An Inexpensive Elevated Mist Net Apparatus

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ABSTRACT

We describe the design and use of a mist net apparatus capable of sampling vegetation strata from ground level to an 8.5 m height. The device is inexpensive to produce (about US $35, not including the mist net) and, once erected, safe to captured birds, simple to use, and versatile.

INTRODUCTION

Mist netting is one of the most efficient means used to sample small birds (Austin 1947, Berthold 1976, Karr 1981). The placement of a mist net in a habitat is also important for the determination of which species are present (Stamm et al. 1960, Jenni et al. 1996). In habitats that possess multiple vertical vegetation strata, mist nets set in the standard manner sample effectively only those species that move commonly near the ground (Slud 1960, Munn 1991, Remsen and Good 1996). To sample birds that spend all or part of their life cycle in the higher vegetation strata of these habitats, it is necessary to elevate mist nets (Jenni et al. 1996, Greenlaw and Swinebroad 1967, Humphrey et al. 1968, Meyers and Pardieck 1993, Munn 1991, Paton et al. 1991, Whitaker 1972). Many designs capable of elevating mist nets and successfully capturing birds have been introduced (Dejonghe and Cornuet 1983, Greenlaw and Swinebroad 1967, Heselton 1990, Humphrey et al. 1968, Chapin 1988, Karr 1979, Mease and Mease 1980, Meyers and Pardieck 1993, Munn 1991, Nixon 1972, Sheldon 1960). These methods, however, have disadvantages and remain mostly unused by banders.

Some disadvantages of existing methods include the following:

1) Components of the design are expensive and not readily available.
2) Design is complicated and difficult to construct.
3) Design requires more than one person to operate.
4) Design requires skilled tree climbers, tall trees nearby, and can damage trees.
5) Design is difficult to use and requires too much time to operate.

We developed a simple, elevated mist net system of inexpensive materials (an 8.5 m device costs about US $35 without the mist net) that requires little heavy construction and no tree climbing to assemble. Once erected, our system is quick and simple to operate for a single individual. The net has also proved safe to captured birds and adequate to capture the same size species as with a standard mist net placement.

METHODS

During spring 1999, a single elevated mist net system was tested on the north side of Pewaukee Lake in Waukesha Co., Wisconsin, at an existing banding station run by the Zoological Society of Milwaukee County as part of the Birds Without Borders-*Aves Sin Fronteras* project. The success of this initial test led to the construction of three more devices all placed at the same station in different habitat types during fall 1999.

The design described here is for a system that elevates a single net to a height of 8.5 m. More materials can be added or subtracted if other

Safe Haven Wildlife Removal
Ex. 1010
Page 1 of 6

heights are desired. (We use two elevated net systems measuring 7 m and find them adequate in locations with lower canopy vegetation or when the desired results facilitate use of nets at lower levels). We recommend a maximum height of 10 m with the pole material described. Metal stress may result on the lower electrical metallic tube of a pole erected above this height.

Materials – The following materials needed to construct the elevated mist net system can be obtained in any good hardware store:
- Six 2.5 cm (1 in) by 3 m (10 ft) electrical metallic tubes (EMT).
- Four 2 cm (3/4 in) by 10 cm (4 in) black pipe nipples.
- 85 m (280 ft) of 0.5 cm (3/16 in) diameter "clothesline cord" (148 kg [325 lb] breaking strength and 1% stretch with 16 kg [35 lb] load recommended).
- Two single pulleys designed for a 0.5 cm (3/16 in) diameter rope size.
- One double pulley designed for a 0.5 cm (3/16 in) diameter rope size.
- One mid size rope cleat.
- Ten metal shower curtain pins.
- Correct size nuts, bolts, and washers necessary to attach pulleys and rope cleat.

Assembly of the Poles – Three attached 3 m lengths of EMT constitute the poles for each side of the elevated net system (see Fig.1). First, drill holes for the hardware and guy lines to fit dimensions shown on Fig.1 and Fig. 3. Poles are then attached to one another using black pipe nipples as dowels. To join poles, drive a pipe nipple into each end of the two center sections of EMT that comprise each pole. To insert the nipple into the EMT, use a lubricant (WD-40, WD-40 Co. San Diego, CA) on the pipe nipple and mallet to drive the nipple into place. When inserting the pipe nipple, brace the opposing side of the EMT on a hard surface and drive the nipple half way into the central EMT section. Pipe nipples are made of a heavy duty steel, but care should be taken when hammering not to hit them unevenly causing them to dent.

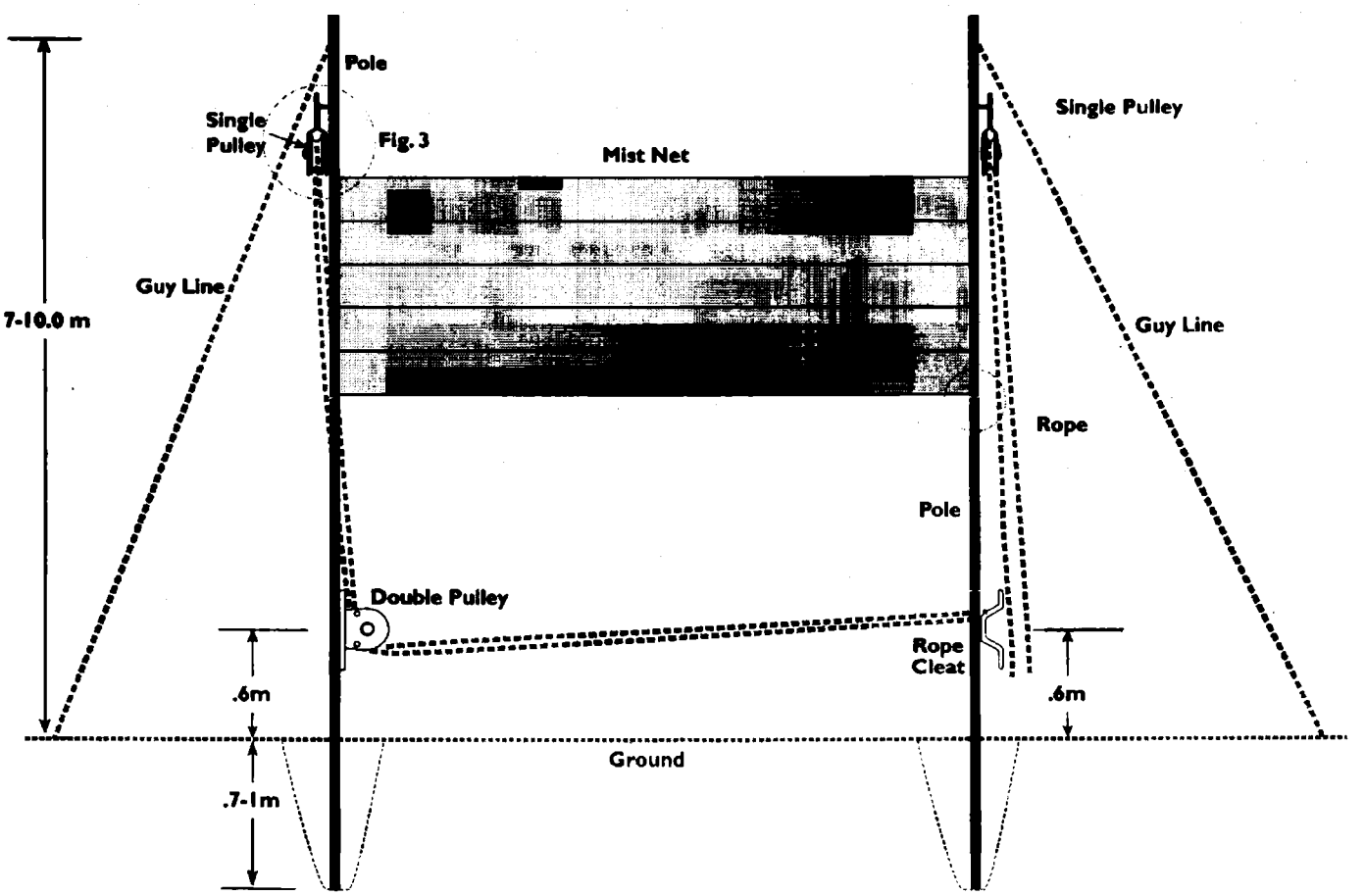

Figure 1. Diagram of elevated mist net apparatus. Diagram is not to scale

Safe Haven Wildlife Removal
Ex. 1010
Page 2 of 6

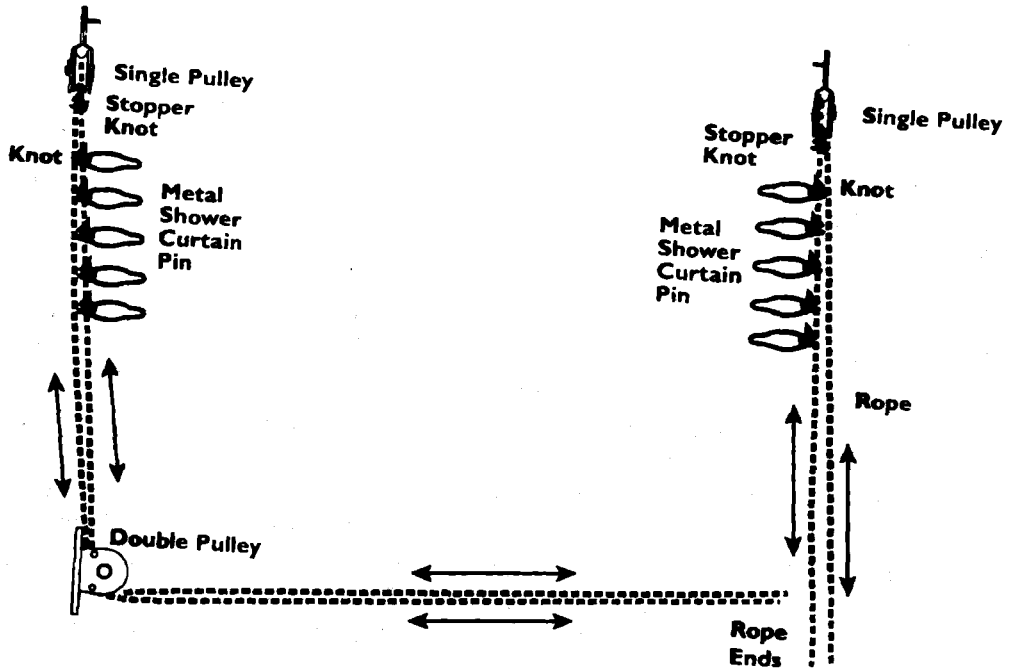

Figure 2. Diagram of rope layout and assemblage.

After nipples are in place on both sides of the center section of EMT, end sections of each pole can then be attached (Fig. 1). We recommend construction of poles be done at the location where the net is to be erected. This allows for easier manipulation and transport of poles. Lubricate the exposed halves of the pipe nipples and position the end sections of EMT over the top of the exposed nipple. *Drilled holes for pulleys and rope cleat must be oriented so the parts are positioned as in Fig. 1 before connecting end sections of EMT.* Again, brace opposing ends of the EMT sections you are connecting on a hard surface. Hammer the end sections of EMT over the exposed pipe nipple until the EMT sections join, creating a smooth coupling. The EMT is made of much softer metal than the black pipe nipples. When hammered, the EMT may dent before sections join over the nipple. The denting will be minimal and will not affect the system itself, as the sections of pole between the pulleys remain smooth and undented.

Assembly of the Rope Schematic – Assembly of a correct rope schematic is essential to operation of this elevated net system (Fig. 2). The premise of the system is for the rope to glide uninterrupted through the pulleys. *Long sections of rope must therefore be used within the pulley system.* If additional swaths of rope are needed to lengthen the rope assemblage within the pulley system, attach the added rope at the position of the stopper knots located at the top of the rope schematic (Fig. 2). More rope may be added to areas clear of the pulley system.

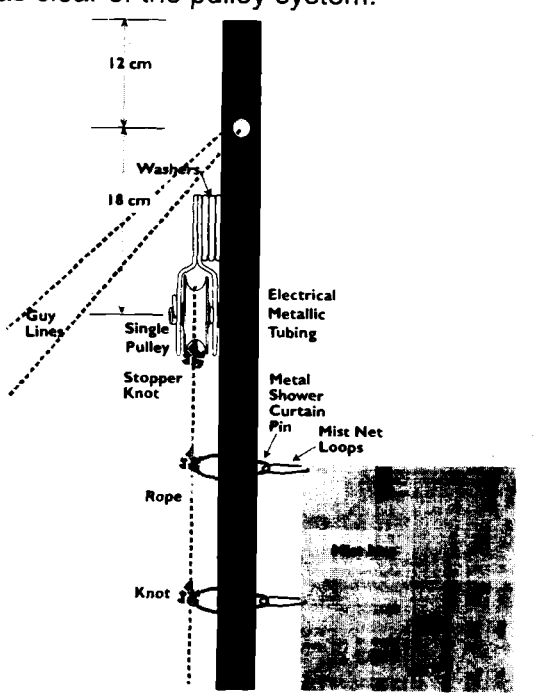

Figure 3. Detail of single pulley and guy line dimensions. Note correct metal shower curtain pin and rope assemblage attachment.

A separate length of rope with correctly attached shower curtain pins is required for each pole. Length of rope needed for each pole is different (Fig. 2). We recommend a length of rope measuring 28 m (90 ft) for the pole with the single and double pulley attachments (Fig. 1). A shorter length of rope measuring 22 m (70 ft) is recommended for the pole with the pulley and rope cleat attachments (Fig. 1).

Shower curtain pins tied into the rope carry the net up and down. When purchased, shower curtain pins are circular with an elongated extension on which the pin clasp is found. The elongated extension must be eliminated in order for pins to move on poles. Use a pair of pliers to straighten the bend of the pin that forms the elongated extension. When the manipulation of the pin is complete, its shape will resemble a teardrop (Fig. 3), and it will slide smoothly up and down the vertical pole.

Tying shower curtain pins into the ropes requires precision. Use the mist net intended for the system as a guide when spacing shower curtain pins. Spacing of these pins on the rope is essential to maintaining the correct pocket depth in each tier. Space pins on the rope at exactly the same length that separates each tier of the net when the vertical trammel line is fully extended and tie them tightly into the rope. When all of the pins are tied into the rope, they mimic the spacing of the net loop to which they will eventually be attached. The resulting pocket depth in the mist net is approximately 10 cm (4 in) to 15 cm (6 in). Deeper pocket depth improves the capture rate of larger bird species (Merseyside Ringing Group, 1971). To make pocket depth deeper, shorten the distance between shower curtain pins.

Erection of Elevated Mist Net Apparatus – Attachment of rope assemblage and hardware to poles is done before erection of the apparatus. To complete pole assembly, attach single pulleys positioned at the top of each pole (Fig. 1). Use enough washers to insure that when the single pulleys are fixed in their final positions they rest level and parallel to the pole (Fig. 3). Slide the shower curtain pins of the completed rope assemblages onto the poles to which they correspond, and feed the end of the rope into the attached single pulleys (Fig. 3). Attach the double pulley and rope cleat onto the poles. String and fasten lengths of rope through holes drilled for guy line. (To save on the cost of rope, we used a very inexpensive clothesline cord for the guy lines and knot together any scraps of rope from the pulley rope assemblage.)

To erect the apparatus, dig a small 0.7 m (2 ft) hole in the location where the first pole is to be placed. To secure the pole in the ground, gather enough rock or any heavy refuse material to refill the hole. (In areas with wet or soft soil, holes and refill material are not necessary if the poles can be pushed into the ground to the desired depth.) Raise the first pole and place it in the hole. *Make sure the pole is orientated in manner shown in Fig. 1.* Fill the hole with rocks and then pile dirt removed from the hole around the base of the pole. Be sure to stomp down dirt and rocks, as they will settle in a few days. Tie the guy lines so that the pole is straight and secured.

Use the mist net intended for use with the apparatus as a guide to establish the distance of the next pole location. (Mist nets can vary slightly in length.) Attach the loops of the mist net to the shower curtain pins on the rope assemblage (Fig. 3) of the erected pole, and walk the mist net out in the direction that you want the mist net placed. Stretch the top trammel line until it is tight and mark the ground under the spot of its maximum stretch. We have determined that this is the best method for establishing the location of the second pole. During use and exposure to weather, mist nets will stretch (G. Albanese, pers. obs.). We strongly recommend the use of this method for establishing the distance to the second pole location, as it ensures that the net maintains the correct tension necessary to capture birds safely while in use with this apparatus. At this mark, dig another hole and repeat the instructions described for raising the first pole. Attach the mist net to the shower curtain pins on the rope assemblage of the second pole. String the rope through the double pulley using the correct rope schematic (Fig. 2).

Operation – This system requires only one person to operate. Locate the four rope ends near the rope cleat. By pulling on the two correct rope ends, the operator can raise and lower the mist net. Opposing lines on the poles, when pulled

simultaneously, will raise or lower the net evenly (when birds are captured in the net, care should be taken to keep the net level when lowering). When the mist net is open, ropes are fastened to the rope cleat to prevent the net from moving on the poles if a large number of birds are captured. Always free the ropes from the rope cleat before attempting to move the net. To avoid confusion when raising or lowering the net, we color-coded the rope ends two different colors so the operator can readily identify which two rope ends to pull to raise or lower the net. (We use green on the rope ends that take down the net when birds are present and red on the ends that return the emptied net to the elevated position.) If, after lowering the mist net, birds captured in a top tier cannot be reached for removal by the operator, pulling down the shower curtain rings on the pole to the desired level will lower the tiers of the net.

Under certain conditions, such as in damp weather, mist nets may become loose. Rather than moving the poles of the system, we have found that rubber bands can be utilized to eliminate sag in the nets. Locate the sagging vertical trammel lines of the net. At the end of these lines locate the net loops used to attach the mist net to the apparatus. Stretch and fasten a rubber band at or before the mid point of the net loop. The result is a smaller net loop. Reattach the smaller net loop to the shower curtain ring. Repeat this process on any net loops attached to sagging trammel lines. During wet conditions this method will eliminate sag in the attached mist nets, so that safe operation of the elevated mist net apparatus may continue.

To sample a height less than 8.5 m, keep the mist net level on the poles and choose the desired height. When the net is elevated to the desired height, tie the rope ends off on the rope cleat. The mist net will remain secured at this height.

To remove the mist net, unlatch it from the shower curtain rings and store. If the location warrants the mist net be left out for an extended period, the mist net can be furled by lowering the shower curtain rings and furling and tying the net.

DISCUSSION

The elevated mist net apparatus described here has proven capable of capturing various sized birds successfully in multiple vegetation strata. Of the 371 birds captured during 1999 with the device, no injuries or fatalities were incurred. While our data is preliminary at this time, use of the elevated mist net apparatus at our Wisconsin and Belize study sites will allow us to determine the effectiveness of this apparatus in capturing a representative sample of the avian community utilizing higher vegetation strata.

The elevated mist net apparatus described in this paper is inexpensive to produce (about $35 US in 1999). It is uncomplicated to assemble and erect. Once materials are acquired, it takes two individuals about 3 to 4 hours to assemble and erect. In addition, once constructed, it is easily operated by only one individual.

Jenni et al. (1996) suggested that mist nets should cover the entire vegetation height of a habitat to allow adequate sampling of birds preferring higher vegetation strata. They also suggested that sampling all vegetation strata might aid in determining vertical distribution patterns. The uncomplicated design and affordability of our elevated mist net apparatus makes these options possible for researchers.

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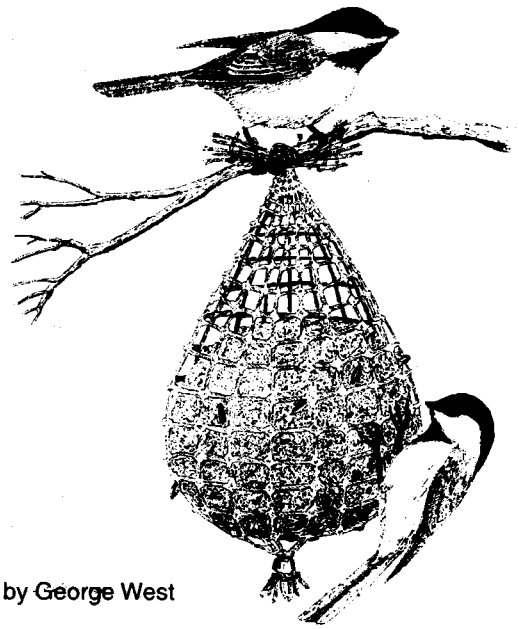

Black-capped Chickadees by George West

Safe Haven Wildlife Removal
Ex. 1010
Page 6 of 6