National Quail Symposium Proceedings

Volume 4 Article 29

2000

Temperature and Humidity Relationships of Scaled Quail Nests in Southern New Mexico

Carol A. Evans
New Mexico State University

Sanford D. Schemnitz
New Mexico State University

TEMPERATURE AND HUMIDITY RELATIONSHIPS OF SCALED QUAIL NESTS IN SOUTHERN NEW MEXICO

Carol A. Evans[1]
Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, NM 88003-8003

Sanford D. Schemnitz
Department of Fishery and Wildlife Sciences, New Mexico State University, P.O. Box 30003, MSC 4901, Las Cruces, NM 88003-8003

ABSTRACT

We observed unmarked and radio-marked (20 females/1994; 9 females and 11 males/1995) scaled quail (*Callipepla squamata*) during the nesting season in the Chihuahuan Desert of southern New Mexico. In 1994, pairing was completed by early April. Clutch size averaged 13.8 ± 1.7 (n = 7). Nests were located an average 216 ± 13.8 m from permanent water. All 97 chicks disappeared from radio-marked pairs by 16 July. In 1995, all radio-marked females and 6 of the radio-marked males were paired by mid-April. Clutch size averaged 10.3 ± 1.3 in nests (n = 8) that averaged 545 ± 1.7 m from permanent water. Almost half of the hatched chicks (49.6%) fledged in 1995. Nest temperature never exceeded 34°C, while ambient temperatures reached ≥43°C. Nest humidity averaged 23%, while ambient humidity averaged 12%.

Citation: Evans, C.A., and S.D. Schemnitz. 2000. Temperature and humidity relationships of scaled quail nests in southern New Mexico. Pages 116–118 *in* L.A. Brennan, W.E. Palmer, L.W. Burger, Jr., and T.L. Pruden (eds.). Quail IV: Proceedings of the Fourth National Quail Symposium. Tall Timbers Research Station, Tallahassee, FL.

INTRODUCTION

Scaled quail are native to the Chihuahuan Desert and surrounding grasslands of the southwestern United States and northern Mexico where they inhabit arid to semi-arid habitats that average 20.3–38.1 cm of annual precipitation (Agricultural Research Service 1994). Scaled quail populations have been declining at an average rate of 3.8% per year throughout their range since 1966, with the decline increasing to 8.2% annually since 1982 (Church et al. 1993). Because of their importance as a game bird, research has focused on improving habitat to increase numbers in the states where they occur (Campbell 1960). One such habitat improvement has been installation of rain catchments called guzzlers. Studies by Campbell (1960), however, have shown water developments to be of little value for scaled quail. Little is known about the reproductive biology of scaled quail and how it may influence population numbers. Therefore, we studied temperature and humidity relationships of scaled quail nests to derive a better understanding of their reproductive ecology.

STUDY AREA

Observations of scaled quail were conducted on the USDA Jornada Experimental Range (JER), a working cattle ranch that is closed to sport hunting, located 37 km north of Las Cruces, New Mexico. JER was established in 1912 for range research and currently is part of the Long-Term Ecological Research Program (LTER). Precipitation on JER, which averages 24.7 cm annually, reflects its location near the northern edge of the Chihuahuan Desert (Agriculture Research Service 1994). Over half of the annual rainfall occurs between 1 July and 30 September. Annual precipitation was 16.1 cm during 1994 and 22.7 cm in 1995 on JER. Average spring and summer rainfall on JER is 1.1 cm in May, 1.5 cm in June, 4.5 cm in July and 5.0 cm in August. No rainfall occurred during May 1994, 1.8 cm fell in June, 4.5 cm fell in July and 2.1 cm fell in August. In 1995, 1.9 cm of rain fell in May, 1.6 cm fell in June, 3.7 cm fell in July and 2.9 cm fell in August. Mean maximum ambient temperature is highest in June when it averages 36°C, and lowest in January when it averages 13°C. During 1994, beginning on 30 May the temperature was over 36°C on 47 days, and it exceeded 40°C for 13 days beginning on 24 June. In 1995, the temperature exceeded 36°C for 27 days between 30 May and 31 July. Temperatures were above 40°C for 4 days beginning 25 July in 1995. Humidity averaged 8% from May until the beginning of the "monsoon season" in July. From the beginning of the summer rains through August, humidity averaged 19%. Temperatures often ranged as much as 25°C between day and night.

METHODS

After locating coveys on JER using Weimaraner bird dogs, we placed funnel traps baited with whole milo at covey locations. We weighed, aged and sexed

[1] Present address: U.S. Department of the Interior, Fish and Wildlife Service, Route 2, 202A, Alamo, TX 78516.

Table 1. Ambient temperature and humidity in relation to scaled quail nest temperature and humidity at the Jornada Experimental Range, New Mexico (1995).

Nest site and no.	Date	Time of recording	Ambient °C temp.	Nest temp °C	Difference	Ambient humidity	Nest humidity	Difference
Guzzler 1	June 2	7:30 a.m.	29	32.0	+3.0	5%	9%	−4
Guzzler 1	June 6	10:00 a.m.	27	32.3	+5.3	1%	15%	−14
Guzzler 1	June 10	7:30 a.m.	18	19.4	+1.4	15%	22%	−7
Smith tank	June 8	11:00 a.m.	27	32.0	+5.0	8%	19%	−11
Smith tank	June 29	3:00 p.m.	30	32.0	+2.0	10%	20%	−10
Smith tank	June 30	7:30 p.m.	29	34.0	+5.0	19%	35%	−16
Smith tank	July 18	6:00 p.m.	30	31.7	+1.7	20%	35%	−15
Smith tank	July 25	12:00 p.m.	37	33.2	−3.8	12%	34%	−22
Smith tank	July 31	2:00 p.m.	40	33.7	−6.3	18%	26%	−8
Guzzler 2	July 28	3:30 p.m.	43	33.3	−9.7	12%	15%	−3

captured quail. We radio-marked a sample of the captured birds each year with 6.5–7.0-g transmitters. These birds were subsequently located every two days. Once hens began laying eggs, nest locations were recorded. After incubation was initiated, temperature and humidity sensors were placed inside nests (n = 1, 1994; n = 3, 1995). Temperature/humidity sensors, the size of a dime, were obtained from HyCal Engineering, El Monte, California. Sensors were connected by a 60-m PVC-encased cable to a hand-held voltage meter which provided on-site nest microenvironmental readings. Separate ambient temperature and humidity readings were taken simultaneously at 60 meters adjacent to the nest site. Wire mesh access and escape ramps were attached to metal cattle water troughs. Means are accompanied by SE for standard error in text.

RESULTS

We captured 68 scaled quail in 1994 (29 females, 39 males) and 20 (9 females, 11 males) in 1995. The average breeding mass of adult males in 1994 was 197.5 ± 3.3 g (n = 15), immature males' mass averaged 195.7 ± 2.6 g (n = 24), adult females' mass averaged 192.4 ± 4.2 g (n = 11), and immature females' mass averaged 182.6 ± 2.1 g (n = 18). In 1995 adult males averaged 188.3 ± 4.6 g (n = 11), adult females' average mass was 202.2 ± 4.6 g (n = 9). No immature quail were trapped in 1995 suggesting poor survival of 1994 hatchlings.

We radio-marked 20 female scaled quail in 1994 and 9 female and 11 male quail in 1995. By 1 April 1994, 11 radio-marked females were paired. Pairs moved up to 1 km from permanent water. Pairs nested an average of 216 ± 13 m (n = 3) from permanent water in 1994. Clutch size (n = 7) the first nesting season averaged 13.8 ± 1.7. The first monitored clutch hatched on 23 June and the last on 30 June 1994. By 16 July, all 97 chicks of radio-marked hens had disappeared. Three 12 day-old chicks drowned in water troughs without escape ramps. No renesting attempts were observed. Scaled quail began reforming coveys by 1 August in 1994.

In 1995, we monitored 16 radio-marked quail from June to October. All radio-marked females were paired by April 10, and the 6 males that found mates were paired by 16 April. Nests averaged 545 ± 17 m (n = 4) from permanent water and clutch size averaged 10.3 ± 1.3. The first nest hatched 14 June 1995 and the last, a renest, on 19 August 1995. Almost half (49.6%) of chicks that hatched (n = 15) fledged. One cock incubated eggs through hatching after his mate was killed by a great-horned owl (*Bubo virginianus*). Once hatched, adult quail brought their chicks to water sites with ramp access in 1995. One pair led their 1-day old brood 3 km to a water trough where ramps had been constructed to provide quail access to drinking water.

Ninety percent of nests (n = 15) over both years were located in large honey mesquite (*Prosopis glandulosa*) plants in areas of coppice dunes, while the remaining 10% of nests were in soaptree yucca (*Yucca elata*). Of those nests found in mesquite, half were in wood rat (*Neotoma* spp.) middens. Five transmitters that had been apparently lost were carried by wood rats into their subterranean dens, one to a depth of 1 m.

Ambient temperature at nests averaged 31°C, while temperatures in nests averaged 31.4°C (Table 1). The highest ambient temperature recorded at nest sites was 43°C; highest temperature recorded in any nest was 34°C (Table 1). From June through July, ambient humidity at nests averaged 12%, while humidity in the nests averaged 23% unless a rain event occurred. After a thunderstorm on 30 June 1995, ambient humidity was 19% and nest humidity was 35%, and on 18 July 1995, ambient humidity was 20% and nest humidity was 35%. These were the highest readings for ambient and nest humidity during the nesting period for both 1994 and 1995.

DISCUSSION

JER experienced a drought during 1994 and 1995. Average rainfall for JER during May–August was 6.3 cm and 1.4 cm below average for that time period in 1994 and 1995 respectively. Henderson (1971) stated that scaled quail are well adapted where ambient temperatures rarely exceed 40°C. During 1994, temperatures were above 40°C for 16 days during summer months. However, temperatures exceeded 40°C for only 4 days in 1995, and that occurred between 23–31 July when chicks were 33–40 days old. Within 4 weeks of hatching, all chicks had disappeared in 1994. Further, we captured no immature scaled quail during

spring 1995. Nearly half of monitored pairs' chicks fledged on JER in 1995. We hypothesize that the long period of high temperature exacerbated by drought conditions was primarily responsible for reproductive failure on JER in 1994.

After chicks were lost in 1994, radio-marked scaled quail did not renest. By 1 August, they were observed forming coveys, which is 1 month earlier than reported in west Texas by Wallmo (1957). In 1995, 2 pairs renested after their nests were destroyed by coyotes (*Canis latrans*) and successfully hatched 10 eggs each.

Nest temperatures were generally greater than ambient temperatures, and nest humidity was consistently greater than ambient humidity in nests during daylight hours. Humidity of the nest averaged 23% throughout the nesting period despite the ambient humidity averaging 12%. The birds maintained the nest temperature below 34°C despite ambient temperatures in excess of 38°C.

Clutch size in 1994 averaged 13.8 ± 1.7 (n = 7) and in 1995 averaged 10.3 ± 1.3 (n = 15). Zammuto (1986) stated clutch size for scaled quail averaged 13.4 (n = 86).

ACKNOWLEDGMENTS

We think K. Havstad for permitting access to JER to conduct observations. We thank R. Wells, H. Bray, J. Moen and M. Parmeter, Quail Unlimited and its Southern New Mexico Chapter for funding and field assistance. New Mexico Department of Game and Fish supplied leg bands and traps. We are thankful for the assistance and support provided by Ken Holmes and Willis Bird, Bureau of Land Management for funding and the use of their equipment. We thank P. Zwank and C.A. Davis for their review of this article.

LITERATURE CITED

Agricultural Research Service. 1994. The Jornada Experimental Range. Las Cruces, New Mexico. Agricultural Bulletin 1–21.

Campbell, H. 1960. An evaluation of gallinaceous guzzlers for quail in New Mexico. Journal Wildlife Management 24:21–26.

Church, K.E., J.R. Sauer, and S. Droege. 1993. Population trends of quail in North America. National Quail Symposium Proceedings 3:44–54

Henderson, C.W. 1971. Comparative temperature and moisture responses in Gambel and scaled quail. Condor 73:430–436.

Wallmo, O.C. 1957. Ecology of scaled quail in west Texas. Texas Game and Fish Commission Special Report, P-R Project W-57-R.

Zammuto, R.M. 1986. Life histories of birds: clutch size, longevity, and body mass among North American game birds. Canadian Journal of Zoology 64:2739–2746.