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Improved Satellite Transmitter Harness Attachment Technique

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Key Words: *Black Vulture*; Coragyps atratus; *attachment method*; *backpack harness*; *satellite transmitter.*

Kenward et al. (2001) observed: ''Techniques for studying animals should not prejudice either the welfare of the individuals or the scientific quality of the results. This is especially important when advances in technology create new opportunities, as well as new risks.'' Satellite telemetry technology has revolutionized the ability of scientists to conduct long-term studies of avian movements and behavior (e.g., Prince et al. 1992, Cappelle et al. 2011, Chevallier et al. 2011). Effective application of this technology depends on many factors, including the proper attachment of the transmitter to the bird. For large birds, transmitters are attached using a backpack-style harness to position the transmitter snugly on the back of the bird (e.g., Dunstan 1972, Buehler et al. 1995). The harness is then secured by sewing, gluing, or crimping brass ferrules around the leads of the harness, the exact methods depending upon the preferences of the investigator. In previous telemetry studies with vultures, we found that properly fitting and securing the harness by sewing, gluing, and crimping was sometimes difficult and stressful to the bird as well as to the investigator. So, to help prevent transmitter loss, obtain a proper fit, and expedite the attachment procedure, we developed and tested a new method that is quicker, easier, and inexpensive to apply, and that improves the security of the harness for long-term satellite telemetry studies (Avery et al. 2011).

Methods

Before applying our method on free-flying birds, we tested it by attaching a ''dummy'' transmitter on a captive adult Black Vulture (*Coragyps atratus*). We monitored the bird daily for the first week and periodically thereafter for 8 wk to determine if it was able to damage or remove the harness or if the bird suffered any injury from the harness.

In our field study, we used 70-g transmitters (PTT 100, Microwave Telemetry, Columbia, Maryland, U.S.A.) which come with built-in plastic attachment tubes in the front and rear of the transmitter. To prepare the backpack harness, we first threaded a length of one quarter-inch Teflon® ribbon through each attachment tube, leaving about 20 cm of ribbon on either side, at the front and rear of the transmitter. After centering the ribbon in each tube, we tied knots in each ribbon on each side of the transmitter to prevent the harness ribbon straps from shifting.

We placed the bird on the work surface with the transmitter positioned so that its anterior end was approximately in line with the shoulder area. We adjusted the four harness straps over the sternum to ensure the fit was not too tight or too loose. We held the ribbons in place with hemostat clamps and we located the harness attachment point by marking where the four straps met on the sternum. With a one-hole paper punch, we made a 1.6- to 3.2-mm hole in the center of the two forward straps at the marked location. We then inserted the male portion of the nylon snap rivet (ITW Fastex Snap Rivets part number 236-220603-00-0101; 1.6-cm head diameter; Fig. 1) through the punched hole with the point of the rivet facing away from the body of the bird. We punched a similar hole through the rear ribbons in the previously marked location and placed the rivet through that hole. The attachment was completed by placing the female portion of the rivet (ITW Fastex Snap Rivets part number 236-220604-00-0101; Fig. 1) on the male portion and snapping it in place. We trimmed the ribbons close to the rivet to prevent the bird from pulling at the ends, and we placed a drop of super glue or nail polish on the connection and at the tips of the cut ribbon to reduce fraying. We then removed the bird from the working surface and checked for proper placement of the transmitter by placing two fingers between the transmitter and bird. If the harness seemed too loose, we easily tightened it by gathering the excess ribbon from the front or rear harness leads and, leaving the first rivet in place, inserted a second rivet at the new juncture per the methods above. We never experienced a harness attachment that seemed too tight. Should that occur, we recommend that the harness be removed and the entire process start anew.

Results

The captive vulture picked at the harness and dummy transmitter for several days after attachment, but in the 8-wk test, the unit was not dislodged or damaged, the bird remained uninjured, and we proceeded with our field study. We removed the harness and dummy transmitter from the captive vulture 40 mo later when the bird died. We found substantial fraying to one of the harness leads, but otherwise the unit was secure. There were no discernible lesions or other evidence of tissue damage due to the harness.

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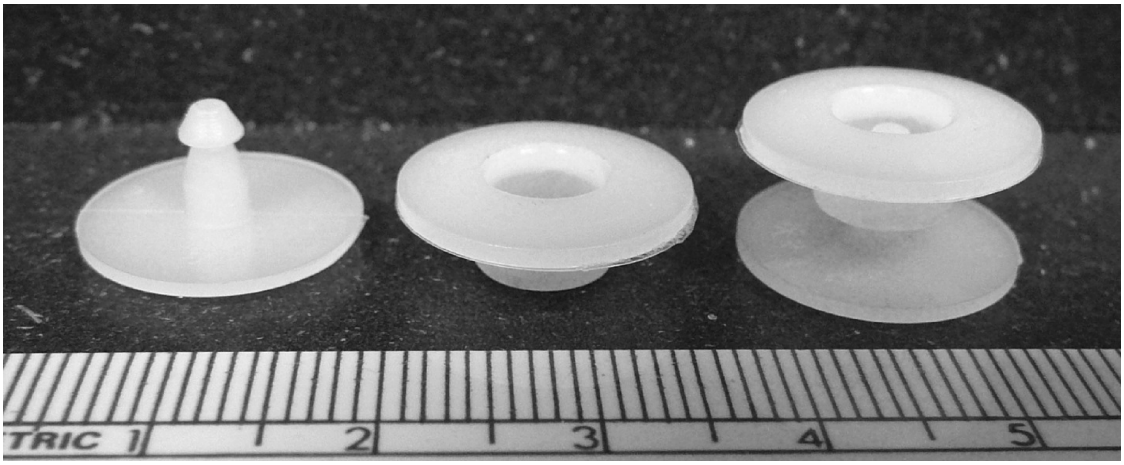

Figure 1. Nylon snap rivet used to attach the leads of transmitter harnesses comfortably and securely on Black and Turkey vultures: ITW Fastex Snap Rivets part number 236-220603-00-0101 (left), part number 236-220604-00-0101 (center), and assembled unit (right).

During the 2-yr field study, we attached transmitters to 11 Black Vultures and 11 Turkey Vultures (*Cathartes aura*). We recovered transmitters from several birds that died of various causes, but rapid deterioration of the carcasses prevented any evaluation of effects of the harness on the bodies of the birds. With one exception, the harnesses we recovered showed minimal wear. The one exception was a harness that was severed where the Teflon ribbon exited the transmitter. It had been on the bird 20 mo.

DISCUSSION

Transmitter attachment methods often face competing requirements: the transmitter must stay on the bird for the desired course of the study, but also it is often desirable for the transmitter to detach from the bird once the study is completed or the projected life of the transmitter is reached. The improved method we developed accommodates each of these objectives. The snap rivet fastener is very durable and unlikely to fail if properly installed. But, this does not prevent a self-removal or planned failure feature being incorporated into the harness system if desired (Herring and Gawlik 2010).

Combining this study with subsequent telemetry trials, we have applied this attachment method to 27 vultures with an aggregate active deployment time in excess of 50 yr (Avery et al. 2011; M. Avery unpubl. data). During these studies, we have recorded no failure of the snap rivet harness attachment. Rather than failure of the snap rivet, from our experience it is more likely that a harness will fail through abrasion of the Teflon ribbon repeatedly rubbing against the attachment tubes of the transmitter. Although we have applied this method only to vultures, there is no reason that the same harness attachment method cannot be applied in telemetry studies of other raptors as well.

We share concerns expressed by other researchers that use of transmitters must not adversely affect a bird's health or behavior (e.g., Phillips et al. 2003, Steenhof et al. 2006, Peniche et al. 2011). Withey et al. (2001) reviewed 96 articles that assessed the impacts of transmitters on wildlife. They found that adverse effects were reported in 68% of the studies that used backpack harness attachments. Negative effects were particularly prevalent in studies of upland game birds (9 of 16) and waterfowl (10 of 12). Raptors appeared less affected by the use of a backpack harness (2 of 6), and Withey et al. (2001) concluded that ''tagging raptors is relatively benign.'' Other, more recent, raptor studies indicated that effects of backpack harness attachments can be anything but benign (Steenhof et al. 2006, Peniche et al. 2011). Our improved harness attachment method contributes to minimizing negative effects by reducing handling time during the attachment process, simplifying adjustments to assure the harness fits properly, and securing the attachment so that the harness won't loosen and subsequently interfere with the bird's natural movements.

TÉCNICA MEJORADA DE SUJECIÓN DEL ARNÉS DE UN TRANSMISOR SATELITAL

RESUMEN.—La telemetría satelital a menudo requiere de la sujeción de un transmisor en el ave utilizando un arnés de configuración tipo mochila. El calce apropiado del arnés sobre el ave es esencial para un despliegue efectivo y para el bienestar de las aves. Presentamos una técnica mejorada de sujeción del arnés que emplea un remache barato y disponible de forma inmediata. Este método reduce el tiempo de manipulación y permite a los investigadores ajustar las guías del arnés de forma rápida y luego

asegurarlas eficientemente sin coser, enroscar o pegar con plástico caliente.

[Traducción del equipo editorial]

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