Role of refuges in muskrat management. Number 10 1954

Mathiak, Harold A.; Linde, Arlyn F.
Madison, Wisconsin: Game Management Division, Wisconsin Conservation Department, 1954

ROLE OF REFUGES IN MUSKRAT MANAGEMENT

TECHNICAL WILDLIFE BULLETIN NUMBER 10

Game Management Division

WISCONSIN CONSERVATION DEPARTMENT

Madison

1954

ROLE OF REFUGES IN MUSKRAT MANAGEMENT

by

Harold A. Mathiak and Arlyn F. Linde

Pittman–Robertson Project 15-R

TECHNICAL WILDLIFE BULLETIN NUMBER 10

Game Management Division
WISCONSIN CONSERVATION DEPARTMENT
Madison

1954

ACKNOWLEDGEMENTS

We wish to thank Cyril Kabat, Chief of Wildlife Research for supervision and advice during the study; Robert S. Dorney and Harold D. Hettrick for assistance in the tagging program; and personnel of the Horicon Marsh Maintenance Project, especially Robert W. Dobbratz, for aid in the search for ear-tagged muskrats at the checking station.

Edited by RUTH L. HINE

TABLE OF CONTENTS

INTRODUCTION

Wisconsin with its abundant waterways and marshes has long been a leading producer of muskrats. In the peak year of 1952, over one and one-fourth million muskrats were harvested, thereby providing considerable income to trappers and others handling furs or trapping supplies. The size of the catch in any one year not only depends on the level of the muskrat population, but may be greatly influenced by weather conditions, trapping season limitations, and general economic conditions such as pelt prices and employment levels.

This refuge study was undertaken to investigate one factor affecting the size of the harvest which can often be controlled—that of complete protection by closing trapping seasons. In the present investigation, a 95-acre section of Horicon Marsh was declared a refuge and closed to trapping for two years. Where grossly inadequate harvests are obtained for any reason at all, a partial refuge can be said to exist. Therefore, many other refuges exist in this country because of closed trapping seasons or the lack of trapping despite open seasons.

Excessive protection to muskrat populations persists in many instances despite well-documented reports of the danger in attempting to stockpile this species (Lay, 1945). Habitat destruction, disease possibilities, excessive losses due to intra-specific strife, and climatic hazards to muskrats are ever present to nullify or prevent population increases in spite of under-harvesting policies; furthermore, it has been shown that the tremendous reproductive potential of the muskrat is not utilized when excessive breeding stocks are present (Errington, 1951).

During the past five-year period, based upon prevailing pelt prices, the loss of each rat from lack of harvesting or from depressed breeding represented a potential loss of $1.00 to $2.00 in value. Thus, proper management would be proportionately profitable.

Too frequently muskrats are under-harvested because the value of this resource is not appreciated, and management is focused entirely on huntable species, principally waterfowl. Ten years ago, Gabrielson (1943) clearly stated the benefits of muskrat activities to waterfowl, yet muskrat management apparently is still treated as a merely incidental chore, not as a technique which can be used to encourage greater waterfowl production and usage of an area.

OBJECTIVES

Our intent was first to analyze the restocking characteristics of a muskrat refuge. Do muskrats leave the refuge? If so, how many, when, and why? Where do they move? Is the restocking value of the refuge greater than the economic loss suffered by not harvesting within the refuge?

Secondly, we wished to determine the extent to which an untrapped muskrat population would increase in good habitat. If a very high population resulted, some temporary refuges might be justified, even if there was no significant restocking of adjacent habitats. Survival and longevity of muskrats also requires consideration in connection with a refuge study as considerable annual natural losses must occur if longevity is low and movement out of the refuge is small.

STUDY METHODS

Trapping unit 14 of the Horicon Marsh Wildlife Area was selected for the refuge study because of its excellent muskrat habitat, its central location in the marsh, and definite water boundaries on three sides (Figure 1). It was closed to trapping for two years. Emergent vegetation in the 95-acre trapping unit consisted largely of bulrushes (*Scirpus acutus* and *S. fluviatilis*), cattail (*Typha latifolia* and *T. angustifolia*), sedge (*Carex* sp.), and bur-reed (*Sparganium eurycarpum*). The adjacent trapping units, with similarly good habitat, are annually subjected to a heavy trapping pressure under a share-trapping system. This provides extensive, lightly-populated areas into which the refuge muskrats could move, if they so wished, without inducing undue strife with resident muskrats.

Knowledge of muskrat densities within the refuge was obtained mainly through the ear-tagging and subsequent recovery of refuge muskrats. Live-trapping of muskrats was attempted, but so few were captured that little information was obtained by this means. Litter-tagging, or the tagging of young muskrats caught in houses, proved a more successful technique. In litter-tagging, houses were opened hurriedly and any kits caught were quickly placed into a pail until ready for tagging. Often kits escaped into plunge holes before the operator could catch them. The

muskrat house then had to be opened sufficiently to expose all the plunge holes and the kits were caught, if possible, as they came to the surface for air. A few kits were captured swimming in the water outside of the houses.

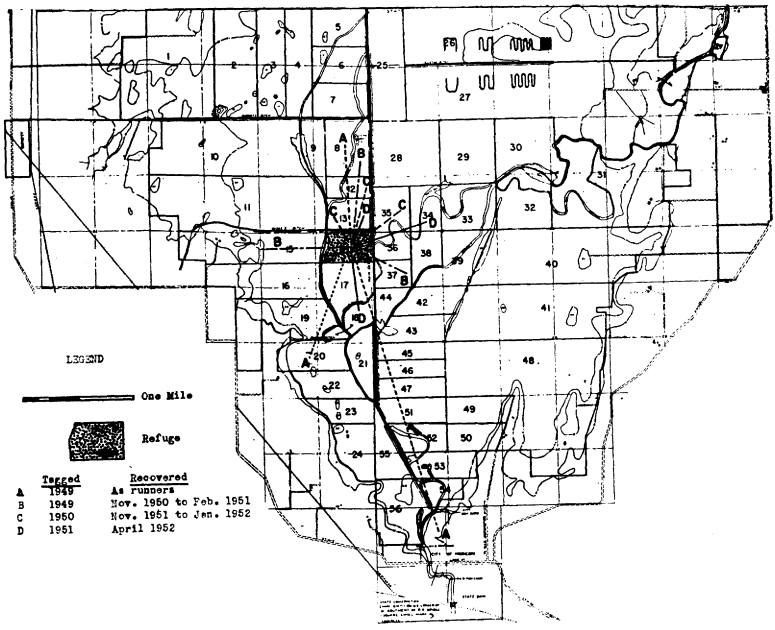

Figure 1. Horicon Marsh Wildlife Area showing location of refuge unit and the movements of tagged muskrats from the refuge.

Monel metal fingerling tags (Aldous, 1946) were attached to the right ears of all kits having tail lengths of at least 68 mm. (or weighing over 70 grams, Mathiak, 1949). The tail length of one kit selected at random for each litter was measured for aging purposes. After sexing, and tagging if the kits were sufficiently large, the house was roughly rebuilt over at least one plunge hole.

The recovery of ear-tagged muskrats caught by trappers on state land was a relatively simple operation. Under the conditions of the share-trapping system in operation at Horicon, all trappers were required to bring their day's catch to the conservation headquarters for counting and examination. All muskrats brought in were then inspected for ear tags by conservation department employees, and movements of tagged muskrats out of the refuge could thus be detected. In order for muskrats to move off of state lands where the share-trapping system is not in oper-

ation, they would have to move at least two miles to reach the nearest point of favorable muskrat habitat. Such movements are possible but not likely to occur in significant numbers to invalidate the findings of this study. Furthermore, the surrounding units are so heavily trapped that muskrats should be trapped for the most part between the refuge and any "outside" area.

In addition to the tagged muskrats found during the trapper's check, several tagged refuge muskrats were caught alive or found dead on the ice as winter runners. Most returns were obtained in 1951 when trapping within the refuge was resumed in order to determine the number of tagged muskrats within the refuge and to what extent, if any, the refuge muskrat population had increased under total protection.

RESULTS AND DISCUSSION

Movements

Our first consideration was the restocking value of the refuge. In the following section we will examine the data from the first- and second-year recoveries of litter-tagged muskrats in order to determine the number of muskrats which left the refuge when they emigrated, and the extent of their movements.

First year. Muskrat kits were litter-tagged in the refuge from 1949 to 1951. The number tagged and the distribution of recoveries is shown in Table 1. Three of the eight kits tagged in 1949 and recovered in the first trapping season were tagged very close to the south boundary of the refuge and were caught by a trapper just across the refuge line. There obviously was no emigration involved; apparently the refuge boundary ran through the home range of this particular litter. The other five first-year recoveries were winter-runner muskrats—two were caught in the refuge and three were recovered away from the refuge (Figure 1).

There were no first-year recoveries of the 154 kits litter-tagged in 1950. The low 1949 return and the zero 1950 return indicates the relative immobility of muskrats under favorable habitat conditions. Muskrats are known to swim across the water courses bounding three sides of the refuge, but no first-year recoveries were made near these boundaries. There are even greater opportunities to trap refuge muskrats just outside the south boundary of the refuge which is merely marked by a few iron posts in the bog; yet only three tagged refuge muskrats were taken

in this area (1949) in two years of trapping. These data contradict a widespread belief among trappers that many muskrats can be drawn out of a closed area by means of heavy trapping along the boundaries.

When trapping was resumed in the refuge in the fall of 1951 and early spring of 1952, 33 first-year recoveries were made of the 106 kits tagged in the summer of 1951. Only three of these were found outside the refuge, and all three were taken in the early spring season which commenced at the time of the spring break-up.

Table 1

Refuge Muskrats Tagged and Recovered from 1949–1951

Year	*No. Litter-Tagged*	*Number Recovered*			
		1949	*1959*	*1951*	*Total (Per cent of Tagged Sample)*
1949	149	8 (2)*	3 (0)	1 (1)	12 (8.1%)
1950	154	----------	0	5 (2)	5 (3.2%)
1951	106	----------	----------	33 (30)	33 (31.1%)

*Numbers in parentheses indicate muskrats recovered within the refuge.

Neither the 1949, 1950, or 1951 muskrat crops in this refuge, then, contributed *restocking* through movement for the first trapping season or winter period. This agrees with the report of Errington and Errington (1937) that young muskrats in good habitat are likely to remain in or near the locality of their birth through the first winter.

Although some muskrats did move out of the refuge, they were *runner* muskrats. When cold weather and freezing conditions cause muskrats to "freeze-out", they "run" in search of food and shelter. These runner muskrats seldom survive such unfavorable conditions until spring breakup to become breeders. Therefore, no restocking values can be credited to these movements.

The three spring recoveries suggest that if any major dispersal is likely to occur, it would take place during the *spring dispersal.* Breeding season intolerance probably constitutes the prime factor causing the muskrats to move at this time although spring floods may induce some movement. However, winter mortality, under Wisconsin conditions, could greatly decimate a refuge muskrat population in some years before restocking movements actually started.

Errington (1940) has pointed out that muskrat movements can be expected before the first winter in marsh areas subject to late summer drouth. These summer migrants are often conspicuous as road kills and may be found far from the nearest water. Movements from marshes which dry out completely, however, are not comparable to movements found in this refuge study, since the refuge area holds sufficient water to satisfy muskrats during drouth periods.

Dorney and Rusch (1953) have also reported considerably more first-year movements between trapping units by the muskrats handled during their growth study made on another portion of Horicon Marsh in 1950. The disturbance caused by their intensive study methods involving much rehandling may have been responsible for the more numerous movements observed. In the refuge study, all of the litters tagged were handled during a relatively short period, and only a few were rehandled. Some first-year movements between trapping units do occur naturally, of course, largely because of the extension of home ranges across unit boundaries. But such movements also cannot be considered as restocking movements.

Second year. In the 1950 trapping season, there were only three recoveries of the 149 kits tagged in 1949 (Table 1). These were, of course, trapped outside of the refuge. Similarly, in the 1951 season, three outside recoveries were made of the 154 kits tagged in 1950.

Such trivial numbers of restocking movements as measured by both the first- and second-year recoveries bestow a discouraging outlook to the value of the refuge. *Added production in the rest of the marsh because of this restocking would be insignificant compared to the direct losses sustained through lack of trapping in the refuge.* Although the second-year recoveries may have resulted from kits moving out of the refuge at any time after tagging, most of the movements probably occurred during spring dispersal following the first winter season of each year's crop of muskrats.

Extent of movement. Known movements of tagged muskrats out of the refuge are diagrammatically shown in Figure 1. The movements are plotted from the center of the refuge to the center of the unit in which the muskrats were recovered, since the exact point of recovery within the unit trapped is usually not known. The three longest movements (A) were made by muskrats tagged in 1949 and recovered as runners late in the same winter. At that time all water areas on the marsh were covered with thick ice, and these runners could not have

survived until spring. Lack of food and shelter combined with the activities of predators insured rapid death to the runners. The absence of trapping in the refuge seemed to be correlated with excessive numbers of runners. Food supplies were probably exhausted somewhat sooner due to the higher density of muskrats in the refuge. Observations made while driving through various parts of the marsh during the winter of 1949, showed that the incidence of runners originating in the refuge was noticeably greater than in the units which had been heavily trapped.

Second-year recoveries as shown by B and C in Figure 1 may have been short movements as in the case of the four muskrats taken in units adjacent to the refuge. It is more likely, however, that these constituted genuine restocking movements rather than home-range extensions across refuge boundaries. The spring dispersal movements of early 1952 are shown by C, Figure 1. All of the restocking movements shown are approximately one mile or less. Although the size of the sample of recoveries is naturally small, it appears that muskrats leaving a refuge tend to stop when suitable habitat conditions are found rather than moving aimlessly for long distances. On the other hand, the movements were long enough to indicate that from the point of view of movements alone muskrat refuges are not practical on private lands unless very large acreages are involved.

Population Changes Within the Refuge

Changes in over-all muskrat productivity in the refuge, as measured by the harvest, are compared to productivity changes of the four surrounding units for a four-year period in Table 2. Location of the four units in relation to the refuge can be seen in Figure 1. These four units produced 5.3 muskrats per acre in 1948 and 6.3 muskrats per acre in 1951, indicating a gain in productivity. The refuge dropped from 11.0 to 6.3 muskrats per acre during the same period. It is obvious that the refuge population did not build up, but actually decreased under the refuge or no trapping system. The assumption can be made that if trapping had been permitted in the refuge in 1949 and 1950, the yield per acre in 1951 would have been at least 6.3 muskrats per acre or probably even greater. These figures are affected very little by differences in trapping ability of trappers working in each unit.

There was a marked difference in wintering conditions between 1949 and 1950. The winter of 1949 was quite cold and snowless. Severe freezing of the bog caused some natural reduction in the refuge muskrat

population through winter running. The winter of 1950, however, was just the opposite. Heavy snows favored winter survival but made trapping difficult. The snow was so deep it covered many feeder houses and main houses so they could not be trapped. The low 1950 average yield of 3.8 muskrats per acre for the four units in Table 1, then, is a reflection of trapping difficulties rather than population levels. Therefore, in 1951 there was not a lack of breeding stock in or outside of the refuge.

Table 2

History of Muskrat Harvest in Refuge and Surrounding Units 1948–1951

Unit	Acres	1948		1949		1950		1951	
		'Rats	R/Acre	'Rats	R/Acre	'Rats	R/Acre	'Rats	R/Acre
13	67	518		329		287		722	
15	130	341		914		509		800	
17	106	656		627		337		432	
36	51	350		433		219		261	
	354	1865	5.3	2303	6.5	1352	3.8	2215	6.3
Refuge	95	1044	11.0	Closed	-------	Closed	-------	594	6.3

The drop from 11.0 to 6.3 muskrats per acre in the refuge showed that *the refuge failed in one major objective—the attempt to build up a high muskrat population by means of a "no trapping" policy.* Not only did the build-up fail to materialize, but the immediate cash value of the 1949 and 1950 crops of muskrats in the refuge was wasted, particularly since it was not counterbalanced by restocking values. The economic loss resulting from no commercial trapping during the two-year closure was considerable. Assuming that the production on the refuge would have averaged the same as that on adjacent trapped units, the 95-acre area might have provided a harvest of some 978 'rats during the 1949–50 trapping seasons. Based on the average pelt values for these two years, this amounted to a loss of over $1200. Actually, this is a very conservative estimate, for the muskrat population in the refuge was so high, according to the sign present, that twice as many muskrats could have been harvested in this area as the 978 'rats figured above (on the basis of the number trapped per acre in surrounding units). This would have made the monetary loss reach over $2000.

Survival and Longevity

Survival data provided by the recoveries of tagged muskrats give additional information on the value of a refuge in building-up a muskrat population. A comparison of second-year recoveries of kits tagged in the refuge with those tagged in the rest of the marsh is presented in Table 3. The number of known first-year recoveries has been subtracted from the number tagged in each group in order to determine the maximum number which might be available in the second trapping season. This indicated the maximum number available is necessarily much too high because of the heavy mortality which undoubtedly takes place before the first trapping season (Mathiak 1952, Dorney and Rusch 1953).

Table 3

Second Year Recoveries of Litter-tagged Muskrats Tagged in Refuge vs. Tagged in Rest of Marsh

Area	*Year Tagged*	*No. Tagged*	*No. First Year Recoveries*	*Maximum Available*	*No. Recoveries Second Year*
Refuge	1949	149	8	141	3 (2.1%)
Rest of Marsh	1949	1159	177	982	24 (2.4%)
Refuge	1950	154	0	154	5 (3.2%)
Rest of Marsh	1950	2405	455	1950	47 (2.4%)
Summary:					
Refuge	49 & 50	303	8	295	8 (2.7%)
Rest of Marsh	49 & 50	3564	632	2932	71 (2.4%)

When the second-year returns are grouped for the two years, there are eight or 2.7 per cent returns for the refuge muskrats and 71 or 2.4 per cent returns for all kits tagged in the rest of the marsh. Actually two of these eight refuge recoveries were obtained within the refuge in the 1951 trapping season. If the refuge policy had been extended one more year, the number of second-year refuge recoveries would have dropped to six or 2.0 per cent which is a lower rate of recovery than was found in the trapped population. *This negligible difference in recovery rates emphasizes the natural rapid turnover in muskrats which seems to be largely independent of trapping pressure.* Apparently as many second-year returns can be expected from a trapped as from an untrapped muskrat population.

The loss of muskrats due to complete protection for two years can be further demonstrated by comparing the total returns of muskrats litter-

tagged in the refuge to total returns for muskrats litter-tagged in other portions of Horicon Marsh in 1949 and 1950. At the end of the 1952 trapping season, 8.1 per cent (Table 1) of the kits tagged in the refuge in 1949 were recovered while 17.7 per cent of kits tagged in the rest of the marsh had been taken in the same period. There is a greater disparity in the returns for kits tagged in 1950 due to the absence of refuge runner returns. For the 1950 kits, 3.2 per cent of the refuge kits and 21.6 per cent of the kits in the annually trapped part of the marsh had been recovered by the end of the 1952 trapping season. This 18 per cent difference represents a large numerical loss of refuge muskrats.

A short life span is not unexpected in a mammal such as the muskrat which produces several large litters each year. If heavy decimating factors were not operating, a muskrat population would in short time increase to the point where the habitat would be completely destroyed. A total of 4,158 muskrat kits have been litter-tagged at Horicon (Truax, 1947, 1948 and Mathiak, 1951) which could have reached the age of three years or more during the present (1953–54) trapping season yet not one tagged muskrat has been recovered which reached the age of three years. A muskrat would have to be lucky to elude the trappers through three trapping seasons and survive three long winters under the ice. Recent winters have been relatively mild so that winter losses due to excessive freezing were not an important factor in these studies in the failure to recover tagged muskrats as old as three years.

MANAGEMENT RECOMMENDATIONS

Management practices to increase muskrat production will necessarily vary for different areas or even for the same area from year to year. Size of the marsh, location in respect to other muskrat habitat, food and water conditions, and weather extremes preclude the formation of rigid harvesting rules.

One of the main problems of muskrat management is the harvest. Observations in Wisconsin indicate that undertrapping is more prevalent than overtrapping. A yearly harvest is strongly recommended whenever average or larger populations are found. Failure to harvest a crop is strictly a gamble as to whether or not the population will be significantly larger the next year. Habitat deterioration, disease outbreaks, and incomplete utilization of the muskrat's reproductive potential are often associated with insufficient cropping. Adequate muskrat harvests in marshes,

particularly in public areas where waterfowl are of major importance, are a must from the standpoint of marsh management. Adequate harvests will provide a breeding population that maintains as high a level as the habitat will support. At the same time the habitat conditions will also remain relatively constant. Muskrat populations that fluctuate wildly damage themselves and affect the marsh habitat similarly so that other aquatic wildlife and perhaps fish are affected.

Muskrat refuges, therefore, established as a means of "protecting" the population, are not needed at all where control over trapping exists in some form, for the entire area can be trapped and the harvest terminated in each section as desired.

Submarginal habitats also require little consideration in trapping practices for the total production is low and natural restocking will prevent any prolonged absence of breeding stock. Generally speaking, areas in which winter survival is uncertain should be trapped heavily, while deeper water areas can be trapped more lightly if the presence of extra breeding stock seems desirable. However, if only small numbers of muskrats are harvested for purposes of allowing a population to increase, careful observations should be made to watch for "eat-outs" or incidence of disease.

Refuges on small holdings are hardly justifiable since spring movements out of the area are likely to be of most benefit to other landowners.

On the other hand, small muskrat refuges may be desirable on public lands where there are no restrictions on trapping pressure. Several trappers operating at each muskrat house or den on an area could seriously deplete a muskrat population. Muskrat refuges should be located in deeper water areas where winter survival is likely to be high. If areas are set aside as refuges it may be necessary to rotate the selected sites to prevent habitat damage.

SUMMARY

The muskrat is important in Wisconsin—both from the standpoint of being a furbearer, and also because it has a profound effect on the management of marshes for all wildlife. Therefore, means of maintaining or increasing the production of muskrats are being sought. This study was initiated to see if muskrat refuges might be justified in good habitat. Refuge conditions occur commonly because many areas are undertrapped for various reasons resulting in inadequate harvests.

A 95-acre trapping unit with excellent food and water conditions which was centrally located in Horicon Marsh was closed to trapping for two years. From 1949–1951, 409 muskrat kits were litter-tagged in this refuge unit. Ear-tagged muskrats were recovered when share-trappers operating in adjacent trapping units brought their day's catch into the headquarters' checking station.

Records of recovery of tagged muskrats in any one year indicated that movement out of the refuge before the first winter was inconsequential. Some movement out of the refuge took place during the spring break-up coincident with the spring dispersal. However, total movements out of the refuge were so few that restocking values could hardly begin to compensate for the direct loss sustained by failure to harvest the two crops of muskrats within the refuge.

Comparison of the harvest history of the refuge with four surrounding trapping units showed that cessation of trapping failed to build up the muskrat population within the refuge, and wasted the cash value of the muskrat crop during the two-year closed period.

Total recoveries of muskrats litter-tagged in the refuge were much lower than recoveries of kits tagged in other portions of the marsh, indicating the economic loss suffered by not trapping. Second-year recoveries on surviving muskrat kits tagged in the refuge and the untrapped residue of kits tagged in the rest of the marsh were practically equal. Survival rates after the first winter therefore seemed to be independent of trapping pressure.

A short life span is indicated for the muskrat due to the failure to recover any tagged muskrat as old as three years from a total sample of 4,158 litter-tagged muskrats.

LITERATURE CITED

Aldous, Shaler E. 1946. Live trapping and tagging muskrats. Jour. Wildl. Mgt. 10(1):42–44.

Dorney, Robert S. and Alan J. Rusch. 1953. Muskrat growth and litter production. Tech. Wildl. Bull. No. 8. Wis. Cons. Dept. Madison, Wisconsin. 32 pp.

Errington, Paul L. 1940. Natural restocking of muskrat-vacant habitats. Jour. Wildl. Mgt. 4(2):173:185.

————, 1945. Fur refuge experiments pay out. Iowa Conservationist. 4(10):175,6.

Errington, Paul L. and Carolyn Storm Errington. 1937. Experimental tagging of young muskrats for purposes of study. Jour. Wildl. Mgt. 1(3,4):49–61.

Gabrielson, Ira N. 1943. Wildlife Refuges. 257 pp, Illus. Macmillan Co. New York.

Lay, Daniel W. 1945. The problem of undertrapping in muskrat management. Trans. Tenth N.A. Wildl. Conf. pp. 75–78.

Mathiak, Harold A. 1949. Wisconsin Fur Research Project (15–R) Wis Wildl. Res. 7(4):49–53.

————, 1951. Wisconsin Fur Research Project (15–R). Wis. Wildl. Res. 10(4):59–65.

————, 1952. Wisconsin Fur Research Project (15–R). Wis. Wildl. Res. 11(2):59–65.

Truax, Wayne C. 1947. Wisconsin Fur Research Project (15–R). Wis. Wildl. Res. 6(3):95–105.

————, 1948. Wisconsin Fur Research Project (15–R). Wis. Wildl. Res. 7(2):70–72.