Preparation and Deployment of Canopy Mist Nets Made by Avinet

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Introduction

Some species of bats appear restricted to the canopy and subcanopy of forests and thus are rarely captured in nets set at ground level. Major sampling bias may result unless nets are deployed from the ground into the canopy (Kalko and Handley, 2001). For example, Francis (1994) found that both species richness and relative abundance of Old World plant-visiting bats were markedly higher in the subcanopy than at ground level.

Several methods of sampling the canopy and subcanopy exist (Kunz and Kurtz, 1988; Munn, 1991; Simmons and Voss, 1996; Tschapka, 1998). Most include elaborate pulley systems that raise a series of stacked, "horizontal nets" (i.e., those with the long axis of the net positioned parallel to the ground) into the subcanopy. Some methods require installation of permanent supporting structures (Kunz and Kurtz, 1988; Simmons and Voss, 1996), each of which may be physically challenging to install, as well as potentially risky to the investigator (but see Tschapka, 1998). Installation of poles and other supporting hardware can be burdensome and time-consuming, especially in difficult terrain or where netting must be done at some distance from a base camp. Thus, a system that relies on cumbersome hardware may limit placement of canopy nets to convenient locations.

For capturing birds, Munn (1991) used a canopy netting system in which standard mist nets were restrung so that shelf strings were perpendicular, rather than parallel, to the long axis of the net. Restrung allowed the net to be positioned vertically, with the long axis perpendicular to the ground. Francis (1994) used a similar system for capturing Old World fruit bats. With this method, the net was supported by poles at the top and bottom, instead of at the sides. Net and supporting poles were suspended from overhead branches by a rope that was positioned initially using a slingshot or crossbow. A major advantage of this portable, vertically positioned net was that it allowed rapid deployment in small forest gaps, high in the canopy, where other methods failed to sample bats. Additionally, the system could be positioned near flowering or fruiting trees to capture plant-visiting bats.

Until recently, a major drawback of canopy netting was that vertically strung nets were not commercially available, and thus, each net had to be restrung manually—a time-consuming procedure. Pre-strung vertical nets, however, are now available from Avinet, (Dryden, NY; www.avinet.com). These nylon canopy nets are available in 6-m (6 shelves) and 12-m (12 shelves) heights, with a standard 3-m width and 38-mm mesh. In addition to cloth (nylon) loops at the top and bottom of the net for attachment to supporting poles, the nets have plastic rings positioned at the lateral edges. These side rings allow more precise positioning and installation of a guideline to allow the net to be opened fully.

We successfully have used canopy nets from Avinet in the northeastern United States and Amazonian Ecuador. Set-up time in the field has been reduced to as little as 15 min and tending these nets is easy. In this paper, we describe a simple procedure for preparation and deployment of these canopy nets.
Required Materials
A number of pieces of rope are required. We use braided nylon or polyester rope that is 6 mm (1/4 in) in diameter. Braided rope is preferred over rope made by twisting three strands together, because braided rope is more resistant to unraveling. Two sections of rope are needed to form the sides of the netting system. For canopy nets that are 12-m high, we use a 10-m length of rope, and for nets that are 6-m high we use a 5-m length of rope. In addition, a 4-m length of rope is needed to form a "hanger" that will help suspend the system, and finally, a rope that is at least twice the height of desired net placement (40 m is adequate for many situations) is required.

Two poles are needed to support the top and bottom of the net. These should be 3.5-m long, to match the width of the nets, and ca. 1.2-2 cm in diameter. Poles can be made from any stiff, lightweight material, such as electrical conduit or bamboo.

Other required materials include a 25-cm length of thick wire (e.g., a coat hanger), needed for preparation of the system for use, and a metal "figure-8," ca. 5-cm long, that will be used for attaching the pulley and balancing the net. Such figure-8's often are sold in hardware stores as a "closed S-hook." Finally a plastic tarp (3 by 4 m) helps prevent woody debris from becoming entangled in the net.

Preparation of New Nets
This process requires about 0.5 h and should be done prior to deployment in the field. Secure one set of the black, nylon loops of the net to a stationary object (Fig. 1a). Next cut the retaining string from one set of the lateral, white, plastic guide rings, being careful not to drop the rings (Fig. 1b). Transfer the rings onto the stiff wire and bend into a circle. This secures the rings and prevents them from becoming tangled in the net.

Starting from the secured end, which ultimately will be the top of the net, find the white plastic ring attached at the base of the first, black, cloth loop. Pass one end of a rope through the white plastic ring, leaving 0.5 m of rope extending beyond the ring toward the secured end. Tie an overhand knot in the rope on each side of the white ring (Fig. 1c).

Unfold the net slightly to determine which white ring is next in line, and remove this ring from the wire retaining loop. Pass the free end of the rope through the second white ring, and make a single overhand knot in the rope (Fig. 1c), immediately beyond the ring and 75 cm from the previous knot. This knot will support the shelf string, producing the correct amount of "bag," once the system is in place. Depending on amount of bag desired, distance between knots can be decreased to 70 cm (more bag) or increased to 80 cm (less bag). Repeat this procedure until the last white ring is reached. Secure the last ring with only one knot (to allow easy identification of the top of the net) and leave the excess rope free to secure the net to the lower support of the frame.

Repeat the procedure for the set of white plastic rings on the other side of the net. When finished, return the net, including the newly installed ropes, to the plastic storage bag that originally contained the net. To simplify later deployment position the net in the bag with the black loops of the double-knotted end on top.

Deployment of Nets
Position a "pulley rope" over a horizontal branch by throwing a rock attached to a rope or use a slingshot to project a weighted object (e.g., 20-50 g lead weight) attached to fishing line. Alternatively, if the targeted branch is not high a fishing rod and reel can be used to cast the weight and line over the branch. If fishing line is used, tie the loose end of the fishing line to the rope, and pull the rope over the branch. To avoid snagging the line in overhanging vegetation, wrap the knot that joins the rope and fishing line with a small piece of duct tape to give the knot a tapered profile.

Spread a plastic tarp on the ground so that the ends of the pulley rope hang at the center of the tarp. Remove the net's black loops from the bag and spread them to ensure that they are in correct order. Insert one of the poles through the loops and space them along the pole until the net is slightly taut. Tie the first and last loops in place using the loose ends of the nylon rope that was installed to form the sides of the net panel.
Tie the 4-m section of nylon rope, with the "figure-8" attached, to both ends of the pole to form a hanger (Fig. 1d). Then, position the "figure-8" at the center so that the pole hangs parallel to the ground. Attach a hanging pulley rope to the "figure 8" (Fig. 1e), and hoist the net. When the net is completely above the ground, attach a second pole to the bottom loops in the same manner as the top. Note that it may be necessary to secure one end of either pole to a stationary object to prevent the net from swiveling, especially in windy conditions. Raise the net to the desired height, being careful not to snag the net on tree branches. In cluttered environments, additional ropes may be attached to each end of the lower pole to guide the net while it is being raised.

Fig. 1. Preparation and deployment of a canopy mist net: a) attachment of nylon loops to stationary object; b) wire retaining loop holding the lateral, white, plastic rings; c) two knots in guideline, flanking topmost plastic ring, but one knot in guideline below each subsequent ring; d) frontal view of deployed canopy net; e) figure 8 (closed S-hook) assembly used to attach pulley rope and balance net.

**Tending Nets**

When a bat is captured, one person lowers the net, while another person guides it onto the tarp. Lowering onto a tarp prevents leaves and other debris from becoming tangled in the net. It is possible for one person to operate the system, but this individual must control simultaneously both the net and pulley rope; threading the pulley line through a belt or belt-loop to control speed of descent can
facilitate this. If a net is deployed at the same location for longer than 1 night, it can be lowered onto the plastic tarp and covered, by folding the tarp over the net. This prevents damage from rain, falling leaves, fruits, and other objects.

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Literature Cited


