

Natality of ruffed grouse *Bonasa umbellus* in central Wisconsin, USA

Authors: Small, Robert J., Holzwart , James C., and Rusch, Donald H.

Source: Wildlife Biology, 2(1) : 49-52

Published By: Nordic Board for Wildlife Research

URL: <https://doi.org/10.2981/wlb.1996.007>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Natality of ruffed grouse *Bonasa umbellus* in central Wisconsin, USA

Robert J. Small, James C. Holzward & Donald H. Rusch

Small, R.J., Holzward, J.C. & Rusch, D.H. 1996: Natality of ruffed grouse *Bonasa umbellus* in central Wisconsin, USA. - Wildl. Biol. 2: 49-52.

Radio-marked female ruffed grouse *Bonasa umbellus* were monitored in central Wisconsin, USA, during 1983-1988 to estimate nesting rates (the percentage of hens that initiate a clutch), clutch size, nest success, and the prevalence and success of renests. All 23 radio-marked females initiated a clutch, 22 completed a first clutch; the remaining hen was killed by a predator during laying. Mean clutch size of first nests was 11.0 ± 0.5 eggs (range = 7-13). Five of nine (56%) hens attempted to renest with a mean clutch size of 7.4 ± 1.3 eggs (range = 6-9). Mean nest success was 46%; 43% for yearlings and 60% for adults. First nests produced the large majority of eggs that hatched (86.1%) compared to renests (13.9%). Productivity was estimated at 5.8 chicks hatched for each hen alive on 20 April, the mean date of the first egg laid.

Key words: clutch size, natality, nest success, renest, ruffed grouse, *Bonasa umbellus*, Wisconsin, USA

Robert J. Small¹ & James C. Holzward², Department of Wildlife Ecology, University of Wisconsin, Madison, WI 53706, USA

Donald H. Rusch, National Biological Service, Wisconsin Cooperative Wildlife Research Unit, University of Wisconsin, Madison, WI 53706, USA

Present addresses:

¹National Biological Service, Vertebrate Ecology Section, 4512 McMurtry Avenue, Fort Collins, Colorado 80525, USA

²Wisconsin Department of Natural Resources, P.O. Box 343, Berlin, WI 54923, USA

Received 17 November 1995, accepted 27 February 1996

Associate Editor: Ralph J. Gutiérrez

Natality among tetraonids varies greatly, depending on food, predation pressure, nesting cover, age, social interactions, etc. (Keppie 1981, Bergerud 1988, Martin et al. 1989, Jönsson et al. 1991). Little is known about the natality of ruffed grouse, even though it is a well studied species. Although clutch size and nest success have been estimated for ruffed grouse (see Bergerud 1988), there is a paucity of information on two critical components of natality: 1) the percentage of hens that initiate a clutch, and 2) the prevalence and success of renests. Thus, we

present additional information on these components of the bird's natality.

Bump et al. (1947) speculated that up to 25% of ruffed grouse hens did not breed in some years; yet, this was an indirect estimate prior to the use of radio-telemetry. Brander (1967) radio-marked four hens and located nests for the three yearlings but not for the adult. Maxson (1978), using telemetry, recorded 100% of hens (N = 15) nested in contiguous mixed-hardwood forests during a cyclic population high in Minnesota, USA. However,

some hens were captured on the nest during this study, thereby precluding an accurate estimate of the percentage of hens that attempted to nest. Maxson (1977) also provided the first indirect evidence of a renesting attempt by ruffed grouse.

Our objective was simply to increase the limited amount of information on ruffed grouse natality by studying a population in the fragmented forests of central Wisconsin, USA. We estimated nesting rates (the percentage of females initiating a clutch), clutch size, nest success, and the prevalence and success of renesting by monitoring radio-marked yearling and adult female grouse.

Study area and methods

The study was conducted during 1983-88 in Marquette and Waushara counties in central Wisconsin (44°01'N, 89°23'W). The study area was a mosaic of forests (36%), cropland and pasture (48%), commercial forest of Red pine *Pinus resinosa* (8%), and marsh lands (8%) (Small & Rusch 1989).

We trapped hens from July through November, and in April and May using lily-pad traps (Dorney & Mattison 1956). We also recaptured some hens at the nest to replace transmitters. We estimated age by molt progression (Hale et al. 1954) and calamus diameter ratios (Rodgers 1979). We fitted hens weighing >350g with a 16 - 21 g radio-transmitter attached to a poncho (Amstrup 1980), and one anodised aluminum leg band; hens <350g were not fitted with a radio-transmitter. Hens less than 12 months of age were classified as yearlings, all others as

adults. To estimate the date of first egg and hatch date, we assumed laying rates of 1.5 days per egg and an incubation period of 23 days (Bump et al. 1947:288).

Once their nest was found each female was located by triangulation every other day, followed by a visit to the nest on the predicted hatch date to estimate the number of eggs that successfully hatched. If the estimated location of the hen diverged from the nest, we examined the nest to estimate the time and cause of nest failure. If a first clutch was destroyed we continued to monitor the hen to estimate renesting occurrence and success. Due to the relatively small number of first nest attempts (N = 23) observed during the study, we did not perform statistical analyses to examine potential age-specific differences in nesting parameters.

Results

A total of 23 radio-marked hens survived until 20 April, the mean date of the first egg laid. Only one hen was captured in spring, on 27 March, approximately 25 days before she laid her first egg. Twenty-two of the 23 radio-marked hens completed a first clutch during 1983-88; the remaining hen was killed by a predator after laying four eggs. Predators destroyed nine complete first clutches and killed one additional hen. Two completed clutches were accidentally destroyed during recapture attempts and were excluded from the remaining analyses for first nest attempts; one of the hens whose nest was destroyed re-nested. A clutch of 13 eggs did not hatch because of infertility or early embryonic death; the hen incubated these

Table 1. Ruffed grouse nest success, clutch size, and hatch success in Marquette and Waushara counties, Wisconsin, USA, 1983-1988^a.

Age	Nests		Clutch size		Hatch success	
	No attempted	No successful (%)	Mean (sd)	Range	No laid	No hatched ^b (%)
First Nest						
Yearling	17 ^c	8 (47)	11.0 (0.5)	7-13	176	80 (45.5)
Adult	4	2 (50)	10.8 (0.4)	10-11	43	19 (44.2)
Combined	21	10 (48)	11.0 (0.5)	7-13	219	99 (45.2)
Renest						
Yearling	4	1 (25)	7.0 (1.2)	6-8	28	8 (28.6)
Adult	1	1 (100)	9.0 (-)	-	9	8 (88.9)
Combined	5	2 (40)	7.4 (1.3)	6-9	37	16 (43.2)
Total						
Yearling	21	9 (43)	10.3 (4.7)	6-13	204	88 (43.1)
Adult	5	3 (60)	10.4 (0.8)	9-11	52	27 (51.9)
Combined	26	12 (46)	10.3 (3.9)	6-13	256	115 (44.9)

^a Two complete clutches destroyed during trapping are not included.

^b From nests in which at least one egg hatched.

^c Data from a yearling that was killed after laying four eggs was included only in the nest success estimate.

inviability for 52 days. Based on these results, we calculated first nest success at 48%, with a mean first clutch size of 11.0 ± 0.5 eggs (Table 1).

Fifty-six percent of hens which survived after their first nests were destroyed attempted to re-nest, with a re-nest success of 40% and a mean clutch size of 7.4 ± 1.3 eggs (see Table 1). Renesting hens incubated their first clutch for an average of 9.4 days (range = 5 - 18), and began laying their second clutch 4.8 days after nest destruction (12 - 27 May). The difference in first clutch size between hens that re-nested and hens that did not was minimal (10.6 vs. 11.6 eggs). Precise estimates of first nest initiation and destruction were recorded for only five hens; the mean time invested (days of egg laying and incubation) in first nests was similar for the three hens which re-nested compared to the two that did not (22.0 vs. 21.5 days).

Combined nest success was 46%; 43% for yearlings and 60% for adults. Combined hatch success was 44.9% for nests in which at least one egg hatched, and did not differ significantly between yearlings and adults ($z = 1.25$, $P = 0.21$, see Table 1). The mean number of eggs hatched was 9.9 and 8.0 for successful first nests and re-nests, respectively, with overall productivity estimated at 5.8 (115/20) chicks hatched for each hen alive on 20 April. Of 115 eggs hatched from 256 total laid, the large majority were from first nest attempts compared to re-nests (86.1% vs. 13.9%). We did not detect any possible effects of radio-transmitters on breeding hens, yet we did not monitor unmarked hens for a proper comparison.

Discussion

The 100% nesting rate of ruffed grouse observed in our study supports previous results of Brander (1967) and Maxson (1978). Although Bump et al. (1947: 359) speculated that nesting rates could be as low as 75% for ruffed grouse, their inference may have been biased by indirect estimates. The radio-telemetry studies of nesting hens suggest, therefore, that high nesting rates are common for ruffed grouse. These comparable results were recorded at both high and low densities (this study; see Small et al. 1991), and in both fragmented and contiguous forests, implying that nesting may neither be limited by social exclusion (Hannon et al. 1982) nor by nesting habitat. Finally, high nesting rates by ruffed grouse would follow Bergerud's (1988:580) conclusion of forest grouse in general: "... nearly all adult females breed and nest and that most yearlings attempt to do so". However, Hannon & Zwickel (1987) reported that a small percentage of females may not nest in some blue grouse *Dendragapus obscurus* populations.

The 46% nest success rate for ruffed grouse observed in our study is lower than the 61% mean rate summarised

from 13 studies by Bergerud (1988: 593). Our lower nest success rate could be a result of the high proportion of yearlings in the sample, as our trapping effort was directed primarily towards yearlings. Adults ($N = 5$) comprised only 22% of our marked population, a percentage lower than expected from age-specific survival estimates from the same study (Small et al. 1991), and from age ratios reported from other ruffed grouse populations (Rusch & Keith 1971). As yearling female ruffed grouse generally exhibit a lower nest success than adults (61% vs. 71%, Bergerud 1988: 600; 43% vs. 60% our study), the bias towards yearlings in our sample would yield a lower nest success estimate. Finally, the large majority (91%) of nest failures in our study was due to destruction by predators, typical for tetraonids (Bergerud 1988: 593, Storch & Willebrand 1991). Perhaps, the extensive fragmentation within our study area may have increased nest predation, consistent with results from other studies (e.g. Andr  n et al. 1985, Wilcove 1985) which indicate that forest fragmentation increases nest predation.

The proportion of hens that re-nested after their first nest was destroyed in our study was 56% and this is a substantially higher proportion than the 12-22% reported previously for ruffed grouse (Bump et al. 1947: 364, Maxson 1977). In addition, the amount of parental investment in the first clutch did not appear to determine whether a hen would initiate a second clutch. The high percentage of ruffed grouse hens re-nesting in our study is more typical of steppe grouse according to Bergerud (1988: 597), as the percentage of forest grouse hens that usually re-nest is relatively low, e.g., blue grouse 25% (Sopuck & Zwickel 1983), and spruce grouse *Dendragapus canadensis* 10% (Ellison 1974). However, Willebrand (1992) reported a re-nesting frequency of 53% among radio-marked black grouse *Tetrao tetrix*. Thus, we contend that such generalisations be considered tenuous until larger samples of nesting females of both forest and steppe grouse are monitored by radio-telemetry.

Acknowledgements - we thank the personnel of the Wautoma field station of the Wisconsin Department of Natural Resources (WDNR) for assistance throughout the fieldwork, and the research assistants that aided in data collection. We thank the private landowners of Marquette and Waushara counties, without whose cooperation the project would not have been possible. L. Sileo, S.A. Temple, S.R. Craven, C.G. Lorimer, and J.E. Botero reviewed the manuscript. Financial support was provided by the Bureau of Wildlife Management and Research of WDNR. The Cooperative Wildlife Research Unit is supported by the University of Wisconsin-Madison, WDNR, United States Fish and Wildlife Service, and the Wildlife Management Institute.

References

Amstrup, S.C. 1980: A radio-collar for game birds. - *Journal of Wildlife Management* 44: 215-217.

- Andrén, H., Angelstam, P., Lindstrom, E. & Widén, P. 1985: Differences in predation pressure in relation to habitat fragmentation: an experiment. - *Oikos* 45: 273-277.
- Bergerud, A.T. 1988: Population ecology of North American grouse. - In: Bergerud, A.T. & Gratson, M.W. (eds.); *Adaptive strategies and population ecology of northern grouse*. Vol. 2. University of Minnesota Press, Minneapolis, pp. 578-684.
- Brander, R.B. 1967: Movements of female ruffed grouse during the mating season. - *Wilson Bulletin* 79: 28-36.
- Bump, G., Darrow, R.W., Edminster, F.C. & Crissey, W.F. 1947: The ruffed grouse: life history, propagation, management. - New York State Conservation Department, 951 pp.
- Dorney, R.S. & Mattison, H.M. 1956: Trapping techniques for ruffed grouse. - *Journal of Wildlife Management* 20: 47-50.
- Ellison, L.N. 1974: Population characteristics of Alaskan spruce grouse. - *Journal of Wildlife Management* 38: 383-395.
- Hale, J.B., Wendt, R.F. & Halazon, G.C. 1954: Sex and age criteria for Wisconsin ruffed grouse. - Wisconsin Conservation Department Technical Wildlife Bulletin Number 9, 24 pp.
- Hannon, S.J., Sopuck, L.G. & Zwickel, F.C. 1982: Spring movements of female blue grouse: evidence for socially induced delayed breeding in yearlings. - *Auk* 99: 687-694.
- Hannon, S.J. & Zwickel, F.C. 1987: Spacing behaviour and population regulation in female blue grouse. - *Auk* 104: 344-347.
- Jönsson, K.I., Angelstam, P.K. & Swenson, J.E. 1991: Patterns of life-history and habitat in Palearctic and Nearctic forest grouse. - *Ornis Scandinavica* 22: 275-281.
- Keppie, D.M. 1981: A difference in production and associated events in two races of spruce grouse. - *Canadian Journal of Zoology* 60: 2116-2123.
- Martin, K., Hannon, S.J. & Rockwell, R.F. 1989: Clutch size variation and patterns of attrition in fecundity of willow ptarmigan. - *Ecology* 70: 1788-1799.
- Maxson, S.J. 1977: Activity patterns of female ruffed grouse during the breeding season. - *Wilson Bulletin* 89: 439-455.
- Maxson, S.J. 1978: Spring home range and habitat use by female ruffed grouse. - *Journal of Wildlife Management* 42: 61-71.
- Rodgers, R.D. 1979: Ratios of primary calamus diameters for determining age of ruffed grouse. - *Wildlife Society Bulletin* 7: 125-127.
- Rusch, D.H. & Keith, L.B. 1971: Seasonal and annual trends in numbers of Alberta ruffed grouse. - *Journal of Wildlife Management* 35: 803-822.
- Small, R.J. & Rusch, D.H. 1989: The natal dispersal of ruffed grouse. - *Auk* 106: 72-79.
- Small, R.J., Holzward, J.C. & Rusch, D.H. 1991: Predation and hunting mortality of ruffed grouse in central Wisconsin. - *Journal of Wildlife Management* 55: 512-520.
- Sopuck, L.G. & Zwickel, F.C. 1983: Renesting in adult and yearling blue grouse. - *Canadian Journal of Zoology* 61: 289-291.
- Storch, I. & Willebrand, T. 1991: Workshop summary: Management implications of nest and brood predation in grouse. - *Ornis Scandinavica* 22: 271-272.
- Wilcove, D.S. 1985: Nest predation in forest tracts and the decline of migratory songbirds. - *Ecology* 66: 1212-1214.
- Willebrand, T. 1992: Breeding and age in female black grouse *Tetrao tetrix*. - *Ornis Scandinavica* 23: 234-238.