

A Technique for Locating and Recovering Radiotransmitters at Close Range

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When radiotracking amphibians, reptiles, and other small vertebrates, determining the location of an animal to within less than a meter is frequently desirable. This is often difficult because most antennas are optimized for locating signals that are several meters to several kilometers away, and because of the complex habitat structure where many small vertebrates are found. For example, one might want to determine the location of a turtle in a large logjam, the position of a snake in a rock fissure, or the site of a frog sitting in a thicket. Being able to locate a transmitter to within centimeters can add valuable information to a tracking study as well as greatly facilitate the recovery of lost transmitters.

When trying to locate a nearby transmitter in locations where a normal multi-element antenna is ineffective, biologists often remove the antenna from the end of the coaxial cable and use the cable as a weak, omnidirectional antenna. Careful sweeps in a grid pattern can sometimes help locate the transmitter in grasslands and similar habitats, but this technique is not practical in many settings. To solve this problem, we have modified and greatly simplified a technique originally used by FWS biologists to recover lost duck transmitters from ponds (anonymous, unpublished FWS report).

First, we modify a coaxial cable by removing the connector at the antenna end of the cable, and stripping back the insulation and ground wire sheath about 2 cm. By separating the two wires in the cable, a small omnidirectional antenna is created. We then cut a 75-150 cm length of 1.4 cm (1/2") schedule 80 PVC pipe and seal one end with a PVC cap. The antenna cable is fed into the PVC pipe and the other end is connected to the radio receiver. The modification to the end of the cable creates a small antenna that is much more efficient compared with a plain cable that many biologists use. While an unmodified cable does detect some radio signals, it does not allow one to localize the signal nearly as well. The use of a PVC pipe allows researchers to more easily probe into crevices and underwater, compared with a loose cable.

We have used this system to locate the exact position of red-legged frogs (*Rana aurora*) during an ongoing study of habitat use. Red-legged frogs often sit in dense vegetation (e.g., cattails, poison oak, blackberry, nettles) or in logjams along creeks. Without the antenna pole, we would only have a general idea of where the frogs were located.

Recovering lost transmitters, or recapturing animals with expiring transmitters, is often a time consuming

part of telemetry studies. The antenna pole is extremely useful for these tasks. Gluing a magnet to the antenna pole with epoxy can facilitate the recovery of transmitters no longer attached to animals. The best magnets for this purpose are rare earth magnets, since they have far more pull (for their size) than ceramic magnets. We currently use a grade 30 neodymium disc magnet (2.5 cm diameter x 1.0 cm high, Catalog number NE150, \$18.00 from Dowling Magnets, 1-800-624-6381, www.dowlingmagnets.com/index1.html) though a wide range of sizes and strengths are available. Note that rare earth magnets are more brittle than standard ceramic magnets, so a thick magnet is preferable. The magnet can be attached to the capped end of the antenna pole so that one can locate and retrieve a transmitter simultaneously. Since we often use our antenna pole for locating animals that we do not want to disturb or capture, we use a separate wooden pole for the magnet.

We bolted a small angle bracket to the end of a broom handle and epoxied the rare earth magnet to the end. The bracket provides a secure attachment to the pole and a good surface for gluing the magnet. A rare earth magnet such as the one we use will pick up (and firmly hold) a small radiotransmitter from about 3-4 cm away.

When trying to locate a lost transmitter, we typically use the antenna pole to locate the transmitter as closely as possible. If we happen to bump the transmitter or touch the transmitter antenna, the signal often changes to a slightly higher or lower pitch. We then either reach down and simply pick up the transmitter, or switch to the magnet pole. When using the magnet pole, it is best to monitor the signal; the magnet can cause a notable change in signal (distortion or change of pitch) at close range, or can turn off the transmitter if the transmitter has an internal reed switch. In either case, changes in the signal are a clear indication that the transmitter is within 6-8 cm of the magnet. Of course, the distance over which a change might occur depends on intervening objects (e.g. mud, water, rocks, sticks) and the performance of the transmitter.

We have used the above technique for the last five years and have found lost transmitters in root masses, on the bottom of ponds, in dense cattails, and other difficult situations. Without the antenna pole, we would have spent far more time locating transmittered frogs and we would have frequently obtained only a general location. Additionally, since used transmitters can be refurbished with a new battery for about half the cost of a new transmitter, we have saved thousands of dollars by recovering nearly all our transmitters.

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