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AN IMPROVED RADIO TRANSMITTER HARNESS WITH A WEAK LINK TO PREVENT SNAGGING

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Abstract.—Radio transmitters strapped to birds can become entangled thereby trapping and ultimately killing the bird. We describe a transmitter harness that allows an entangled bird to free itself from the harness and escape.

NUEVO ARNÉS PARA COLOCAR RADIOTRANSMISORES EN AVES

Sinopsis.—El arnés para colocar radiotransmisores en aves, peude enredarse particularmente con la vegetación, quedando el pájaro atrapado, lo que puede causarle eventualmente su muerte. En este trabajo se describe un nuevo arnés. Si un ave con este tipo de arnés se enredase, el mismo cedería al forcejeo del pájaro y le permitiría escapar.

Researchers have used a variety of methods for attaching radio transmitters to free-ranging birds. Many have used a body harness system (Brander 1968, Dwyer 1972, Nicholls and Warner 1968) or wing loops (Godfrey 1970). Others have glued transmitters to feathers or sutured them to the epidermal layer (Martin and Bider 1978, Perry et al. 1981, Raim 1978). Transmitters glued to feathers or skin have a variable retention time (Perry et al. 1981, Raim 1978). However, transmitters attached by a harness system could stay on indefinitely and, for forest birds, could end the life of the bird if the harness became snagged on branches. Boshoff et al. (1984) fitted a radio transmitter to a Cape Griffon Vulture (*Gyps coprotheres*) using a harness with a "weak link" section which would eventually weather and break, allowing the transmitter to fall off. For forest birds, the harness designed by Boshoff et al. has two disadvantages—a "weak link" which is not specifically designed to snap if the harness becomes snagged, and a rear harness loop which remains intact after the "weak link" has broken.

For our radio-tracking studies of the New Zealand Pigeon (*Hemiphaga novaeseelandiae*), a large (ca. 650 g) forest-dwelling bird, we chose a harness system of transmitter attachment because we wanted our study birds to carry transmitters (weighing ca. 20 g) for at least 6 mo. After one of our study birds was caught by its harness on a small branch of a tree, we re-designed our harness system to incorporate a "weak link" designed for use with a back-mounted transmitter. Once the "weak link" has snapped or rotted through, both the neck and body loops of the harness open completely, allowing the bird to escape from a snag or eventually shed an inoperative radio transmitter.

METHODS

Harness assembly.—The harness consists of a neck loop, breast section ("weak link") and body loop (Fig. 1a), the dimensions of which were

determined by attaching radio transmitters with harnesses to captive birds. The radio transmitter and battery are encased in epoxy resin with attachment lugs at either end and level with the bottom surface of the transmitter (Fig. 1a). A thin piece of closed-cell foam, slightly wider than the transmitter, is fixed with epoxy resin to the bottom surface of the transmitter to provide a flat base and some thermal insulation against the bird's back.

The neck and body loops are braided nylon cord (approx. 2 mm diameter), and the "weak link" is made from 40 grade cotton sewing thread protected by a sleeve of plastic tubing. The harness is constructed as follows:

Step 1

At the end of a length of braided nylon cord make a small eye by parting the strands of the cord and passing the end of the cord back through the parted strands. Melt this end back to the cord to secure the eye (Fig. 1b). The other end of the cord must be able to slide easily through this eye.

Step 2

Pass this length of nylon cord through the front attachment lug of the transmitter. Tie a knot almost at the end of the nylon cord and pass this end through the eye formed in Step 1 (Fig. 1a). This forms the neck loop. Ensure that the knot is tied so that the neck loop is of the predetermined size for the particular species of bird.

Step 3

Glue the nylon cord to the front attachment lug on the transmitter with epoxy resin so that the two pieces of cord forming the neck loop are of equal lengths from the transmitter to the knot/eye junction.

Step 4

At the end of another length of nylon cord make a small eye as in Step 1. Tie a knot almost at the end of a third length of nylon cord and pass that end through this small eye. These two lengths will form the body loop.

Step 5

Cut off the ends of the cord that form the neck and body loops near the knots so that they extend past the small eyes by 3–4 mm (Fig. 1b and 1c).

Step 6

Cut the plastic tubing to length so that it is slightly shorter than the distance between the attachment lugs on the transmitter, otherwise the neck and body loops will not fit snugly onto the bird.

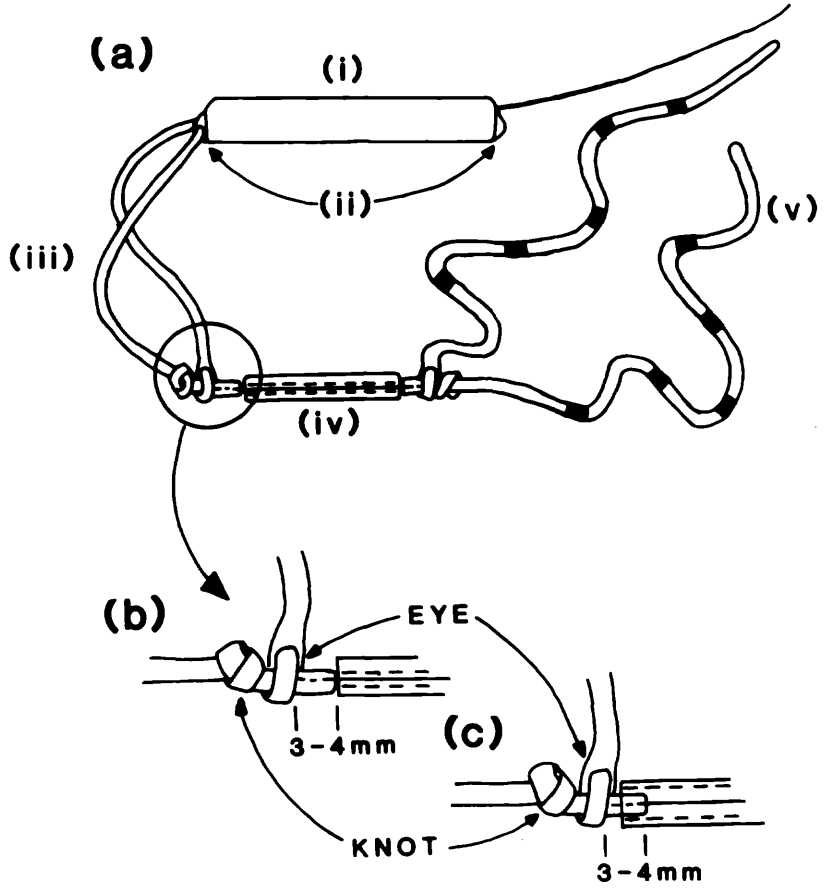

FIGURE 1. Radio transmitter harness arrangement. (a) (i) Transmitter package with whip antenna. (ii) Attachment lugs. (iii) Neck loop. (iv) Breast section ("weak link"). (v) Body loop. (b) Detail of "weak link" junction showing the plastic tubing abutting the nylon cord, as used on New Zealand Pigeon harnesses. (c) Detail of "weak link" junction showing the nylon tubing which is able to slide freely over the nylon cord, as used on Kaka harnesses.

Step 7

Join the neck and body loops with one or more cotton threads sewn through the loop ends and passed through the plastic tubing. The number of threads may be varied according to the required strength of the "weak link." Ensure that the thread is drawn tight to minimize abrasion of the cotton by the ends of the tubing.

Step 8

The two lengths of nylon cord that form the body loop can be marked with a spirit based ink at equal distances from the knot in several places

to help centralize the transmitter and harness when it is placed on the bird.

The internal diameter of the plastic tubing can be selected to allow the nylon cord to either abut against it (Fig. 1b), or to slide freely inside (Fig. 1c). The latter arrangement avoids any abrasion of the cotton thread by the plastic tubing.

Transmitter attachment.—While one person holds the bird, another person can position the radio transmitter by passing the bird's head through the neck loop and placing the transmitter on the bird's back. The two cords forming the body loop are passed, one on each side, around the bird, in front of the legs and behind the wings. The end of each cord is then drawn (in opposite directions) through the rear attachment lug on the transmitter and tightened equally on both sides (as judged by the marks on the cord) so that the breast section runs down the sternum and the transmitter and harness fit snugly but not tightly. The two ends of the body loop are tied off with a reef or square knot and glued to prevent untying.

RESULTS AND DISCUSSION

Our harness design has been used successfully on 21 free-ranging New Zealand Pigeons and 5 Kaka (*Nestor meridionalis*). Both species have carried transmitter packages using this harness without any observed ill effects. Behavior (including feeding, successful breeding, and seasonal migration) of birds with transmitters has appeared normal and we have not witnessed sustained attempts by the birds to remove transmitters or harnesses.

The harnesses used on New Zealand Pigeons had "weak links" consisting of 1 or 2 cotton threads protected by plastic tubing of 1.0 mm bore which abutted against (but did not fit over) the ends of the nylon harness loops (Fig. 1b). Twelve of the 21 harnesses attached to pigeons are known to have broken at the "weak link," causing the transmitter to fall from these birds while they were still operating. The exact cause of breakage of the link could not be determined in most cases, but two of these transmitter harnesses were found suspended from snags among dense foliage. In these instances the "weak links" had apparently snapped and freed the transmitter harnesses from the birds after they had become snagged. Nine of the 21 transmitter harnesses on pigeons remained on birds at least until the transmitters ceased functioning, up to 8 mo after attachment. One bird was sighted 13 mo after capture, still carrying its transmitter.

The harnesses used on Kaka had "weak links," designed for greater strength. Four cotton threads formed the "weak link" and were protected by nylon tubing of 3.0 mm bore, which fitted over the ends of the nylon harness loops (Fig. 1c) to avoid any possibility of abrasion of the cotton. All five harnesses on free-ranging Kaka remained attached for at least the life of the transmitters (3–5 mo) and another harness of this design,

fitted to a Kaka held in an aviary, remained attached until removed from the bird after 14 mo (P. R. Wilson, pers. comm.).

The problem of birds becoming snagged on branches by transmitter harnesses is not unique to our study. Hines and Zwickel (1985) recorded three deaths of Blue Grouse (*Dendragapus obscurus*) caused by harnesses becoming snagged on tree branches. The "weak link" harness that we describe could help in preventing this sort of problem in other radio-tracking studies of forest-dwelling birds. The materials used for the "weak link" and its protective sleeve may be varied according to the species being studied and the harness strength required.

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