62 | 107 | 43 | 10 | 222 | 63:37 | 13.87 |
| State Forests | 11 | 15.43 | 68 | 130 | 33 | 10 | 241 | 66:34 | 15.62 |
| Totals | 45 | 50.86 | 203 | 370 | 107 | 20 | 700 | 65:35 | 13.76 |

TABLE V. MINNESOTA DEER CENSUS SUMMARY

| Year | No. of Census Areas | Total area censused (sq. miles) | No. deer counted | Sex Ratio F. : M. | Deer per section |
|-----------|---------------------------|---------------------------------------|---------------------|----------------------|---------------------|
| 1935..... | 45 | 75 | 1,256 | 63.0:37.0 | 16.6 |
| 1936..... | 51 | 69 | 1,175 | 61.8:38.2 | 17.0 |
| 1937..... | 50 | 61 | 832 | 62.5:37.5 | 13.6 |
| 1938..... | 48 | 61 | 774 | 61.2:38.8 | 12.7 |
| 1939..... | 45 | 51 | 700 | 65.0:35.0 | 13.7 |

Superior and Chippewa National Forests and on the Kabetogama, Cloquet Valley and Pine Island State Forests by the C.C.C. and the S.C.S. The information is obtained by establishing checking stations on all roads leading into the hunting areas, so that an almost one hundred per cent tally is made of the number of hunters and their success. These checks were made in the regions where the census data applies, embracing an average total area of approximately five thousand square miles. The results of these studies indicate that an average of from one and one-half to two deer per square mile are removed during the open hunting season. The normal annual reproductive capacity of the deer herd is far above this number, and consequently this low hunting take could not be responsible for the decline, even though losses from illegal hunting are taken into consideration.

The comparative data obtained by the annual deer counts have indicated that the decline has occurred principally in the Superior National Forest. Data from the individual drives show that the principal reduction in the Superior National Forest has occurred in the areas previously supporting the highest deer concentrations, so that at the present time the population is distributed more uniformly throughout that region. The reduction in the number of deer in those areas is due partly to hunting, but largely to losses through winter mortality.² Studies during the past three years, carried on by the Superior National Forest, covering approximately ten thousand acres, have disclosed that an average of eleven deer per square mile of wintering area have died each year largely as a result of malnutrition. The heaviest losses occur among fawns and very old deer. The greatest loss occurred during the winter of 1938-39, when an average of 14.5 dead deer per square mile was found in the winter deer yards. It is estimated that deer concentrate on approximately ten per cent of their summer range for wintering in that area. This loss is far in excess of the number of deer taken by hunters over the Superior National Forest as a whole.

In addition to the studies on the abundance of deer, the hunting take, and winter mortality, attention has been paid to the condition

² Olson, Herman F. "Deer Tagging and Population Studies in Minnesota." Transactions of the Third North American Wildlife Conference, 1938, pp. 280-286.

of the deer range. Winter deer yards have been examined to determine the kind of browse present and the degree of utilization of each. In areas supporting more than average deer concentrations, browse lines are being found in the winter yards, indicating over-utilization of the food present. Studies on the food habits of deer have revealed that the browse species that form a greater part of the winter food of deer are those species now most available but not those of the greatest nutritional value.³ Due to the abundance of deer in those localities and due to over-browsing, deer are forced to depend on foods that are low in nutritional value during the winter months. The conclusion has been reached that unless the deer herd is held within the carrying capacity of the range, which is limited by the winter food supply, the ability of the range to support deer will continue to decline. Obviously, control of environmental factors to create conditions favorable for the production of natural deer foods is also an important factor, which must be considered in any attempt to adequately manage the existing deer herd.

Conclusions:

1. The deer census work involving the total deer count method on sample areas has revealed that an average population of 13.76 deer per square mile existed in the fall of 1939 over a total of forty-five sample areas comprising fifty-one square miles.
2. Annual deer counts reveal a decline of three deer per square mile on the sample areas since 1935.
3. Hunting take studies have shown that from one and one-half to two deer per square mile are removed by hunters during the open hunting season.
4. Winter mortality studies in the Superior National Forest show an average loss of eleven deer per square mile of wintering range since 1937 and that this loss, due largely to malnutrition, is in excess of the hunting take.
5. Studies on the condition of the deer range indicate that in areas where more than average deer concentrations occur the capacity of the range to support deer is declining.
6. In order to adequately manage the deer herd in Minnesota, efforts must be made to control their abundance within the carrying capacity of the range and to maintain and increase the carrying capacity of the range through environmental control.

³ Aldous, S. E. and Smith, C. F. "Food Habits of Minnesota Deer as Determined by Stomach Analysis." Transactions of the Third North American Wildlife Conference, 1938, pp. 756-767.

A REVIEW OF FALL COLORING WITH SPECIAL
REFERENCE TO WINONA COUNTY, 1939

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SOME FISH-BORNE PARASITES OF BIRDS AND
MAMMALS

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THE RETICULO-ENDOTHELIAL SYSTEM AND
IMMUNITY IN HOG CHOLERA

Published in *Journal of Immunology* 39:85-88, 1940

COLOR AND SUPER HIGH SPEED CINEMATOGRAPHY
OF THE ISOLATED HEART-LUNG

M. B. VISSCHER, G. K. MOE, AND W. A. HUNT
University of Minnesota

RATE OF VEGETATIONAL CHANGE AT RICHMOND
GULF, PROVINCE OF QUEBEC, CANADA

JOHN MARR
University of Minnesota

RECENT GLACIAL HISTORY OF PRINCE WILLIAM
SOUND, ALASKA, FROM VEGETATIONAL
EVIDENCE

W. S. COOPER
University of Minnesota