

POOR RETENTION RATES OF 8-g ANCHOR RADIO TRANSMITTERS BY NORTHERN SHOVELERS

JOHN M. ZIMMER¹

*School of Forestry, Wildlife, and Fisheries
Louisiana State University Agricultural Center
Louisiana Agricultural Experiment Station
Baton Rouge, Louisiana 70803 USA*

Abstract.—One asset of radio telemetry is the ability to relocate individuals over a period of time. Selecting the most effective transmitter design and attachment method is vital to achieve desired retention rates while minimizing the physical and behavioral effects on radio-tagged individuals. During a 30-d study, I marked 42 adult female Northern Shovelers (*Anas clypeata*) with 8-g anchor transmitters using an attachment method that was modified from Pietz et al. (1995). Twenty transmitters fell off before the tracking interval had expired, resulting in a 30-d retention rate of 0.55. Potential causes of transmitter loss included increased transmitter size and mass, and the use of cyanoacrylate glue on the sutures and skin.

POBRES TASAS DE RETENCION DE RADIO-TRANSMISORES DE 8-G EN ANAS CLYPEATA

Sinopsis.—Una ventaja de la radioteleetría es la habilidad de relocalizar individuos radiomarcados a través de un período de tiempo. La selección del diseño de transmisor más efectivo y del método de fijación son vitales para obtener tasas de retención deseadas mientras a la vez se minimizan los efectos físicos y etológicos de marcar los individuos. Como parte de un estudio de ecología de camadas de 30 días de duración, marqué 42 hembras adultas de *Anas clypeata* con transmisores de ancla de 8-g usando n método de fijación que se modificó de Pietz et al. (1995). Veinte radiotransmisores se cayeron antes que el intervalo de servicio hubjese expirado, resultando en una tasa de retención de 0.55 en 30 días. Posibles causas de pérdida de los transmisores incluyen el aumento en tamaño y en masa del radiotransmisor, y el uso de pegamento a base de cianocrilato en las suturas y en la piel.

The ability to dependably relocate breeding females makes radio telemetry a valuable tool for studies of waterfowl ecology. One focus of transmitter design has been to increase retention rates while decreasing physical and behavioral effects on marked birds. Traditional backpack harness packages (Dwyer 1972) have good retention times, and the elevated external antenna maximizes signal range. However, this design negatively affects behavior and reproductive output of captive and free-ranging ducks (Houston and Greenwood 1993, Pietz et al. 1993, Rotella et al. 1993). Abdominally implanted transmitters are a useful alternative (Olsen et al. 1992), especially in diving ducks that will not tolerate backpacks, as retention rates are close to 100%. However, signal strength is compromised (Korschgen et al. 1984). Transmitters attached with sutures and glue (Wheeler 1991) have negligible behavioral effects on marked individuals and better signal strength than implants, but retention time is inadequate for many types of studies, including those assessing reproductive success or brood survival (Houston and Greenwood 1993, Rotella et al. 1993).

¹ Current Address: Acadia National Park, P.O. Box 177, Bar Harbor, Maine 04609 USA.

Mausser and Jarvis (1991) designed a transmitter for use on ducklings that supplemented the suture and glue attachment with an anchor that was inserted subcutaneously for added retention. Pietz et al. (1995) tested an enlarged and modified anchor radio package on breeding adult Mallards (*Anas platyrhynchos*) and Gadwalls (*A. strepera*) and found better retention rates than glue and suture mounts, with no detectable effect on behavior of marked individuals. In this paper, I report on retention rates of an 8-g anchor radio package that was used on breeding adult Northern Shovelers (*Anas clypeata*).

METHODS

Study area, nest location, and trapping.—Nests were located using chain drags (Klett et al. 1986) on eight study areas located in the prairie-pothole habitat of North-central North Dakota (99°N, 48°W). Female Northern Shovelers, were trapped late in incubation (18–23 d) at the nest using either a long-handled dip net or a walk-in trap (Weller 1957). Anchor transmitters, nasal markers (Lokemoen and Sharp 1985), and U.S. Fish and Wildlife Service leg bands were used to mark individual females. I used methoxyflourane to anesthetize birds just prior to placing them on their nests to decrease nest abandonment associated with capture and handling (Rotella and Ratti 1990).

Transmitter design and attachment.—Each anchor transmitter was designed for 45-d of battery life and did not have a mortality switch. Transmitters were circular with a 23-mm diameter, flat base, and a 12-mm height. A stainless-steel anchor extended 11-mm from the anterior portion of the base, and an antenna extended 23.5 cm at a 45° angle from the posterior portion of the base. The complete package weighed approximately 8 g, which was <0.5% of the average adult female body mass of Northern Shovelers (Bellrose 1980).

Feathers were trimmed from the attachment area. The area was swabbed with Glutacide (a sterilant) and injected with a local anesthetic (Lidocaine without epinephrine), before the sutures were threaded through the skin. Surgical instruments also were sterilized using Glutacide. Cyanoacrylate glue was used to secure suture knots and was also placed between the skin and the underside of the transmitter to aid in retention. Major differences between transmitter designs used in this study and those used in Pietz et al. 1995 were transmitter shape (circular vs. elongated) and mass (8 g vs. 4 g). For a more complete description of the attachment process, refer to Pietz et al. (1995).

Data collection and analyses.—Each brood female was located via telemetry every three days over a 30-d interval to assess brood survival. Animal care guidelines were strictly followed (American Ornithologists' Union 1988). Daily transmitter retention and female survival rates were calculated using the Mayfield (1961, 1975) method as described in Pietz et al. (1995). Interval retention and survival rates were calculated over the period from hatch to 30-d post hatch, which was the period used to estimate brood survival to fledging. Confidence intervals (95%) for survival and

retention rates were calculated using methods described in Johnson (1979).

RESULTS AND DISCUSSION

Of 42 radio transmitters attached, 20 fell off before the 30-d interval had expired. All 20 shed transmitters were recovered. Daily transmitter retention rates for Northern Shoveler females were 0.98 (95% CI = ± 0.01), which extrapolates to a 30-d retention rate of 0.55. The daily survival rates for radio-marked Northern Shovelers were 0.99 (95% CI = ± 0.01), which results in a 0.92 probability of survival over the 30-d interval. Predation did not appear to be the major cause of radio loss because: (1) five nasal-marked females whose transmitters had been recovered were subsequently observed with broods; (2) transmitters were usually relocated in wetlands at depths ranging up to 1.5 m; (3) only 6 of 20 transmitters had tissue attached, indicating that transmitters were not torn off; and (4) no recovered transmitter had evidence of predation such as tooth marks or by being recovered in a cache or den.

I suspect that modified transmitter size and attachment methods from those of Pietz et al. (1995) resulted in poor radio retention. Transmitters used in this study were approximately twice as large in width, height, and mass as those used by Pietz et al. (1995). Larger radios may have induced birds to pull on the transmitter and increased the risk of transmitter loss due to entanglement with foreign material such as vegetation. Also, heavier transmitters may have stressed the anchor incision, sutures, and skin more than those used by Pietz et al. (1995). Transmitter bases were flat as in Pietz et al. (1995), but the larger diameter of the base in this study may have led to increased transmitter movement due to a poor fit around the backbone. Cyanoacrylate glue, which has been used to attach transmitters in several studies (Martin and Binder 1978, Perry and Carpenter 1981, Wheeler 1991) causes some types of suture material to become brittle and makes contacted skin rigid (Pietz, pers. comm.). Thus, by applying glue to knots and under the transmitter, I potentially increased the likelihood of premature transmitter loss. Skin thickness may also have compromised retention rate. Northern Shoveler females may have thinner skin than larger species such as Mallards or Gadwalls. Therefore, sutures may have been more susceptible to tearing due to transmitter movement.

CONCLUSION

This study was not designed to evaluate transmitter retention rates, so comparisons with other studies concerning effects of radio transmitters on nesting waterfowl are not possible. Use of 8-g anchor transmitters on Northern Shoveler females attending broods resulted in retention rates that were inadequate for a 30-d brood survival study. What appeared to be minor modifications in transmitter design and attachment had serious consequences on radio retention rates. Smaller anchor transmitters, such as those employed by Pietz et al. (1995), and the avoidance of cyanoac-

rylate glue may yield better retention rates on birds smaller than Mallards. Researchers considering modifications to published methodology should be aware that small changes may have significant impacts. In-depth discussion with researchers who have experience with similar methods can yield vital practical information not available in the published literature.

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