



# **PHEASANTS:**

*Symptoms of Wildlife Problems  
on Agricultural Lands.*

Edited by

*D. L. Hallett*

*W. R. Edwards*

*G. V. Burger*

# **PHEASANTS: Symptoms of Wildlife Problems on Agricultural Lands**

Edited by

**Diana L. Hallett**

Missouri Department of Conservation

**William R. Edwards**

Illinois Natural History Survey

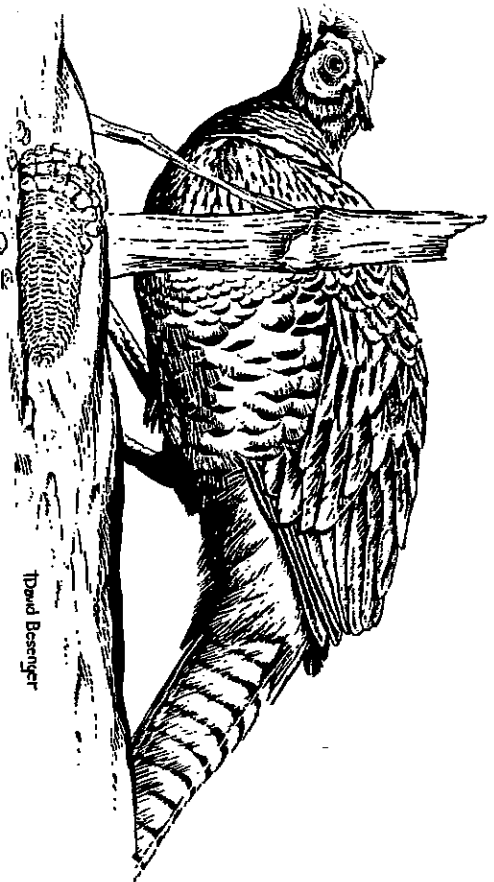
**George V. Burger**

Max McGraw Wildlife Foundation

Proceedings of a Symposium  
held at the 49th Midwest Fish and  
Wildlife Conference Milwaukee, Wisconsin  
8 December 1987

Sponsored by  
The Northcentral Section of The Wildlife Society

1988



Library of Congress Catalog Card Number  
88-63231

Cover Photograph by Ken Willhoite  
Photograph courtesy of Missouri Department of Conservation

Q2  
696  
.G27  
P54  
1988

## PREFACE

As a point of background to this Symposium, the Midwest Pheasant Council—for 20 years the mechanism bringing pheasant research biologists and managers together to share ideas and new information—was disbanded in 1979 by the Midwest Association of Fish and Game Commissioners. Attendees at the final meeting of the Council unanimously voiced strong interest in continuing communication. This interest resulted, in part, in inclusion of pheasant papers in a multi-species workshop at the 1983 Perdix III Symposium. The same needs and interest were expressed at the 1985 annual business meeting of the North Central Section (NCS) of The Wildlife Society. This Symposium is the latest product of the ongoing need to share new information on the ring-neck.

Although pheasant research has been much reduced in recent years, there are important new ideas to report. As George Burger points out, while much research has been undertaken, no significant book on wild pheasants in America has been published in over 30 years. Pheasant life history, artificial propagation, and population regulation were reviewed at a 1973 NCS Symposium. This (1987) Symposium was not designed to update information from 1973; instead we stress perspectives from new pheasant research basic to management under changing midwestern agricultural landscapes.

The basic objective of the Symposium was to: concisely review, summarize, and present current information about the wild ring-necked pheasant, especially in relation to its habitat. Pheasants were used as an example of an upland game bird in the Midwest for presenting management innovations for the 1990's.

The initial papers of this Proceedings set the scene: the midwestern landscape, its change to intensive agricultural land use, and how the altered habitats impact ring-necked pheasants. Two papers deal with fluctuations in pheasant abundance coincident with changes in agricultural landscapes. The 3 papers that follow address policies influencing pheasant habitat: multi-year cropland diversions, annual set-aside acreages, and transitions from livestock-based agriculture to intensive row-cropping. Ensuing papers describe innovative approaches to management: genetic applications to population management; population modeling, stressing survival as a limiting factor; the role of predation; resource demands and how to meet them; and interspecific interactions between pheasants and other upland game birds. The final papers use historical lessons to better predict further directions in pheasant research and management.

Literature Citation Should Read as Follows:  
Author(s). 1988. *Title of chapter*. Pages \_\_\_\_\_ in D. L. Hallett, W. R. Edwards, and G. V. Burger (eds.), *Pheasants: Symptoms of Wildlife Problems on Cultural Lands*. North Central Section of The Wildl. Soc., Bloomington, IL. 345pp.

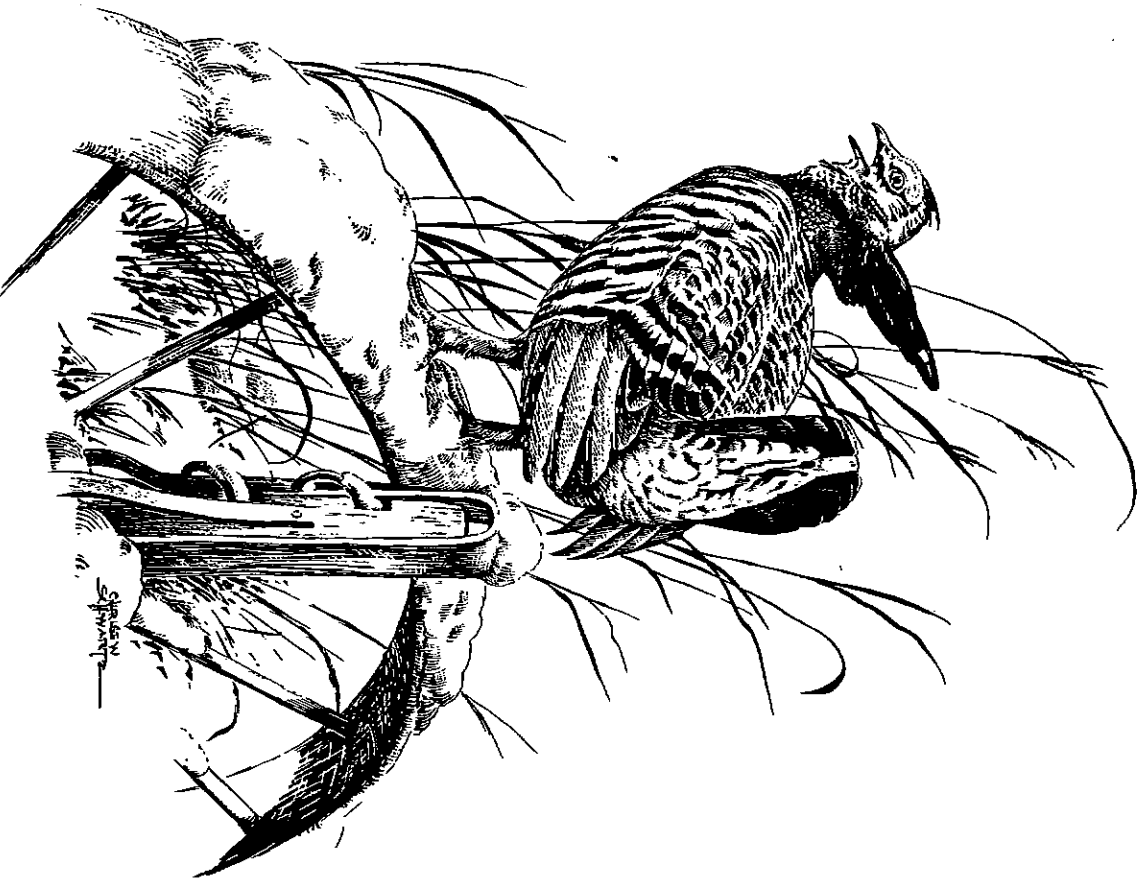
From: PHEASANTS: SYMPOSIUM OF  
WILDLIFE PROBLEMS ON AGRIC. LANDS

D. H. WALLST, ED.

Proceedings 1987

NORTH-CENTRAL TRUS

13



## Potential Impacts of Ring-Necked Pheasants on Other Game Birds

RICHARD O. KIMMEL, Farmland Wildlife Populations and Research Group, Minnesota Department of Natural Resources, Madelia, MN 56062

**Abstract:** Evidence, often circumstantial, indicates that ring-necked pheasants (*Phasianus colchicus*) may adversely impact the abundance of gray partridge (*Perdix perdix*), greater prairie-chickens (*Tympanuchus cupido pinnatus*), and possibly other species via nest parasitism, competition for habitat, transmission of disease, and aggressive behavior. It is postulated that pheasants raised by another species as a result of nest parasitism imprint to the host species, increasing the possibility of interspecific interactions. Potential negative impacts should be considered in management decisions and planning introductions.

**Key Words:** gray partridge, interspecific interactions, nest parasitism, prairie-chicken, ring-necked pheasant

Wildlife managers have expressed concern about negative impacts of ring-necked pheasants on the abundance of other prairie and farmland species, such as gray partridge, greater prairie-chickens, and prairie nesting ducks. While much of the evidence is contained in brief reports and is often circumstantial, information that exists warrants consideration in decisions regarding pheasant introductions.

Herein, I review reports of pheasant interactions with other species and explore costs to the species involved. Because most reports of negative interactions between pheasants and other North American species involve nest parasitism, I will examine it in detail. I will also explore competition for habitat, disease, and aggressive interaction concluding with discussions of population relationships between pheasants and other species, and management strategies.

### NEST PARASITISM

The tendency of pheasants to lay eggs haphazardly... (Carlson and Rolling, 1951) and in nests of other birds (Johnson et al., 1984, Baskett

1947), the overlapping nesting requirements of pheasants with other prairie upland birds and waterfowl, and the tendency of pheasants to nest near other birds (Carlson and Rollings 1941b) are behaviors leading to interspecific nest parasitism by pheasants. This nest parasitism has been thought to negatively impact gray partridge, prairie-chickens, and possibly other species.

### Species Involved

There are numerous reports of gray partridge nests containing pheasant eggs (Tegetmeier 1904, Yeatter 1934, Hamerstrom 1936, Errington and Hamerstrom 1938, North Dakota Game and Fish Department 1942, Yocum 1943, Schrader 1944, Erickson et al. 1951, Edminister 1954). In many cases the incidence of parasitized nests is relatively low. Reported proportions of gray partridge nests containing pheasant eggs are 1.3-7.1% (Carlson and Rollings 1942b, Knott et al. 1943, McCabe and Hawkins 1946). Errington and Hamerstrom (1938) and Carlson and Rollings (1941b) indicated a much higher incidence (>25%) of pheasant parasitism. Parasitized partridge nests have contained 1-20 pheasant eggs (Carlson and Rollings 1941a, b, Carlson 1943, McCabe and Hawkins 1946).

Pheasant eggs have been reported in prairie-chicken nests (Carlson and Rollings 1941a, Vance and Westemeier 1979). Carlson and Rollings (1941a) reported that 2 of 12 prairie-chicken nests in Minnesota each contained 1 pheasant egg. Vance and Westemeier (1979) found that 17 of 197 (3%) prairie-chicken nests in Illinois contained pheasant eggs.

Instances of nest parasitism by pheasants occur for northern pintail (*Anas acuta*) (Carlson and Rollings 1941a, Rollings 1941, Erickson et al. 1951), blue-winged teal (*A. discors*) (Hamerstrom 1936, Carlson and Rollings 1941a, b, Rollings 1941, Erickson et al. 1951, Glover 1956, Nickell 1966, Evans and Wolfe 1967, Baxter and Wolfe 1973), northern shoveler (*A. clypeata*) (Bennett 1936, Baxter and Wolfe 1973), mallard (*A. platyrhynchos*) (Bennett 1938, Carlson and Rollings 1941a, b, Miller and Collins 1954, Baxter and Wolfe 1973). The proportion of waterfowl nests containing pheasant eggs has been reported as 3.7-6.8% (Bennett 1936, Girard 1939, Glover 1956, Baxter and Wolfe 1973). Parasitized waterfowl nests have contained 1-11 pheasant eggs (Bennett 1936, Sharp and McClure 1945, Baxter and Wolfe 1973).

Pheasants parasitize nests of other species, including northern bobwhite (*Colinus virginianus*) (Hamerstrom 1936), king rail (*Rallus elegans*) (Hamerstrom 1936), Virginia rail (*R. limicola*) (Bennett 1936), American woodcock (*Tax minor*) (Leedy and Hicks 1945), blue grouse (*Dendragapus*) (Leedy and Hicks 1945), ruffed grouse (*Bonasa*

*umbellus*) (Bump et al. 1947, Kenaga et al. 1955, Klabbe 1958), turkey (*Meleagris gallopavo*) (Carlson 1943), and domestic chicken (*Gallus gallus*) (Carlson and Rollings 1941b). Tegetmeier (1904) provides records of pheasant eggs in "wood pigeon" and "squirrel" nests in trees. Bump et al. (1947) reported finding pheasant eggs in 11 of 2,016 (0.5%) ruffed grouse nests in New York in areas where woodlands and farms overlapped.

### Consequences of Nest Parasitism

When a nest is parasitized, outcomes vary. Carlson and Rollings (1941a, b) reported abandonment of gray partridge nests due to the presence of many pheasant eggs. Westemeier (1983) noted that nest parasitism by pheasants resulted in both lower hatching success and parasitic broods in prairie-chickens. Pheasant eggs deposited in waterfowl nests may reduce the number of eggs deposited by the host (Bennett 1938).

Vance and Westemeier (1979) suggested that increased predation could be related to nest parasitism; of 17 parasitized nests, 4 hatched successfully, 2 were abandoned, and 11 were depredated. Visits uncovering the nest by a pheasant may increase vulnerability to predation. A nest parasitized by pheasant eggs can result in hatching the young of the host species, the parasitizing species, or both with outcome related to differences in incubation periods of the species involved and the behavior of the incubating hen.

Dumke (1980) reported the incubation period for partridge to be 24-25 days and Knott et al. (1943) reported the incubation period for pheasant to be 23.5 days. If pheasant eggs are deposited in a partridge nest prior to incubation, pheasant chicks could hatch before the partridge eggs hatch. Partridge hen may leave the nest with pheasant chicks and abandon her own clutch. Partridge adults accompanied by a pheasant chick were reported by McCabe and Hawkins (1946), Jenkins (1961), and Wishart (1977:31). In Minnesota I have received reports of partridge pairs with chicks of both species.

Of 12 blue-winged teal nests parasitized by pheasants, pheasant eggs hatched along with teal eggs in 2, 7 nests did not hatch, and 3 hatched only (Bennett 1938). The incubation period for blue-winged teal is 24.2 days (Bellrose 1976), about 1 day longer than for pheasant. Hamerstrom (1936) and Carlson and Rollings (1941b) reported finding parasitized teal nests where eggs of both pheasants and teal had hatched. Nickell (1966) reported pheasants hatching before ducklings in teal nest and an observation of pheasant chicks on the back of a teal.

For waterfowl, "A few of these mixed clutches are successfully incubated, but how the pheasant chicks get along with their foster

brothers and parents is not known" (Erickson et al. 1951:24). With mixed broods, the situation should be resolved the first time the brood takes to water.

Bump et al. (1947:289) reported the incubation period of ruffed grouse to be 24 days, and that pheasant eggs hatch first, "sealing the doom of her own clutch." Kenaga et al. (1955) observed a ruffed grouse in Michigan leaving a nest with 4 pheasant chicks, abandoning viable ruffed grouse eggs that were close to hatching.

### Observations of Parasitized Nests of Captive Gray Partridge

In an attempt to determine the effects of pheasant nest parasitism on gray partridge, I studied captive gray partridge incubating clutches containing both partridge and pheasant eggs. Two pheasant eggs were placed in each of 32 partridge nests after the twelfth partridge egg was laid; 14 nests contained only partridge eggs. After hatching, behavior of adults and chicks was recorded.

During 1984-88, partridge incubated 17 clutches artificially parasitized with pheasant eggs. Of 9 parasitized clutches that hatched, 6 produced broods containing both partridge and pheasant chicks, 2 contained only partridge chicks, and 1 clutch hatched only pheasant chicks.

### Imprinting Considerations

Imprinting determines perception of species and, therefore, the object to which an individual directs social behaviors as an adult (Lorenz 1937). Such behaviors include mating, defense of territory, and flocking. Interspecific imprinting may explain examples of mixed-species coveys involving pheasants (e.g., Nelson 1964) and mixed-species/pheasant hybrids (e.g., Lincoln 1950, Reichholf 1982).

Schein (1963) hypothesized that an individual imprinted to another species will preferentially attempt to mate with the other species, even if conspecifics are available, as demonstrated for Coturnix quail (*Coturnix coturnix japonica*) imprinted to northern bobwhite (Kimmel and Schein 1971). Imprinting potentially explains situations where a pheasant disrupts prairie-chicken mating activity. Follen (1966) reported a male pheasant chasing a booming prairie-chicken and then displaying like a pheasant. Vance and Westemeier (1979) reported a pheasant disrupting the breeding behavior of a male prairie-chicken and then courting a female prairie-chicken. In theory, social behaviors for pheasant cocks

hatched from a parasitized prairie-chicken nest would be directed at prairie-chickens. However, such behaviors would be innately controlled and characteristic of pheasants.

Prairie-chickens gather at leks to display and breed. Male chickens establish small displaying territories in close proximity on booming grounds (Johnsgard 1973). Cock pheasants establish large territories and do not tolerate other males (Trautman 1982). Thus, in theory, a pheasant imprinted to prairie-chickens would be expected to be attracted to a booming ground, attempt to defend a territory the size of which is characteristic of pheasants, and display to prairie-chicken hens. A pheasant in such a case would attempt to defend an entire booming ground and totally disrupt prairie-chicken mating activities on that ground (e.g., Sharp 1957, Vance and Westemeier 1979).

Mating by conspecifics imprinted to other species has been demonstrated in the laboratory (e.g., Kimmel and Schein 1971). Schein (1963) hypothesized earlier that an individual imprinted to another species would mate with members of its own species in the absence of the imprint species. A hen pheasant imprinted as a result of a parasitized nest to prairie-chickens could be mated by a male pheasant and lay fertile eggs. An underlying question: is a hen pheasant imprinted to prairie-chickens as a result of a parasitized nest more likely to parasitize nests of the imprint species?

### Population Density/Nesting Cover Relationships

Errington and Hamerstrom (1938) noted a relationship between the incidence of nest parasitism of gray partridge and pheasant density. In 1934, drought resulted in limited nesting cover, and 5 of 11 nests were parasitized; in 1933 and 1935, 2 of 15 nests were parasitized. Errington and Hamerstrom (1938) concluded that shortage of acceptable nesting sites resulted in increased interspecific competition. Similarly, Bennet (1936, 1938) noted a relationship between the degree of parasitism of waterfowl nests and pheasant density in Iowa. During 1933-35, when he recorded pheasant densities of 1 hen per 4-5 acres, many parasitized duck nests were found. In 1936, after a severe winter had greatly reduced the pheasant population, he found no parasitized duck nests.

Carlson and Rollings (1941b) felt that pheasant nest-parasitism in northwestern Minnesota was not significant for prairie-chickens because of large amounts of available nesting cover, but speculated that pheasant parasitism was a serious limiting factor where intensive agriculture concentrated pheasants into limited nesting cover. While there are reported differences in types of cover used for nesting by pheasants, and

other species that nest in grasslands, reduced amounts of available cover tend to concentrate these species, thus increasing nest parasitism (e.g., Evans and Wolfe 1967).

### Significance of Nest Parasitism

There are differences in opinion on the significance of pheasants parasitizing nests of gray partridge. Leedy and Hicks (1945) felt nest parasitism by pheasants in Ohio was so infrequent as to be unimportant. However, W. R. Edwards (personal communication) found a view, widespread among Ohio game wardens in 1951, that pheasants were responsible for partridge declines in northwestern Ohio in the 1930's and early 1940's. In 1951-53, Edwards found no partridge in parts of Ohio inhabited by pheasants. R. Potts (personal communication) believed that pheasant parasitism of partridge nests on game-keepered estates in England was not a significant factor affecting partridge numbers. Weigand and Janson (1976) felt that few pheasant eggs laid in nests of other birds hatch.

Well over 40 years ago, Carlson and Rollings (1941b) believed that pheasant nest parasitism was a factor limiting the increase of gray partridge in southern Minnesota. They noted that 3 of 6 parasitized partridge nests were abandoned. Failure of parasitized partridge nests was noted in Wisconsin by McCabe and Hawkins (1946).

## OTHER MECHANISMS

### Competition for Habitat

Niche overlap between pheasants and other species occupying similar habitats can result in competition for limited resources. Introduced species, such as the pheasant, can result in reduced populations of native species through competition for habitat (Leedy and Hicks 1945)—areas in Ohio with high concentrations of pheasants had fewer bobwhites, although habitat was good for bobwhites. Errington (1945) reported competition between pheasants and bobwhites for winter cover, finding that bobwhite densities in Wisconsin were lower in winter cover when pheasants were present.

Westerskov (1964) indicated possible competition for roosting, feeding, and nesting habitat between gray partridge and pheasants. Potts (1970) noted possible competition for insects, an important food source for young of both partridge and pheasants. Mettler (1977) noted competition between pheasants and partridge where habitat was limited in intensive

agricultural areas in Minnesota.

The potential for competition for habitat between prairie grouse and pheasants is not clear. Sharp and McClure (1945) reported pheasant competition for food with sharp-tailed grouse in Nebraska. Edminster (1954) noted that pheasants and prairie-chickens rely on the same food; but suggested that this was not a significant factor limiting prairie chicken populations. Westemeier (1983) indicated potential competition between pheasants and prairie-chickens for habitat for mating, nesting and roosting.

Reichholf (1982:18) described a "retreat" of black grouse (*Tetrao tetrix*) in central Europe as a result of possible competition with pheasants for habitat. A habitat shift from lowlands to boreal and alpine habitats by black grouse was suggested as an example of character displacement as a mechanism for coexistence with pheasants (e.g., McNaughton and Wolf 1970).

### Disease

Lund and Chute (1972) found that pheasants were able to tolerate infections of blackhead (*Histomonas meleagridis*), and suggested that pheasants could disseminate blackhead to other gallinaceous birds concluding (1972:6) "...species of birds highly susceptible to histomoniasis cannot thrive for long if they must share their territory with the pheasant." Species highly susceptible to blackhead include ruffed grouse and chukar (*Alectoris graeca*). Pheasants may introduce blackhead to gray partridge (Bishop et al. 1977, Wright et al. 1980).

Losses of wild turkey poults in Pennsylvania followed a severe winter when pheasants and wild turkeys shared feeding stations (Lund and Chute 1972).

### Aggressive Interactions

Wildlife literature contains reports of pheasants impacting other species through aggressive interactions. Pheasant aggression on prairie-chicken booming grounds has been well documented (Harger 1956, Anderson 1969). There are accounts of pheasants killing prairie-chickens (Leopold 1933, Mohler 1952, Vance and Westemeier 1979), gray partridge (Bent 1932), and bobwhites (Leopold 1931). Vance and Westemeier (1979) noted that, in 78% of pheasant x prairie-chicken encounters, pheasant dominated prairie-chickens. Svedarsky et al. (1982) noted several instances of male pheasants harassing feeding prairie-chickens.

Careful planning is imperative when introducing or managing pheasants. Wildlife programs may intentionally manage against pheasants in areas holding remnant flocks of prairie-chickens. Attempts to reestablish prairie-chickens, or introduce gray partridge into areas holding even moderate pheasant densities, may be futile. While evidence is not as abundant for other species, concern for pheasant impacts on bobwhite, ruffed grouse, wild turkey, sharp-tailed grouse (*Tympanuchus phasianellus*), and—possibly—waterfowl is warranted.

Current attempts to introduce Sichuan pheasants (*Phasianus colchicus strauchii*) into Michigan and other states may impose a new threat. The Sichuan pheasant apparently differs from the ringneck in habitat use (Squibb 1985). The Sichuan pheasant potentially could impact a different array of species, including bobwhite, ruffed grouse, sharp-tailed grouse, and wild turkey. Regarding introductions of Sichuan pheasants into Pennsylvania: "although the Chinese birds prefer forest type covers, they should not compete with ruffed grouse for nesting habitat" (Pennsylvania Game Commission 1987). Question: is "should not compete" good enough?

## ACKNOWLEDGMENTS

My thanks to LeRoy Petersen and Al Berner for encouragement to write this paper. Ron Westemeier's significant research and willingness to always share ideas has been appreciated. M. Baker, B. Fritz, P. Coult, B. Haroldson, K. Haroldson, D. Hildreth, D. Lehman, C. Lewis, D. Lockman, S. Malchow, T. Schmitz, and R. Welsh assisted with behavioral observations in the pen study, and Rick Erpelding assisted with the pen study and literature review. David Austin, Kevin Church, William Edwards, Roger Lake, Dan Svedarsky, Ron Westemeier, and Alice Wywialowski provided helpful criticism of this manuscript.

## LITERATURE CITED

- ANDERSON, R. K. 1969. Mating and interspecific behavior of greater prairie chicken. PhD Thesis, Univ. Wisconsin, Madison. 131pp.
- BASKETT, T. S. 1947. Nesting and production of the ring-necked pheasant in north-central Iowa. Ecol. Monogr. 17:1-30.
- BAXTER, W. L. and C. W. WOLFE. 1973. Life history and ecology of the ring-necked pheasant in Nebraska. Nebraska Game and Parks Comm., Lincoln. 58pp.
- BELLOUSE, F. C. 1976. Ducks, geese and swans of North America, second ed. Stackpole Books, Harrisburg, PA. 544pp.

- BENNETT, L. J. 1936. The ring-necked pheasant as a nesting parasite of other game birds. Iowa State Coll. J. Sci. 10:373-375.
- \_\_\_\_\_. 1938. The blue-winged teal: its ecology and management. Collegiate Press, Inc., Ames, IA. 144pp.
- BENT, A. C. 1932. Life histories of North American gallinaceous birds. U.S. Govt. Printing Off., Bull. 162. 490pp.
- BISHOP, R. A., R. C. NOMSEN and R. D. ANDREWS. 1977. A look at Iowa's Hungarian partridge. Pages 10-31 in G. D. KOBRIGER, ed. Proc. Perdix I: Hungarian partridge workshop. North Dakota Game and Fish Dep., Dickinson. 233pp.
- BUMP, G., R. W. DARROW, F. C. EDMINSTER and W. F. CRISSEY. 1947. The ruffed grouse—life history, propagation, management. New York State Legislature. 915pp.
- CARLSON, C. E. 1943. Unusual pheasant nests in Minnesota. Flicker 15:29-31.
- \_\_\_\_\_. and C. T. ROLLINGS. 1941a. Upland game bird division report. Minnesota P-R Quart. 1(2):8-13.
- \_\_\_\_\_. and \_\_\_\_\_. 1941b. Quarterly progress report—wildlife research. Minnesota P-R Quart. 1(3):79-110.
- \_\_\_\_\_. and \_\_\_\_\_. 1942a. Reproductive success, habits and requirements of the Hungarian partridge. Minnesota P-R Quart. 2(2):60-67.
- \_\_\_\_\_. and \_\_\_\_\_. 1942b. Reproductive success, habits and requirements of the Hungarian partridge. Minnesota P-R Quart. 2(3):45-68.
- DUMKE, R. T., Coordinator. 1980. A gray partridge management/research plan for North America. Pages 165-197 in S. R. PETERSON and L. NELSON JR., eds. Proc. Perdix II: gray partridge workshop. For., Wildl. and Range Exp. Stn., Univ. Idaho, Contrib. 211. 244pp.
- EDMINSTER, F. C. 1954. American game birds of field and forest. Charles Scribner's Sons, New York. 490pp.
- ERICKSON, A. B., D. B. VESALL, C. E. CARLSON and C. T. ROLLINGS. 1951. Minnesota's most important game bird the pheasant. Flicker 23:23-49.
- ERRINGTON, F. L. 1945. Some contributions of a fifteen-year local study of the northern bobwhite to a knowledge of population phenomena. Ecol. Monogr. 15:3-34.
- \_\_\_\_\_. and F. N. HAMERSTROM JR. 1938. Observations on the effect of a spring drought on reproduction in the Hungarian partridge. Condor 40:71-73.
- EVANS, R. D. and C. W. WOLFE. 1967. Nest parasitism between duck and pheasants. Nebraska Bird Rev. 35(2):47.
- FOLLEN, D. G. SR. 1966. Prairie chicken vs pheasant. Passenger Pigeon 28(1):16-17.
- GIRARD, G. L. 1939. Notes on life history of the shoveler. Trans. N. Am. Wildl. Conf. 4:364-371.
- GLOVER, F. A. 1956. Nesting and production of blue-winged teal (*Anas discors Linnaeus*) in northwest Iowa. J. Wildl. Manage. 20:28-46.
- HAMERSTROM, F. N. JR. 1936. A study of the nesting habits of the ring-necked pheasant in northeast Iowa. Iowa State Coll. J. Sci. 10(2):173-203.
- HARGER, E. M. 1956. Behavior of a ring-necked pheasant on a prairie chicken booming ground. Wilson Bull. 68:70-71.
- JENKINS, D. 1961. Population control in protected partridges (*Perdix perdix*). J. Animal Ecol. 30:235-258.
- JOHNSGARD, P. A. 1973. Grouse and quails of North America. Univ. Nebraska Press. 553pp.



- JOSELYN, B. a. . . LAKE, compilers. 1986. Status of wildlife populations, fall 1986 and 1979-1985 hunting and trapping harvest statistics. Unpubl. rep., Sect. Wildl., Minnesota Dep. Nat. Resour., St. Paul. 119pp.
- KENAGA, E. E., M. A. WOLF and A. E. DOTY. 1955. A mixed clutch of ruffed grouse and ring-necked pheasant eggs hatch on the same day. *Auk* 72:80-81.
- KIMMEL, R. O. and R. ERPELDING. 1987. Utilization of gray partridge by hunters in Minnesota. Pages 133-135 in R. O. KIMMEL et al., eds. *Perdix IV: gray partridge workshop*. Minnesota Dep. Nat. Resour., Madelia. 155pp.
- and M. W. SCHEIN. 1971. Sexual behavior in Japanese quail as influenced by imprinting and taming. *Am. Zool.* 11:622.
- KLEBBE, C. E. 1958. Deposition of pheasant eggs in ruffed grouse nest. *Murrelet* 39(1):10.
- KNOTT, N. P., C. C. BALL and C. F. YOCUM. 1943. Nesting of the Hungarian partridge and ring-necked pheasant in Whitman County, Washington. *J. Wildl. Manage.* 7:283-291.
- KOBRIGER, G. D., ed. 1977. *Proc. Perdix I: Hungarian partridge workshop*. North Dakota Fish and Game Dep., Dickinson. 238pp.
- LEEDY, D. L. and L. E. HICKS. 1945. The pheasants in Ohio. Pages 57-130 in W. L. McATEE, ed. *The ring-necked pheasant and its management in North America*. Am. Wildl. Inst., Washington, DC. 320pp.
- LEOPOLD, A. 1931. Game survey of the north central states. *Am. Game Assoc.*, Washington, DC. 299pp.
- . 1933. Game management. Charles Scribner's Sons, New York. 481pp.
- LINCOLN, F. C. 1950. A ring-necked pheasant x prairie chicken hybrid. *Wilson Bull.* 62:210-212.
- LORENZ, K. Z. 1937. The companion in the bird's world. *Auk* 54:245-273.
- LUND, E. E. and A. M. CHUTE. 1972. The ring-necked pheasant (*Phasianus colchicus torquatus*) as a host for *Heterakis gallinarum* and *Histomonas meleagridis*. *Am. Midl. Nat.* 87:1-7.
- MCCABE, R. A. and A. S. HAWKINS. 1946. The Hungarian partridge in Wisconsin. *Am. Midl. Nat.* 36:1-75.
- MCCROW, V. P. 1982. Gray partridge habitat use and nesting biology in north-central Iowa. PhD Thesis, Iowa State Univ., Ames. 239pp.
- MCNAUGHTON, S. J. and L. L. WOLF. 1970. Dominance and the niche in ecological systems. *Science* 167:131-139.
- METTLER, B. J. 1977. Factors contributing to the increase of the gray partridge in Minnesota. *Loon* 49(4):205-210.
- MILLER, A. W. and B. D. COLLINS. 1954. A nesting study of ducks and coots on Tule Lake and Lower Klamath National Wildlife Refuge. *California Fish Game* 40:17-37.
- MOHLER, L. L. 1952. Fall and winter habits of prairie chickens in southwest Nebraska. *J. Wildl. Manage.* 16:9-23.
- NELSON, L. K. 1964. A ten-year study of ring-necked pheasant introductions in Kentucky. *Kentucky Dep. Fish Wildl. Resour. P-R Game Manage. Rep.* 14. 153pp.
- NICKELL, W. P. 1966. Ring-necked pheasants hatch in nest of blue-winged teal. *Wilson Bull.* 78:472-474.
- North Dakota Game and Fish Department. 1942. Upland game nesting studies, 1942. *North Dakota Game and Fish Dep. P-R Rep.* 278. 51pp.
- Pennsylvania Game Commission. 1987. Commission acquires the Sichuan pheasant. *Release # 87-05*, March 17, 1987. 4pp.
- POTTS, G. R. 1970. Recent changes in the farmland fauna with special reference to the decline of the gray partridge. *Bird Study* 17(2):144-166.
- REICHHOLF, V. J. 1982. Verdrangte der fasan (*Phasianus colchic.* as birk-huhn (*Tetrao tetrix*)? *Anz. Orn. Ges. Bayern* 21:3-19.
- ROLLINGS, C. T. 1941. Checking up on the pheasants. *Minnesota Conserv. Volunteer* 3(13):41-44.
- SCHEIN, M. W. 1963. On the irreversibility of imprinting. *Zeit. Tier.* 20(4):462-467.
- SCHRADER, T. A. 1944. "Huns" and bobwhites. *Minnesota Conserv. Volunteer* 7(42):43-48.
- SCHWARTZ, C. C. 1975. Upland wildlife populations in Iowa, 1974. *Iowa Wildl. Res. Bull.* 17. 34pp.
- SHARP, W. M. 1957. Social and range dominance in gallinaceous birds—pheasants and prairie grouse. *J. Wildl. Manage.* 21:242-244.
- and H. E. McCLURE. 1945. The pheasant in the sandhill region of Nebraska. Pages 203-233 in W. L. McATEE, ed. *The ring-necked pheasant and its management in North America*. Am. Wildl. Inst., Washington, DC. 320pp.
- SPIKER, C. J. 1929. The Hungarian partridge in northwest Iowa. *Wilson Bull.* 41:24-29.
- SQUIBB, P. 1985. The Sichuan pheasant. *Michigan Nat. Resour.* 54(5):5-11.
- SVEDARSKY, W. D., R. J. OEHELSCHLAGER and T. D. TONSAGER. 1982. A remnant flock of greater prairie chickens in north central Minnesota. *Loon* 54(1):5-13.
- TEGETMEIER, W. B. 1904. Pheasants—their natural history and practical management. Horace Cox Publ., London. 255pp.
- TRAUTMAN, C. G. 1982. History, ecology, and management of the ring-necked pheasant in South Dakota. *South Dakota P-R Proj. Bull.* 7. 118pp.
- VANCE, D. R. and R. L. WESTMEIER. 1979. Interactions of pheasants and prairie chickens in Illinois. *Wildl. Soc. Bull.* 7:221-225.
- WEIGAND, J. P. and R. G. JANSON. 1976. Montana's ring-necked pheasant—history, ecology, and management. *Montana Dep. Fish Game.* 173pp.
- WESTMEIER, R. L. 1980. Greater prairie chicken status and management—1968-1979. Pages 88-17 in P. A. VOHS JR. and F. L. KNOPF, eds. *Proc. Prairie grouse symp.*, Oklahoma State Univ., Stillwater. 89pp.
- . 1983. Responses and impact by pheasants on prairie-chicken sanctuaries in Illinois: a synopsis. Pages 117-122 in R. DUMKE, R. B. STEHL and R. B. KAHL, eds. *Perdix III: gray partridge/ring-necked pheasant workshop*. Wisconsin Dep. Nat. Resour., Madison.
- . 1986. Endangered prairie-chickens and some species interactions. *Illinois Nat. Hist. Surv. Rep.* 262:1-2.
- and W. R. EDWARDS. 1987. Prairie-chickens: survival in the Midwest. Pages 119-131 in H. KALLMAN, ed. *Restoring America's wildlife 1937-1987*. U.S. Dep. Interior, Fish Wildl. Serv., Washington, DC. 394pp.
- WESTERSKOV, K. 1964. The recent decline of the partridge in mid-western United States. *New Zealand Outdoors* 29(4):16-19.
- WRIGHT, V. L. 1966. Status of gray partridge in Indiana. MS Thesis, Purdue Univ., West Lafayette, IN. 63pp.
- , A. L. FARRIS, D. L. GRAHAM and W. R. FELDER. 1980. Effects of *Heterakis* and *Histomonas* on the survival of juvenile gray partridge. Pages 156-164 in S. R. PETERSON and L. NELSON JR., eds. *Proc. Perdix II: gray partridge workshop*. For., Wildl., and Range Exp. Stn., Univ. Idaho, Contrib. No. 211. 244pp.
- YEATER, R. E. 1934. The Hungarian partridge in the Great Lakes region. *School For. and Conserv.*, Univ. Michigan, Bull. 5. 92pp.
- YOCUM, C. F. 1943. The Hungarian partridge in the palouse region, Washington. *Ecol. Monogr.* 13:167-202.