

# SURGICAL IMPLANTATION OF A TRANSMITTER PACKAGE FOR RADIO-TRACKING ENDANGERED HELLBENDERS<sup>1</sup>

RONALD H. STOFFER, JR., *Appalachian Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland, Frostburg State College Campus, Gunter Hall, Frostburg, MD 21532*

J. EDWARD GATES, *Appalachian Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland, Frostburg State College Campus, Gunter Hall, Frostburg, MD 21532*

CHARLES H. HOCUTT,<sup>2</sup> *Appalachian Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland, Frostburg State College Campus, Gunter Hall, Frostburg, MD 21532*

JAY R. STAUFFER, JR., *Appalachian Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland, Frostburg State College Campus, Gunter Hall, Frostburg, MD 21532*

The hellbender (*Cryptobranchus alleganiensis*) is listed as endangered in Maryland and is declining throughout its range (Williams et al. 1981a). A major problem in studying the ecology of this species has been the difficulty in locating individuals on consecutive days because they tend to remain hidden under large, flat rocks during daylight hours (Smith 1907, Bishop 1941, Noeske and Nickerson 1979). Thus far, techniques such as toe-clipping (Hillis and Bellis 1971), mammalian ear tags (Nickerson and Mays 1973a), or Floy T-tags (Nickerson and Mays 1973a, b) have been used to identify recaptured individuals. However, location of individuals is difficult, inefficient, and often results in habitat alteration by the searcher. Often, a marked and released animal is not found at all. Snorkeling or electroshocking equipment is less destructive to the habitat (Williams et al. 1981b), but large areas must be searched to locate a particular individual.

We evaluated the feasibility of using implanted radio transmitters to locate individuals within stream habitat. Surgical implantation of radio transmitters was selected to minimize interference with normal behavioral patterns and susceptibility to skin infections.

## METHODS

### *Maintenance and Transportation*

A covered 1-m × 2-m × 1-m pre- and post-operative holding pen for hellbenders was constructed of 6.4-mm mesh galvanized wire placed on a 5.1-cm × 5.1-cm wooden frame. A woven polyethylene mat was placed on the bottom of the pen to minimize abrasions on the ventral surfaces of the animals. Flat rocks were arranged on top of the mat to provide shelter and to weight the pen. The pen was placed in approximately 25–50 cm of water in a small lotic pool adjacent to the Maryland Department of Natural Resources Fish Rearing Station on Bear Creek, Garrett County. This location contained cool, well-oxygenated water.

Five hellbenders were captured on 1 July 1981 in French Creek, Venango Township, Crawford County, Pennsylvania. Capture was by electroshocking and turning over large flat rocks (Williams et al. 1981b). Seines and dip nets were used with both methods to assist in the capture of animals. The animals ranged from 450 to 560 mm in total length and 445 to 810 g in weight. Each was considered to be adult (Bishop 1941, Nickerson and Mays 1973a). All hellbenders were transported in 75.7-liter plastic trash cans, supplied

<sup>1</sup> Contribution No. 1399-AEL, Center for Environmental and Estuarine Studies, University of Maryland.

<sup>2</sup> Present Address: Horn Point Environmental Laboratories, Center for Environmental and Estuarine Studies, University of Maryland, Cambridge, MD 21613.

with air from an aquarium pump. Ice was added periodically to keep the water cool, although minor temperature changes had little apparent effect on the hellbenders. Transportation time was 6 hours. Upon arrival at the holding facility in Bear Creek, the hellbenders were placed in the pen and allowed to acclimate to the stream for 13 to 28 days prior to surgery. Crayfish (*Orconectes* spp.), mottled sculpin (*Cottus bairdi*), and blacknose dace (*Rhinichthys atratulus*) were supplied as food on alternate days. No change in physical appearance was noted during confinement.

### Implantation Procedure

The surgical technique used was performed under both field and laboratory conditions. Anesthetic solutions were prepared on location and all instruments were sterilized with ethyl alcohol. Sterile surgical gloves were worn during the operation. Prior to surgery, hellbenders were immersed totally in a 1:3 concentration (g/l) at 15 C of MS-222, tricaine methanesulfonate. An animal was judged to be anesthetized when no movement occurred and the body was flaccid when removed from the anesthetic. At a 1:3 concentration, average induction time was 23 ( $\pm 3.4$  SE,  $n = 4$ ) min.

Following removal from the anesthetic, each hellbender was placed dorsal side down in a sterilized dissecting tray. MS-222 solution was added to the tray to a depth of 4 mm to prevent premature revival and to keep the animal's skin moist. A 2–3 cm long incision made with a sterile scalpel was perpendicular to the ventral mid-line about 3 cm from the mid-ventral line and approximately 5 cm anterior of the left rear leg. This location minimized stress on the sutures by the transmitter package (see Winter et al. 1978) resulting in less chance of tearing.

Transmitter packages were sealed cylindrical units 4.8 cm in length  $\times$  1.6 cm in diameter and weighing 11.6 g. About one-quarter of the length consisted of a small loop antenna (Fig. 1). Transmitter frequencies were in the 150–151 MHz range. Life expectancy of transmitters was estimated to be 5–6 months.

A transmitter was placed through the incision and aligned parallel to the intestine and gonads. After checking the operation of the transmitter, the incision was closed with an absorbable gut suture material using 5–6 stitches. Either an Ethicon needle with plain 000 gut or a Dexon needle with polyglycolytic acid (synthetic) gut suture was used. Each operation took from 15–20 min. After surgery animals were placed in fresh water, either in a bucket or the holding pen, to await recovery. Recovery time averaged 25 ( $\pm 2.0$  SE,  $n = 4$ ) min.

### RESULTS AND DISCUSSION

After 19–23 days of post-operative observation with no apparent complications, hellbenders were released in Bear Creek, 9.3 km

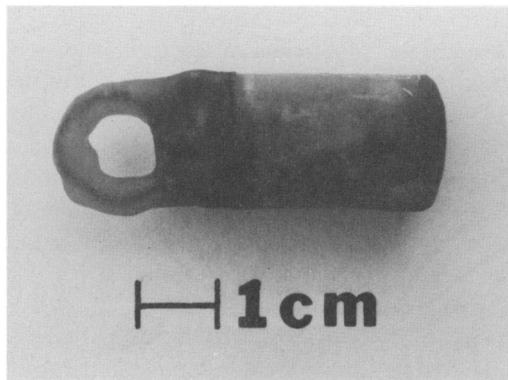


Fig. 1. The small radio transmitter unit that was implanted in the pleuroperitoneal cavity of the hellbender.

downstream of the Fish Rearing Station, on 2 August (2 individuals) and 21 August (3 individuals) 1981. Animals probably could have been released immediately upon recovery from the anesthetic if a nonabsorbable suture material had been used to lessen the possibility that the incision might open.

Animals were located with a handheld, 4-element, Yagi beam antenna and headphones attached to a 20-channel receiver, either from the vicinity of our vehicle on a road paralleling the stream, or by wading or walking along the shore. Streamside vegetation did attenuate the signal somewhat as well as did distance of the road from the stream (100 m at some points). However, the road did occasionally rise 10–15 m or more above the stream allowing better reception of the signal than would have occurred at stream level. When wading the stream or walking along the shoreline, reception was line-of-sight from the investigator to an individual animal. The Yagi antenna was employed until we were within 15 or 20 m of an individual, at which time the signal was of equal strength in all directions. The transmitter could then be pinpointed with a handheld, receiving loop, bi-directional (ping-pong paddle) antenna.

The overall technique was successful in

monitoring the movements of individual hellbenders for an average of 2.8 ( $\pm 0.52$ ,  $n = 5$ ) months (range = 1.4–4.0). Most transmitter failures were thought to be due to possible moisture seepage through the wax and dental acrylic packaging. Animals were usually monitored 3 times/week. Periodic visual observations verified that each animal was alive throughout the monitoring period.

The technique was found to be successful in monitoring the daily and seasonal movement patterns of individuals and could also be used to evaluate the success of release programs designed to re-establish hellbenders in suitable stream habitats.

*Acknowledgments.*—G. A. Feldhamer and G. J. Taylor reviewed the manuscript. T. J. Welch and J. R. Lebo assisted in the initial capture and transportation of hellbenders, and during the surgical procedure. S. H. Harmon, D.V.M., offered advice on the surgical technique during the early planning stages. C. Shifer, Pennsylvania Fish Commission, helped in acquiring all necessary permits. Personnel at the Bear Creek Fish Rearing Station allowed us to maintain hellbenders at the facility. The polyethylene mat was donated by the 3M Company. Typing was done by K. A. Twigg. Funds for this research were provided by the Maryland Department of Natural Resources, Wildlife Administration, and the U.S. Fish and

Wildlife Service through the Maryland Endangered Species Program.

#### LITERATURE CITED

- BISHOP, S. C. 1941. The salamanders of New York. *New York State Mus. Bull.* 324:1–356.
- HILLIS, R. E. AND E. D. BELLIS. 1971. Some aspects of the ecology of the hellbender, *Cryptobranchus alleganiensis alleganiensis*, in a Pennsylvania stream. *J. Herpetol.* 5:121–126.
- NICKERSON, M. A. AND C. E. MAYS. 1973a. The hellbenders: North American "giant salamanders." *Publ. Biol. Geol., Milwaukee Public Mus., Wis.* 1: 1–106.
- AND ———. 1973b. A study of the Ozark hellbender *Cryptobranchus alleganiensis bishopi*. *Ecology* 54:1164–1165.
- NOESKE, T. A. AND M. A. NICKERSON. 1979. Diel activity rhythms in the hellbender, *Cryptobranchus alleganiensis* (Caudata: Cryptobranchidae). *Copeia* 1979:92–95.
- SMITH, B. G. 1907. The life history and habits of *Cryptobranchus alleganiensis*. *Biol. Bull.* 13:5–39.
- WILLIAMS, R. D., J. E. GATES, C. H. HOCUTT, AND G. J. TAYLOR. 1981a. The hellbender: A nongame species in need of management. *Wildl. Soc. Bull.* 9:94–100.
- , ———, AND ———. 1981b. An evaluation of known and potential sampling techniques for hellbender, *Cryptobranchus alleganiensis*. *J. Herpetol.* 15:23–27.
- WINTER, J. D., V. B. KUECHLE, D. B. SINIFF, AND J. R. TESTER. 1978. Equipment and methods for radio-tracking freshwater fish. *Univ. Minnesota Agric. Exp. Sta. Misc. Rep.* 152. 18pp.

Received 13 July 1982.

Accepted 29 January 1983.

