J. Field Ornithol., 70(4):587–590

RADIO TRANSMITTER RETRIEVAL IN WETLANDS USING A MAGNETIC PROBE

PHILIP C. DARBY

Department of Wildlife Ecology and Conservation
Florida Cooperative Fish and Wildlife Research Unit
P.O. Box 110450
University of Florida
Gainesville, Florida 32611-0450 USA

Abstract.—I developed a method for retrieving dropped radio transmitters in wetland and lake habitats. Magnets mounted on a pole altered the transmitter signal, thereby rapidly reducing the search area. Retrieval using the magnetic probe was tested using 15-g and 1.6-g transmitters under a variety of conditions. Using a magnetic probe, transmitter retrieval time in aquatic habitats was reduced from ≥1 h to an average of 12 min (range 5–25 min). The magnet method was advantageous for small transmitters whose retrieval was not facilitated by a motion sensor.

RECOBRO DE RADIOTRANSMISORES EN ANEGADOS UTILIZANDO UNA SONDA MAGNÉTICA

Sinopsis.—Desarrollé un método para recobrar radiotransmisores en anegados y en lagos. Para esto se montó un magneto en un tubo de aluminio que se introdujo en el agua. Esto alteró la señal del transmisor, lo que permitió reducir, marcadamente, el área de búsqueda. El aparato se probó utilizando transmisores desde 1.6 a 15 g de peso bajo diferentes condiciones. Utilizando la sonda magnética, se redujo el recobro de transmisores de más de una hora, a un promedio de 12 min (alcance de 5 a 25 min). El método resultó sumamente ventajoso para recobrar transmisores pequeños, lo que no es facilitado con el sensor de movimiento que se monta actualmente junto a éstos aparatos.

Advances in electronic circuitry and battery miniaturization have permitted telemetric studies to be conducted on avian species ranging in size from Bald Eagles (*Haliaeetus leucocephalus*) (Buehler et al. 1991) to warblers (*Wilsonia citrina*) (Stutchbury 1998), providing data on movements, activity, survival, and physiology (Cochran 1980, Kissner and Brigham 1993, Strong et al. 1997, Powell et al. 1998). Despite technological improvements, retrieving dropped transmitters remains a time-consuming process because of the difficulty of precisely localizing signals. Challenges faced while working in lake and wetland habitats in Florida led me to develop a method for retrieving dropped transmitters that saves considerable time and effort.

I was a field assistant on a project that included radio-tracking Snail Kites (*Rostrhamus sociabilis plumbeus*) (Bennetts and Kitchens 1997), a raptor that forages for snails in wetland and lake systems in Florida (Bennetts et al. 1994, Sykes et al. 1995). Snail Kites were equipped with 15-g radio transmitters. I had to retrieve dropped radio transmitters and transmitters from dead kites, which were often submerged in water in vegetated marsh and lake habitats. The 15-g transmitters were equipped with motion sensors which doubled the pulse rate (a "mortality signal") if the transmitter remained motionless for approximately 4 h (Kenward 1987).

A minimum of 1 h delay in switching to the mortality signal is recommended to avoid mistaking a resting animal for a dead one (Cochran 1980, Kenward 1987).

Dropped transmitters or dead kites were retrieved by isolating the signal to the smallest possible area (usually a 3-m diameter circle) using a radio receiver, and then raking the area with a garden rake until the transmitter was contacted. Once moved, the rapid pulse switched to the normal rate, and the area immediately around the rake was searched intensively. Despite contacting the transmitter with the rake, retrieving transmitters (especially detached ones) from organic substratum, debris, and vegetation often required ≥1 h. Transmitters among emergent or submerged vegetation were sometimes moved by raking vegetation 1–3 m away. This resulted in an intensive search of a much larger area, or waiting 4 h for the return of the mortality signal and then repeating the process. Problems associated with retrieval increased as the water depth increased (transmitters were retrieved from depths up to 3 m in lakes).

Some transmitters have a magnet sensitive on-off switch (Kenward 1987). Transmitter manufacturers ship their units with a magnet attached to keep the transmitters turned off until ready for use. A transmitter could be located if the signal were disrupted with a magnet, avoiding the problem of disturbing the mortality signal and waiting several hours for it to reset. In addition, much smaller volumes of algae, detritus, and plant material would have to be searched.

I constructed a magnetic rake for approximately US$50. The handle consisted of a 2-m long, 2-cm diameter pipe made of 1.5-mm thick aluminum (AL). The 10 × 5 × 3 cm magnets came equipped with eye hooks for mounting. Three magnets were mounted via 3-cm stainless bolts to three separate pieces of 4 × 4-cm aluminum bar. The center bar was 1.5-m long and attached to the handle via stainless sheet metal screws (welding also recommended). The two 28-cm long side-mounting bars were attached to the center bar at a 30° angle. This resulted in a 5-cm space between magnets (Fig. 1), which eased movement through vegetation. Each magnet was rated as having a 25-kg pull. Larger magnets (several times larger than those sent by the radio manufacturer) were chosen because they could alter the signal when placed within 6–12 cm of the transmitter body or its antenna. For use in deep water, the probe was mounted on an extension pole.

I used a 15-g transmitter and a 1.6-g transmitter to test the efficacy of the magnetic probe. Signal alterations included a skip in the pulse, an elimination of the signal, or a lowering of signal pitch. In field trials, signal alteration was achieved when the transmitter was buried 12 cm in soil, when submerged in water up to 3-m deep, and when submerged among macrophytes rooted in mineral and organic substrata. Note that the potting material that coats transmitters limits the strength of magnetic attraction, and therefore retrieval may still require a net or other device, especially in deep water. Retrieval time for 1.6-g transmitters in vegetated wetland habitats was 13 ± 8 min (SD; n = 12) in water depths from 5–

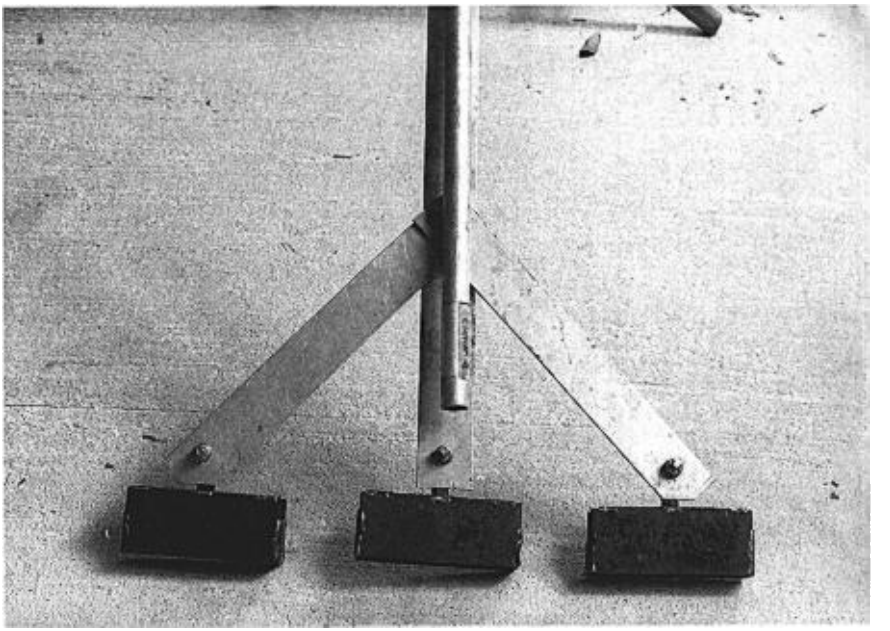

FIGURE 1. Configuration of the magnets mounted on the magnetic probe.

34 cm. Retrieval time generally increased with water depth and vegetation density (qualitative assessment only). Although quantitative data were limited (e.g., no time data were collected on 15-g transmitters), the magnetic rake approach undoubtedly reduced transmitter retrieval times from typically $\geq$1 h to a few minutes.

Telemetry applications for wildlife are limited by the size of the transmitter relative to the mass of the species studied (Cochran 1980). Features such as mortality sensors are limited to larger transmitters (i.e., >5 g according to commercial manufacturers), and, therefore, are not available for use in studies of small organisms. The magnet method is advantageous for use with a small transmitter, such as the 1.6-g transmitter tested here, whose retrieval is not facilitated by a motion sensor.

ACKNOWLEDGMENTS

I was supported under a contract to Rob Bennetts and Wiley Kitchens funded by the U.S. Fish and Wildlife Service and the National Park Service through cooperative agreement #14-16-0007-1544, RWO 090 of the Florida Cooperative Fish and Wildlife Research Unit. I am grateful to Mr. Guy Carpenter of the Florida Game and Fresh Water Fish Commission for his suggestions on the initial development of the magnetic rake, and to Patricia Valentine-Darby, H. Franklin Percival, Paul Sykes and an anonymous reviewer for comments on this manuscript. This is contribution No. R-06622 of the Florida Agricultural Experiment Station Journal Series.

LITERATURE CITED

BENNETTS, R. E., AND W. M. KITCHENS. 1997. The demography and movements of Snail Kites in Florida. Tech. Rep. No. 56, U.S.G.S. Biological Resources Division, Fl. Coop. Fish & Wildl. Res. Unit., Gainesville, Florida. 169 pp.

———, M. W. COLLOPY, AND J. A. RODGERS. 1994. The Snail Kite in the Florida Everglades: a food specialist in a changing environment. Pp. 507–532, *in* S. M. Davis and J. C. Ogden, eds. Everglades: the ecosystem and its restoration. St. Lucie Press, Delray Beach, Florida.

BUEHLER, D. A., T. J. MERSMANN, J. D. FRASER, AND J. K. D. SEEGAR. 1991. Nonbreeding bald eagle communal and solitary roosting behavior and roost habitat on the Northern Chesapeake Bay. J. Wildl. Manage. 55:273–281.

COCHRAN, W. W. 1980. Wildlife telemetry. Pp. 507–520, *in* S. D. Schemnitz, ed. Wildlife management techniques manual. Wildlife Society, Washington, D.C.

KENWARD, R. 1987. Wildlife radio tagging. Academic Press, San Diego, California. 222 pp.

KISSNER, K. J., AND R. M. BRIGHAM. 1993. Evidence for the use of torpor by incubating and brooding Common Poorwills *Phalaenoptilus nuttallii*. Ornis Scand. 24:333–334.

POWELL, L. A., D. G. KREMENTZ, J. D. LANG, AND M. J. CONROY. 1998. Effects of radio transmitters on migrating Wood Thrushes. J. Field Ornithol. 69:306–315.

STRONG, A. M., G. THOMAS BANCROFT, AND S. D. JEWELL. 1997. Hydrological constraints on Tricolored Heron and Snowy Egret resource use. Condor 99:894–905.

STUTCHBURY, B. J. M. 1998. Extra-pair mating effort of male hooded warblers, *Wilsonia citrina*. Anim. Behav. 55:553–561.

SYKES, P. W., JR., J. A. RODGERS, AND R. E. BENNETTS. 1995. Snail Kite (*Rostrhamus sociabilis*). No. 171 *in* A. Poole and F. Gill, eds. The birds of North America. Academy of Natural Sciences, Philadelphia and American Ornithologists' Union, Washington, D.C. 32 pp.

Received 3 Nov. 1998; accepted 2 Mar. 1999.