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APPLICATIONS AND CONSIDERATIONS FOR WILDLIFE TELEMETRY

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This presentation is a review of radio telemetry; that is, the sending of information over some distance using radio frequencies. The technique is a form of biotelemetry, which also includes laboratory/physiology applications wherein signals can be transmitted from subject to receiver/recorder. Radio telemetry is a research tool. When using telemetry, it is essential to consider how it is to be used to achieve one's objectives and what time and money will be required.

Telemetry can be used by the researcher to accurately locate animals for further observation, to determine home range, habitat use, migration routes, activity patterns, predator-prey relationships, survival, and to locate nests, roosts, etc. Transmitters that gather data on the microclimate of the animal have also been developed. In addition telemetry has been used to obtain physiological data. Examples of many of these uses were presented by Amlaner and Macdonald (1980).

Transmitter attachment techniques are as diverse as the size, shape, weight and application of the transmitters. References at the end of this summary provide an introduction to the general literature on wildlife telemetry techniques, and Kenward's paper (1985) provides a good review of raptor telemetry. Successful attachment techniques are far better documented than failures. Therefore, before trying new methods and equipment, check with researchers experienced with similar techniques and species. To summarize briefly, tail mounts can only be used with comparatively light-weight transmitters and are lost when feathers are molted. Backpack transmitters require suitable harness material; teflon ribbon has been useful on raptors. Glue-on transmitters have not been used often on raptors. Transmitters powered by solar cells are very lightweight and can be used alone or with rechargeable batteries to provide nighttime coverage (Wischusen 1981; Kenward 1987). Solar transmitters are not compatible with attachment techniques that allow birds to preen feathers over the transmitter or with animals inhabiting dense vegetation.

Before beginning a radio telemetry study, biologists should determine how long the animals must be monitored. Larger (and heavier) batteries provide longer life and stronger radio signals. Consider compromising between time and weight. Make sure that the company supplying your equipment understands your needs and has experience with similar applications. Design engineers usually provide optimistic estimates of transmitter life, based on signal strength and pulses of their products. However, many variables that affect equipment performance on an animal in the field cannot be factored into basic electronics considerations.

Time frame of the study will also determine appropriate attachment techniques. Many harness materials (e.g., teflon) last for months or years. Presently, few attachment methods (e.g., glue, fasteners for harness material) have been developed to reliably detach at pre-determined durations after attachment. However, David Garcelon (Institute for Wildlife Studies, P.O. Box 127, Arcata, CA 95521) has had success developing a drop-off attachment for Bald Eagles (*Haliaeetus leucocephalus*). Tail mounts are useful for studies not extending beyond a molt.

Behavioral and energetic changes in animals carrying radio transmitters have been incompletely documented for a few species and are completely undocumented for many others. In the short term there may be a period of up to several days of reduced activity as the animal adjusts to a harness and transmitter. Over a longer period, brood abandonment, icing and tangling have been documented for a variety of mammals and birds. Some diving ducks will not feed normally with harness attachments (but see QUESTIONS section). Jim Gessaman (UME 53, Utah State University, Logan, UT 84322) and Mark Fuller (Patuxent Wildlife Research Center, USFWS, Laurel, MD 20708) are investigating energetic implications of additional weight and thermal effects of large transmitters (as a heat sink). A recent article by Caccamise and Hedin (1985) deals with bird size and appropriate transmitter weight. In general transmitter weight should be a smaller percentage of body weight for larger birds than for smaller birds. Transmitter weight affects potential maximum velocity, maximum power and endurance. As a result, escape speed, pursuit speed, payload, persistence of

Table 1. Suppliers of telemetry equipment (compiled June 1987).

Advanced Telemetry Systems, Inc.
23859 NE Highway 65
Bethel, MN 55005
(612)434-5040

Austec Electronics, Ltd.
#1006, 11025-82 Ave.
Edmonton, Alberta T6G 0T1
CANADA
(403)432-1878

AVM Instrument Co., Ltd.
2368 Research Dr.
Livermore, CA 94550
(415)449-2286

Bally Ribbon Mills
23 N. 7th St.
Bally, PA 19503
(215)845-2211
(For teflon ribbon harness material)

Beacon Products Co.
360 East 4500 South
Salt Lake City, UT 84107
(801)265-1383

Biotrack
Stoborough Croft
Grange Rd., Stoborough
Wareham, Dorset BH20 5AJ
ENGLAND
Wareham (09295) 2992

B & R Ingenieurgesellschaft mbH
Johann-Schill-Str. 22
7806 March-Buchheim, WEST GERMANY

Custom Electronics of Urbana, Inc.
2009 Silver Ct. West
Urbana, IL 61801
(217)344-3460

Custom Telemetry and Consulting
185 Longview Dr.
Athens, GA 30605
(404)548-1024

Holohil Systems Ltd.
RR 2 Woodlawn, Ontario
CANADA K0A 3M0
(613)832-3649

J. Stuart Enterprises
P.O. Box 310
Grass Valley, CA 95945

L.L. Electronics
P.O. Box 247
Mahomet, IL 61853
(215)586-2132

Lotek Engineering, Inc.
11 Younge St. S
Aurora, Ontario
CANADA L4G 1L8
(416)727-0181

Microwave Telemetry
610 Chestnut Ave.
Towson, MD 21204

Midwest Telemetry
Judy Montgomery
P.O. Box 773
Urbana, IL 61801
(217)367-1904

Narco Scientific (short range-biomed)
7651 Airport Blvd.
P.O. Box 12511
Houston, TX 77017
(713)644-7521

Remote Monitoring Systems
P.O. Box 2155
Walla Walla, WA 99362
(509)529-1060

Scien-O-Tech Consultants, Ltd.
Box 14426
NAIROBI
or
Box 87054
Mambasa, KENYA

Telemetry Systems, Inc.
11065 N. Lake View Dr.
P.O. Box 187
Mequon, WI 53092
Owner—Owen Royce
(414)241-8335

Telonics
932 Impala Ave.
Mesa, AZ 85204-6699
Owner—Dave Beaty
(602)892-4444

Wildlife Materials, Inc.
R.R. 1
Carbondale, IL 62901
Wildlife Consultant—R. E. Hawkins
(618)549-6330

fat reserves, flight distances and stopover times can be affected. Added drag affects aerodynamic performance and can alter a bird's center of gravity. C. J. Pennycuick (Department of Biology, University of Florida, Coral Gables, FL 33124) has suggested tests for transmitter effects on various flight behaviors and mechanics, and Pennycuick and Fuller are studying some of these aspects. Given that little is known of the impacts of transmitters on animals, it might be desirable to recapture test subjects and remove transmitters, which is often difficult and time consuming.

A little-known fact about radio telemetry is that one needs a license from the Federal Communications Commission (FCC) to conduct telemetry studies. There are restrictions on frequency, power output, numbers of transmitters per unit area, etc. Kolz (1983) has published an informative article on the subject, giving pertinent restrictions. The U.S. Fish and Wildlife Service Bird Banding Laboratory, Laurel, MD 20708, provides brief information on regulations, and a list of companies that manufacture wildlife telemetry equipment (Table 1).

QUESTIONS

William Cochran stated that Judy Montgomery (Midwest Telemetry, see Table 1) has designed a neck collar transmitter attachment that appears not to interfere with the normal feeding activity of diving ducks.

REFERENCES

AMLANER, C. J., JR. AND D. W. MACDONALD. (EDS.). 1980. A handbook on biotelemetry and radio tracking. Pergamon Press, New York, NY.

CACCAMISE, D. F. AND R. S. HEDIN. 1985. An aerodynamic basis for selecting transmitter loads for birds. *Wilson Bull.* 97:306–318.

CHEESEMAN, C. L. AND R. B. MITSON (EDS.). 1982. Telemetric studies of vertebrates. Proc. Symp. Zool. Soc. London. Academic Press, New York, NY.

COCHRAN, W. W. 1980. Wildlife telemetry. Pages 507–520. *In* S. D. Schemnitz, ED., Wildlife management techniques manual, 4th ed. Wildlife Society, Washington, D.C. (lists references for attachment techniques)

INTERNATIONAL CONFERENCE ON WILDLIFE BIOTELEMETRY. Various years and places.

INTERNATIONAL SYMPOSIUM ON BIOTELEMETRY. Various years and places.

KENWARD, R. 1985. Raptor radio-tracking and telemetry. Pages 409–420. *In* I. Newton and R. D. Chancellor, (EDS.). Conservation studies on raptors. ICBP Technical Publication No. 5. Cambridge, UK.

———. 1987. Wildlife radio tagging: equipment, field techniques and data analysis. Academic Press, NY.

KOLZ, A. L. 1983. Radio frequency assignments for wildlife telemetry: a review of the regulations. *Wildl. Soc. Bull.* 11:56–59.

MECH, L. D. 1983. Handbook of animal radio-tracking. University of Minnesota Press, Minneapolis, MN. 107 pp.

PATRIC, E. F., G. A. SHAUGHNESSY AND G. B. WILL 1982. A bibliography of wildlife telemetry and radio tracking. Department of Forest and Wildlife Management, College of Resource Development, University of Rhode Island. Contribution No. 2054, Rhode Island Agricultural Experiment Station, Univ. of Rhode Island, RI 02881.

WISCHUSEN, E. W. 1981. Population dynamics, behavior, and habitat use of the Red-tailed Hawk in westcentral Alabama. Unpub. M.Sc. Thesis. The University of Alabama, Dept. of Biology, P.O. Box 1927, University, AL 35486.

Effects of Transmitters on Behavior:

GILMER, D. S., I. J. BALL, L. M. COWARDIN AND J. H. REICHMANN. 1974. Effects of radio packages on wild ducks. *J. Wildl. Manage.* 38:243–252.

HORTON, G. I. AND M. K. CAUSEY. 1984. Brood abandonment by radio-tagged American Woodcock hens. *J Wildl. Manage.* 48:606–607.

KARL, B. J. AND M. N. CLOUT. 1987. An improved radio transmitter harness with a weak link to prevent snagging. *J. Field Ornith.* 58:73–77.

NENNO, E. S. AND W. M. HEALY. 1979. Effects of radio packages on behavior of Wild Turkey hens. *J. Wildl Manage.* 43:760–765.

PERRY, M. C. 1981. Abnormal behavior of canvasbacks equipped with radio transmitters. *J. Wildl. Manage.* 45: 786–789.

U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD 20708.