Great Basin Naturalist

Volume 46 | Number 4 Article 20

10-31-1986

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HATCHING CHRONOLOGY OF BLUE GROUSE IN NORTHEASTERN OREGON

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ABSTRACT.—Hatching chronology of Blue Grouse (*Dendragapus obscurus*) in northeastern Oregon was determined from 431 immatures examined from 1981 to 1985. Young hatched from 1 May through 8 July; median hatching dates for the five years ranged from 27 May to 5 June. Peak hatching in Oregon occurred from one to four weeks earlier than in most portions of the range of Blue Grouse but were similar to north central Washington and Idaho. Variations in hatching dates possibly were related to rainfall.

Information concerning hatching chronology is essential for study of the breeding ecology (e.g., survival and recruitment) of bird populations and is useful for determining optimum times for population censusing. Bendell and Zwickel (1985) summarized hatching times of Blue Grouse from 25 locations throughout the range and noted that peak hatching dates, which ranged from 24 May to 11 July, were earliest near the center of distribution. Results of research on Vancouver Island, British Columbia (Bendell 1955, Zwickel and Bendell 1967, King 1971, Redfield 1975), southwestern Alberta (Boag 1965), and southcentral Montana (Mussehl 1960) indicated that peak hatching times of Blue Grouse were remarkably similar, mid- to late June, among these diverse locations.

In contrast, Blue Grouse were reported to hatch from two to four weeks earlier in north-central Washington (Standing 1960, Henderson 1960, Bauer 1962, Zwickel 1973) and western Idaho (Caswell 1954). Brown and Smith (1980) noted that most immatures were from six to eight weeks old at the end of August (indicating most hatched from early to mid-July) on their study area in eastern Arizona. Redfield (1975) and Zwickel (1977) found hatching dates of Blue Grouse differed among years on Vancouver Island and attributed these differences to annual variations in weather. Data are unavailable regarding hatching times from several portions of the range of this species, including Oregon. The purpose of this project was to determine the hatching chronology of Blue Grouse in northeastern Oregon and to examine, evaluate, and assess annual variations in hatching times.

From 1981 through 1985 wings and tails of 775 Blue Grouse taken by hunters from 29 August to 30 September each year were collected in Wallowa County in northeastern Oregon. Blue Grouse in this region typically occupy coniferous forest, timbered draws, and adjacent grass-shrubland habitats at elevations ranging from 600 to 1,500 m. Age of birds was classified as adult or immature (young of the year) based on the condition of the outer two primaries (Bunnell et al. 1977) and the presence of juvenal feathers in the wing or tail. Sufficient information (date of kill and primary feathers present) was available to estimate hatching dates for 431 of 467 immatures examined. Dates of hatching were based on replacement rate of primary feathers (Zwickel and Lance 1966) and corrected for bias (Redfield and Zwickel 1976).

Only 17 of the 431 immatures had completed molting of the primaries and, in all instances, presence of sheathing material at the base of the eighth primary indicated the molt was recently finished. These birds were assigned the maximum age of 123 days. Median (suggested by Redfield 1975) and mean hatching dates and periods of peak (14-day period in which greatest number of young hatched) and maximum (time interval during which $> 70\%$ of young hatched) hatching were based on young hatched/day. These data were summarized by weekly intervals, beginning with the earliest hatching date. One-way analysis of variance and the Student-

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TABLE 1. Percent of young Blue Grouse hatched during weekly intervals and median and range of hatching dates, northeastern Oregon, 1981–1985.

Category	1981 (n = 44)	1982 (n = 34)	1983 (n = 106)	1984 (n = 81)	1985 (n = 164)
WEEK					
1–7 May	2	0	1	0	1
8–14 May	2	3	5	1	6
15–21 May	23	15	8	6	15
22–28 May	16	24	47	21	23
29 May–4 June	27	32	18	19	26
5–11 June	11	21	7	26	13
12–18 June	9	6	7	14	11
19–25 June	5	0	8	7	4
26 June–2 July	5	0	1	3	0
3–9 July	0	0	0	4	2
HATCHING DATES					
Mean	30 May	30 May	30 May	7 June	1 June
Median	29 May	31 May	27 May	5 June	31 May
Range	1 May–29 June	14 May–18 June	5 May–30 June	13 May–8 July	5 May–8 July

TABLE 2. Periods of peak (14-day period when most young hatched) and maximum (time during which > 70% of young hatched) hatching of Blue Grouse.

Location	Dates of peak hatching	Period of maximum hatching		Source
		Dates	% young hatched	
Vancouver Island, British Columbia	15–21 June[1]	8–28 June	80	Bendell 1955, King 1971
	17–30 June[2]	11 June–1 July	72	Zwickel and Bendell 1967
Hardwicke Island, British Columbia	—	4–25 June	—	Zwickel (personal communication)
Southwestern Alberta	14–21 June	—	—	Boag 1965
North central Washington	22 May–4 June	—	—	Standing 1960, Bauer 1962 Zwickel 1973
	10 May–25 May	—	—	Zwickel (personal communication)
South central Montana	14–21 June	9 June–3 July[3]	80	Mussehl 1960
Western Idaho	25 May–7 June	—	—	Caswell 1954
Northeastern Oregon	20 May–2 June	18 May–7 June	71	This study

[1]Some authors reported peak hatching periods of < 14 days.
[2]Approximate mean dates for three years (two areas/year).
[3]Average dates for two years.

man-Keuls mean separation test (Snedecor and Cochran 1967) were used to test for differences in mean hatching dates among years. Precipitation and mean temperatures for March, April, and May of each year were obtained for the Enterprise weather station (Climatological Data Oregon, NOAA) and compared to median hatching dates.

Hatching dates of Blue Grouse in northeastern Oregon (Table 1) ranged from 1 May (1981) to 8 July (1984 and 1985). Median hatching dates (Table 1) ranged from 27 May (1983) to 5 June (1984). Comparisons of mean hatching dates, all of which were ± 3 days of respective median dates, indicated that hatching in 1984 (7 June) was significantly ($P < 0.05$) later than in the other four years (range 30 May–1 June); no other differences were detected. Length of the hatching period for all years combined, 10 weeks, was identical to that reported by Zwickel and Bendell (1967) for Blue Grouse on Vancouver Island. The mean annual length of the hatching period in northeastern Oregon was 54 days,

however. In this study, hatching was concentrated from mid-May to mid-June (Table 1).

For all years combined, 54% of the young hatched in May, 45% in June, and 1% in July. Zwickel and Bendell (1967) noted peak hatching lasted approximately two weeks on Vancouver Island, and the period of maximum hatching (> 70%) took place within three to four weeks; they found that 67% of the young hatched during the peak, 7% before, and 26% after the peak. For northeastern Oregon the peak of hatching (55% of the young) occurred from 20 May to 2 June (Table 2); 9% hatched before the peak and 36% after.

Maximum hatching of young (71%) took place from 18 May to 7 June. Median hatching date for the five years was 31 May and the mean was 1 June. Dates of peak hatching of Blue Grouse in northeastern Oregon (Table 2) were from two to four weeks earlier than those reported for British Columbia, Alberta, Montana, and Arizona (Bendell 1955, Mussehl 1960, Boag 1965, Zwickel and Bendell 1967, Brown and Smith 1980, Zwickel, personal communication) and one week earlier than hatching in northern California and northern Nevada (Zwickel, personal communication). Hatching dates were similar to those reported in north central Washington (Standing 1960, Henderson 1960, Bauer 1962, Zwickel 1973) and Idaho (Caswell) 1954.

Factors affecting the timing of reproductive activities of Blue Grouse throughout their range are incompletely understood. King (1971) found that hatching times were related to elevation; Blue Grouse in subalpine areas hatched approximately 3.5 weeks later than those living at lower elevations. Marshall (1946) proposed that plant phenology in spring influenced the timing of migration of Blue Grouse, which in turn affected breeding times. Plant phenology also may directly influence breeding times (Zwickel, personal communication). Plant phenology throughout the range of Blue Grouse is strongly influenced by elevation and latitude. Blue Grouse populations with which our data were compared (Table 2), except for birds in north central Washington and western Idaho, inhabited areas either farther north by > 4° (British Columbia and Alberta) or at higher elevations (≥ 1800 m in Montana and Arizona), which may account for earlier breeding in northeastern Oregon. The study site in Washington was approximately 3° north of our area but was lower in elevation (450–900 m) and the study area of Caswell (1954) in Idaho bordered northeastern Oregon.

Zwickel (1977) noted that temperature and precipitation partially accounted for annual differences in hatching chronology within populations; earlier hatching coincided with warm, dry conditions during April and May. Redfield (1975) suggested that annual differences within populations were related to spring temperatures. In our study the median hatching date in 1984 was from 6 to 10 days later than in any of the other four years. Comparisons of median hatching dates with mean monthly temperature and total monthly precipitation during March, April, and May reveal that precipitation during April/May (10.7 cm) and from March through May (15.4 cm) 1984 was the highest of the five years; mean values for the other four years were 9.2 cm and 13.4 cm, respectively. Temperature data for 1984 were similar to the other four years. No other trends were apparent from these data, and limited sample size (five years) precluded statistical testing.

We concluded that hatching times of Blue Grouse in northeastern Oregon were similar in most years. Mean hatching date differed only in 1984; all dates were within a 10-day interval. Latest hatching corresponded to the wettest spring of the five years. Hatching dates in northeastern Oregon were consistent with the observation of Bendell and Zwickel (1985) of early breeding within the central portion of the range of Blue Grouse.

ACKNOWLEDGMENTS

We would like to thank T. F. Haensly and S. M. Meyers for their assistance in determining sex and age of birds. The manuscript was reviewed by F. C. Zwickel, E. C. Meslow, and R. L. Jarvis. Special appreciation is expressed to F. C. Zwickel for generously sharing unpublished data. This is Technical Publication 7838 of the Oregon Agricultural Experiment Station.

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