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USE OF A FIBERSCOPE FOR EXAMINING CAVITY NESTS

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Abstract.—A system is described that uses a fiberscope to view nests in cavities to provide detailed information on eggs and nestlings. The flexible probe can be inserted around bends, and the tip articulates to allow viewing of the entire cavity and nest. A light guide bundle furnishes light to enable viewing of dark cavities and optical fibers transmit the image from the lens to the eyepiece. Using the fiberscope, we were able to get accurate egg counts and to see details of the nestlings that indicated age and development, including feather growth and whether the eyes were open. Nest checks were also quicker than using the standard light and mirror apparatus. Drawbacks include cost and, possibly, durability.

UTILIZACIÓN DE FIBROSCOPIOS PARA EXAMINAR NIDOS EN CAVIDADES

Sinopsis.—Se describe un sistema que utiliza fibroscopios que permite observar nidos dentro de cavidades y obtener información detallada sobre los huevos y los pichones. La fibra flexible puede insertarce alrededor de esquinas y la punta articula adecuadamente para poder observar la cavidad completa y el nido.

Una guia de luz provee la claridad necesaria para poder observar dentro de cavidades oscuras y la fibra óptica transmite una buena imagen del lente hasta el ocular. Utilizando el fibroscopio, fuimos capaces de obtener números exactos de la cantidad de huevos y observar detalles, tales como el desarrollo de las plumas y apertura de los ojos, sobre el desarrollo y edad de los pichones. El examen de los nidos se hizo más rápidamente que cuando se utilizó un espejo y una fuente de luz convencional. Los aspectos menos positivos lo son el costo del aparato y posiblemente la durabilidad del mismo.

Although the nesting habits of cavity-nesting birds have been well-studied compared to open-nesting species, we know far less about what goes on inside nest cavities than in cup nests. This is primarily due to the difficulty of seeing into nest cavities. Data for primary cavity nesters are especially lacking, and most of what we know about secondary cavity nesters is based on studies that have used nest boxes. Studies using nest boxes may not provide data representative of birds breeding in excavated and natural cavities (van Balen et al. 1982; East and Perrins 1988; Møller 1989, 1992; Nilsson 1984a, 1984b; Robertson and Rendell 1990). Nests in nest boxes have been shown to have lower predation rates (Møller 1989; Nilsson 1975, 1984a,b; Robertson and Rendell 1990) and to differ in clutch initiation dates, clutch sizes, thermal properties, and ectoparasite loads (van Balen 1984; Møller 1989; Nilsson 1975, 1984a; Korpimaki 1984). In addition, mating systems, competition for nest sites, and community structure may be altered by the addition of nest boxes to a habitat (Alatalo and Lundberg 1984, van Balen et al. 1982, Møller 1989, Robertson and Rendell 1990).

Several workers have used small, adjustable mirrors and lights to see into cavities, but bends or curves in a cavity, cavity depth, or entrance diameter sometimes preclude examining nest contents. Others have cut

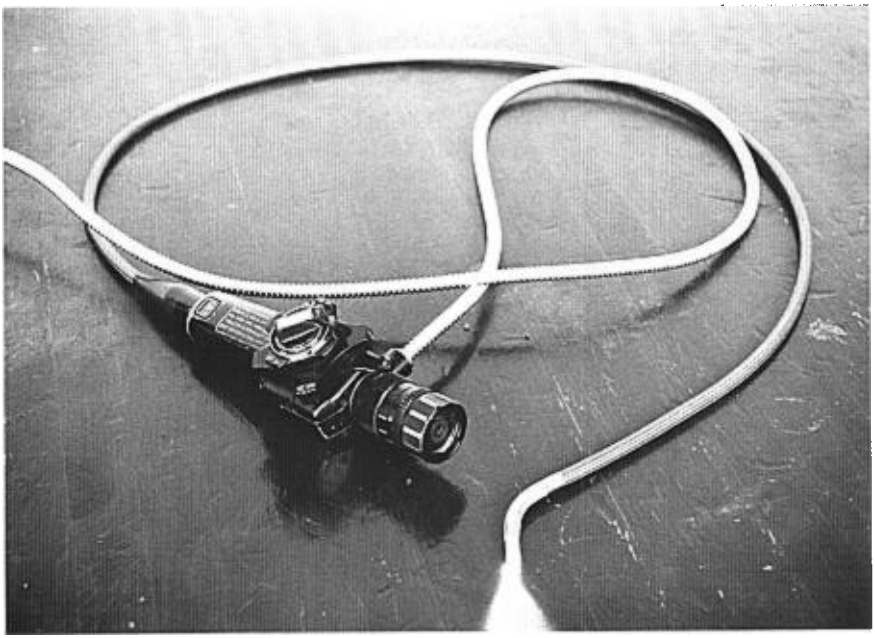

FIGURE 1. Olympus IF8D3-15 fiberscope, light source, and battery.

openings either at the back of the cavity (Jackson 1976) or below the cavity entrance (Stanback and Koenig 1994) that allowed them to reach nests, although these techniques may compromise the longevity of the cavity. Moriarty and McComb (1982) described the use of a fiber-optic system for examining cavity nests, but were unable to provide adequate lighting with a fiber-optic light source. After adding two penlight bulbs to the lens, they could view only cavities with entrances ≥4 cm in diameter. East and Perrins (1988) used a fiber-optic scope to examine nest cavities without describing the equipment. Here I describe a fiberscope that we have been using for 5 yr to see inside cavities of primary and secondary cavity-nesting birds.

An industrial fiberscope is a remote inspection device with a long, flexible insertion tube that contains optical fibers and a light-guide bundle (Fig. 1). A light source with a power supply enables viewing of dark cavities. Optical fibers carry the image from the objective lens back to the eyepiece. The light-guide bundle provides illumination by transmitting light from a light source to light windows near the lens at the distal end. The ocular end has an eyepiece, a focus control knob, and articulation control knobs. The flexible probe can be maneuvered around corners and other obstacles to view nests otherwise inaccessible to the human eye. The tip of the insertion tube articulates, allowing a wider field of view.

Use of this fiberscope has enabled us to view the nests in nearly every cavity to which we could climb (700 nests over 5 yr). We have also used it

to see into enclosed nests such as those of Bushtits (*Psaltriparus minimum*) and occasionally we used it to view House Wren (*Troglodytes aedon*) nests in nests boxes that were jammed full of twigs. Not only can we get accurate egg counts, but we can also track nestling development in detail, including the amount and color of down, growth of flight and body feathers, and whether the eyes are open. Nests can be examined more quickly than with a light and mirror apparatus, reducing the chance of attracting visual predators to the nest site and presumably leaving less human scent at the nest site and in the area.

The fiberscopes we used were Olympus Industrial Fiberscopes, models CHIF8D3-15, with a 1.5-m insertion tube, and CHIF8D3-20, with a 2-m insertion tube. (Trade names and commercial products are mentioned for information only. No endorsement by the U.S. Department of Agriculture is implied.) The 1.5-m length has a larger image and is long enough for all active nests. The tube is 8.4 mm in diameter, is protected by a stainless steel mesh cover, and is waterproof. The tip has four-way articulation, allowing 120° up-down movement and 100° side-to-side movement. Four-way articulation is often necessary to locate the nest within the cavity and individual nestlings in the nest. The field of view is 40°, with a depth of field ranging from 2 mm to infinity. Camera adapters are available.

The light source we use weighs approximately 0.7 kg and has a 150-watt halogen lamp that supplies a bright light in enclosed spaces. A 12-volt, rechargeable, lead-acid battery weighs an additional 2.4 kg.

We carried the fiberscope in a large canvas grocery bag lined with foam and attached to a small backpack containing the light source and battery. Worn on the back, with the bag falling to the side at hip level, the system could be transported easily in the field and worn while climbing.

Drawbacks include cost and possibly durability. Our initial system cost was just under US$6000, although we have since purchased discounted scopes for around US$3000. Our units have required repairs at times—a heavily-used scope seems to require adjustment of the focus cable nearly every year—and twice we have had unrepairable damage. Nevertheless, we believe the quality of the data we obtain is worth the cost.

Another limitation, regardless of the utility of the fiberscope, is that some cavities are not accessible. Nests in snags or dead limbs of live trees and nests high in small-diameter trees pose safety problems. We have encountered only one nest that we could climb to but not see into. This was a White-breasted Nuthatch (*Sitta carolinensis*) nest in a cavity that went straight down a limb scar and then laterally into a major hollow branch. We could see the side of the nest but not into the nest cup.

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