BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

VOL. 43, NO. 1 JANUARY 1972 PAGES 1-84

AN IMPROVED MIST NET RIG FOR USE IN FORESTS

By A. H. WHITAKER

Research on forest birds began in mid-1967 at the Ecology Division's Orongorongo Valley Field Station, near Wellington, New Zealand. The vegetation is subtropical rain forest with emergent trees up to 40 m, a more or less continuous canopy between 16 and 20 m, numerous epiphytes, and a dense understory including tree ferns and tangled lianes. Initially birds were captured in mist nets strung between aluminum poles up to 5 m high, but it soon became apparent that some species were rarely, if ever, caught in such low nets.

First attempts at raising mist nets into the canopy were based on two continuous loops of string over high branches, one for each end of the net. The rig described here was eventually designed, and after further refinements seven such rigs were erected at heights ranging from 13 to 18 m. These have been used continuously for 18 months without changes in design or major operational problems.

Humphrey *et al.* (*Bird-Banding*, **39:** 43-50, 1968) described a net rig used in Brazilian rain forests and working on a principle similar to the one described here. However the present rig has several features giving a much greater net area and allowing easier operation in dense forest. This design was developed independently, but their use of plastic shower curtain rings to hold the mist net loops was subsequently adopted.

MATERIALS AND CONSTRUCTION

The net rig (Fig. 1) is positioned between two trees and consists of four rope blocks, two double sheave blocks attached to branches, and two single sheave blocks anchored at ground level. A continuous loop of rope is threaded through this system in such a way that, when moved, the net carriers at each end of the net site move in the same direction at the same speed. The nets are strung between the falls and can be raised or lowered very easily from either end by one person. All vegetation along the proposed plane of the net and for 2 m on either side was cleared from ground level to above the top rope blocks.

Two stainless steel double-sheave rope blocks, with nylon sheaves 50 mm diameter and 8 mm wide are attached to strong branches in the crowns of trees at either end of the site. Preferably these trees should be emergents to give extra height to the nets. Discrepancies

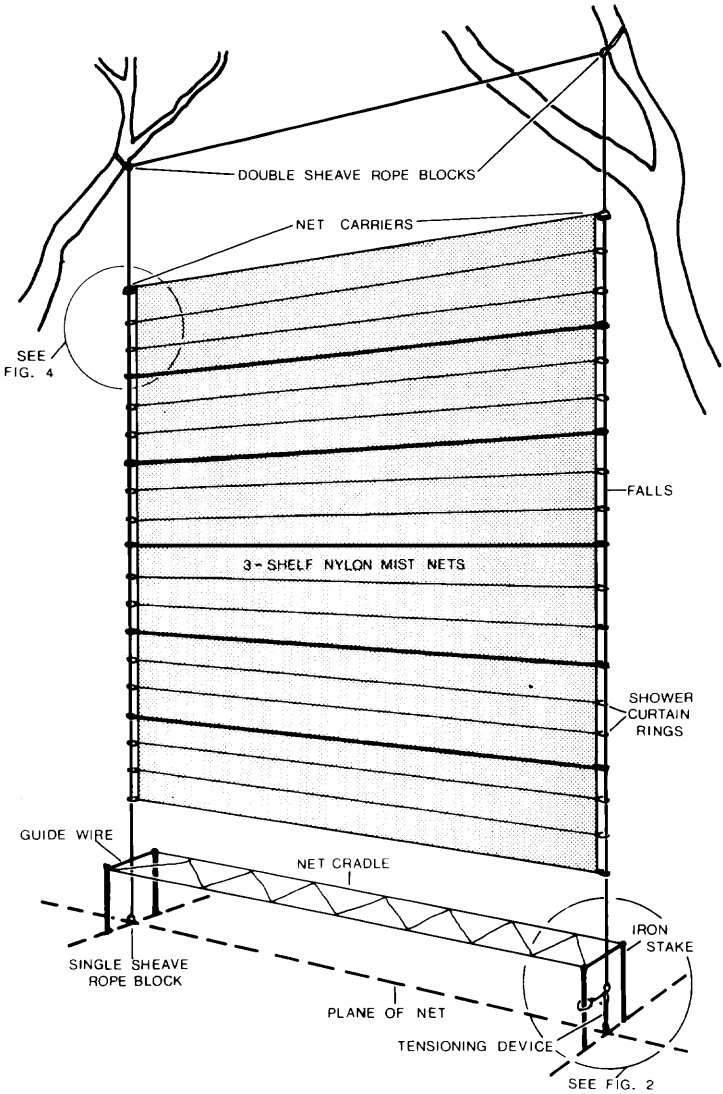

FIGURE. 1. The mist net rig used in forest anchored to branches about 15 m above ground.

in the height of the two blocks do not matter, but they must be placed so that the falls are 15 cm further apart than the total length of the mist net, and the sheaves must be parallel with the plane of the net.

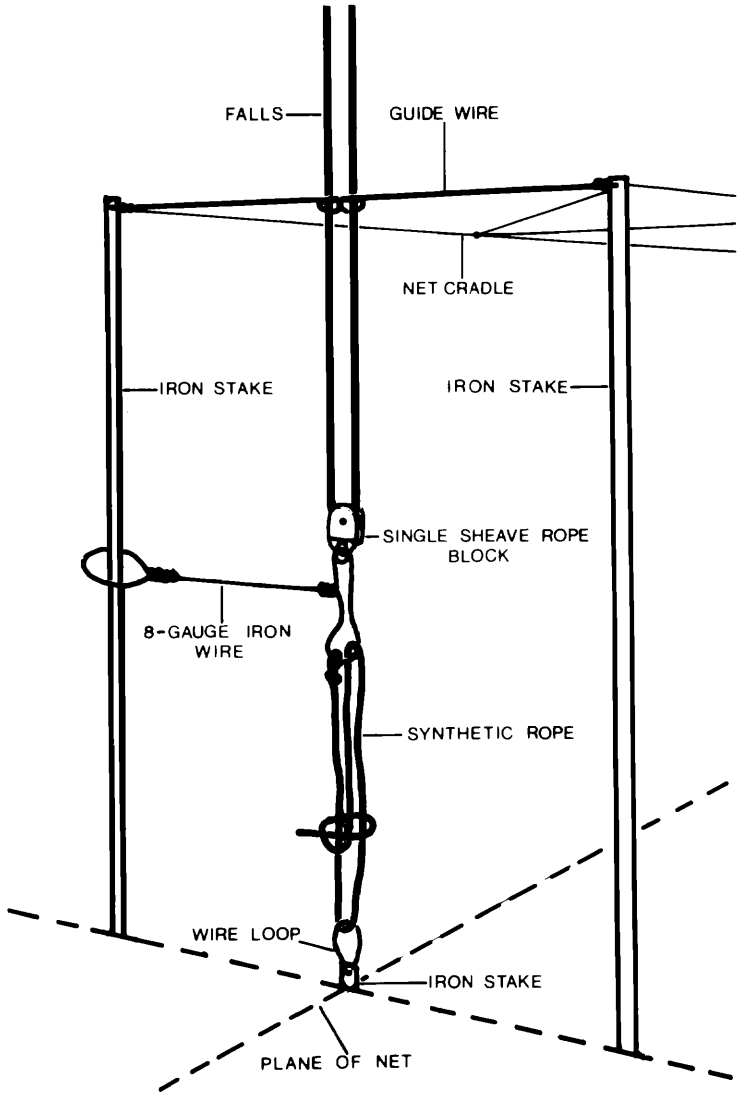

FIGURE 2. Detail of the device for tensioning the falls.

As the double blocks are being positioned, two lengths of 14 mm (circumference) braided terylene rope (ca. 250 kg breaking strain) are threaded through each in turn, making sure that the ropes are parallel and not twisted. These ropes must be slightly longer than the length of the mist nets plus twice the height of the rig. Terylene rope is used because of its resistance to abrasion, low friction, lack of stretch, and great durability under extreme weather conditions.

Directly below each double block an iron stake is driven deeply into the ground to anchor the lower block. At one end, the highest end if the site is not level, a single-sheave stainless steel rope block with a nylon sheave 25 mm diameter and 15 mm wide is attached to the top of the stake at right angles to the plane of the net. At the other end another single-sheave block is attached to a specially shaped, 8-gauge galvanized iron wire loop which in turn is tied to the top of the stake by several loops of strong synthetic rope (Fig. 2). This device stops the block from rotating and permits adjustment of rope tensions in the rig. At this stage it is advisable to tie the ropes temporarily to form a continuous loop (Fig. 3) to test the rope block system.

At each end of the net site, two iron stakes are driven into the ground on either side of the lower block and approximately 40 cm from it so that with the falls they form a plane at right angles to the net site. These stakes should project about one meter from the ground and will carry the fall guide wire and the net cradle. The fall guide wire, of 8-guage galvanized iron with two 15 mm loops in the center, is then fitted between the stakes at each end so that the loops are directly in line with the two blocks. The cradle to hold the lowered nets is made by tying two lengths of heavy line between the tops of the iron stakes at opposite ends of the site (Fig. 1) and then lacing in between with lighter string.

Net carriers are then fitted to the falls at each end of the site. These (Fig. 4) are made from high-density, polyethylene, snap-shut food containers, 80 mm diameter and 50 mm deep. Two holes, centered 14 mm on either side of the center, are cut vertically through the lid and bottom of the container. One hole is to take a 6 cm length of 14 mm diameter aluminum tube, the ends of which are then flared to hold it firmly in position. The other hole is of slightly larger diameter than the falls. A 4 cm length of 14 mm diameter alkathene pipe with the ends smoothed is required to shield the knotted rope and allow it to rotate freely within the net carrier.

To fix the carrier into the net rig and to tie off the continuous loop of rope, run one end of the rope down through the aluminum tube in the net carrier, down through one loop of the guide wire, around the bottom block, up through the other loop of the guide wire, up through the lid of the carrier, and through the alkathene pipe. The other end of rope goes down through the small hole in the body of the carrier. The rope is then securely knotted and the knot pushed into the alkathene pipe, which in turn is sealed into the carrier.

An 8-guage galvanized iron wire hook is looped around the top of the flared aluminum tube to hold the top loop of the mist net. Double-hooked plastic shower curtain rings attach the remaining net loops to the falls. The plastic rings work best if heated and bent so that the free end of the large hook partially overlaps the small hook. The rings are slipped around both falls below the carrier. Allow one less ring per net than the number of net loops.

The average cost of these net rigs (13 m high, 9 m wide), exclusive of the mist nets, was about $28.00, about half of which was for the terylene rope.

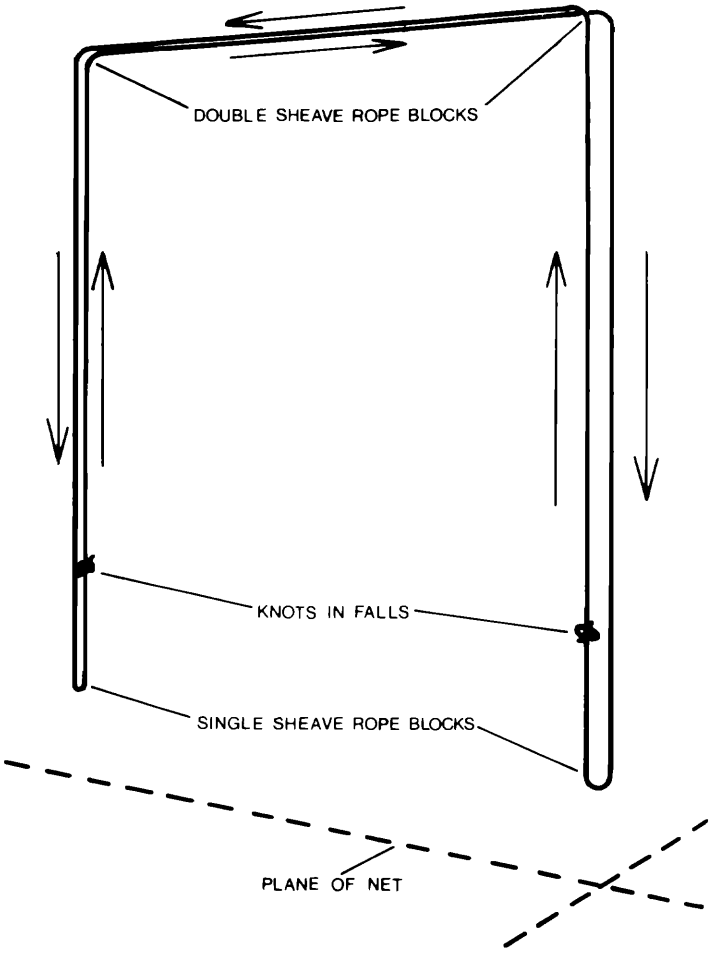

FIGURE 3. Schematic diagram of the rope layout (not to scale).

OPERATION

The tensioning device should be tightened down until there is 30-40 kg tension on the falls. When the net is not in use, it is advisable to slacken this off to avoid stretching.

Faked or coiled mist nets stored in plastic bags can easily be laid out along the net cradle. The top net loop is attached to the wire hook on the net carrier and every loop below to a separate curtain ring. The spacing of shelf strings on the mist nets is controlled by tying the end strings of the net to the desired length.

If a second net is used, its top loop is passed over the lowest net loop of the net above, back between the two nets and then on the same curtain hook (Fig. 4). By linking the end strings of the nets

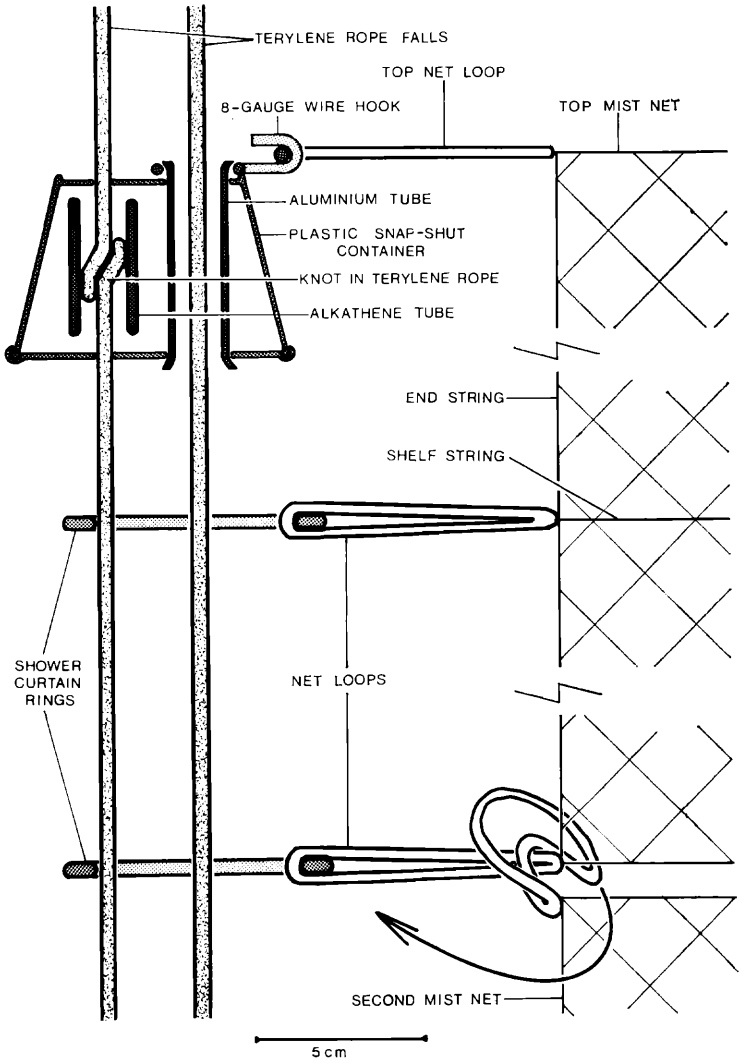

FIGURE 4. Detail of net carrier and net attachment. Note method of linking nets together.

in this manner each net pulls up those beneath it. This also prevents the nets from separating and so provides a continuous curtain of netting. As each net is attached it is best to pull it up out of the way so that further nets can be added below.

The nets are raised or lowered by pulling the falls at one end of the rig in opposite directions. As the nets go up they will open out automatically, and as they are lowered they close on the net cradle.

When temporarily out of use the nets can be left on the cradle, but it is advisable to take them away if unused for extended preiods.

FIELD TRIALS

In a trial period of six months following construction seven rigs were used for an average of nine days per rig. As many as eight nets, the maximum that would fit on any rig, were used without trouble. In the following 12 months, seven 6-net rigs were operated for 48 consecutive hours every two weeks, and since then they have been used for 96 consecutive hours every two months.

The height of the rigs varies between 13 and 18 m. Standard 40 mm mesh, 9 meter, 3-shelf nylon mist nets, tethered on one side, were used on all rigs. The end strings of these nets were shortened by one third to fix the shelf string spacing. The nets were set with the bottom of the lowest one about 1.5 m above the ground. This gave a continuous curtain of 108 sq.m of netting.

In the year of sampling in alternate weeks, 1289 birds of 18 species were caught. These ranged from Riflemen (*Acanthisitta chloris*) weighing 5-6 g to New Zealand Pigeons (*Hemiphaga novaeseelandiae*) weighing about 550 g, but the mesh size was a compromise and most birds caught were in the range of 10-100 g. Very small birds could get through the mesh, whereas larger ones were not entangled and bounced out of the pockets. Thirty per cent of the birds caught were recaptured in the nets on the study area, and there is no evidence that these permanent sites became less effective from one trapping period to the next. Earlier work, however, showed that mist nets became much less effective after five days' continuous use, no doubt because resident birds learned of their presence.

Since installation there has been no entanglement, breakage or failure of the rope and block system. After 14 months one net carrier split, possibly because of prolonged exposure to sunlight, but none of the others show signs of breaking.

The plastic shower curtain rings have a limited life due to abrasion with the falls. Breakage was about 5 per cent in the year of intensive use, but this is not serious because these rings are extremely cheap, easy to replace, and otherwise effective. A supply of spare hooks was always left clipped to the guide wire.

The only other problems were encountered in windy weather. With a moderately strong wind blowing along the net, the mesh tended to move along the shelf strings and catch on the curtain rings. When this happened the net occasionally caught in the moving falls. This did not prevent the net from being lowered nor was it damaged, but it was time consuming to untangle. If nets tethered along the top and bottom had been available, this trouble would not occur. In strong winds the nets occasionally became entangled in branches. The closer the net was set to the foliage, the more birds were caught, so it is necessary to compromise in deciding how much tangling is tolerable. Nets will pull free from foliage or twigs without damage but solid branches should be removed. The nets also collect many leaves and twigs in windy weather and these must be removed frequently to prevent the net from becoming conspicuous.

DISCUSSION

There are several advantages of this net rig over earlier designs. It is cheap to install and requires very little maintenance. After two years' field use practically no deterioration or wear occurred, and there were no serious breakages. The durability of the main components means that these rigs should last for many years.

These rigs can easily be set and operated by one person. With practice, attaching or removing nets takes about 1.5 minutes per net. The very low friction of the nylon sheaves and terylene rope makes the raising or lowering of the nets smooth and easy.

The high tension on the net lines allows the nets to be operated in a narrow clearing with little risk of entanglement, and also means that big expanses of net can be handled. Although only 9 m mist nets were used, nets twice this length could probably be operated without difficulty. Higher rigs would also be feasible, perhaps carrying a curtain of netting to 30 m or more. Provided that the support branches were strong enough, the materials specified here could withstand tensions up to 150 kg, more than enough to support 600 sq. m of mist nets.

One difficulty with this rig is that the supporting trees must be climbed to attach the top rope blocks. In this study full use was made of specialized mountain climbing equipment, particularly a set of Heibler rope clamps that enable a person to climb a vertical rope.

SUMMARY

An improved mist net rig is described, one that has been found effective to catch birds in the canopy of subtropical rain forests. The net rig is simple and cheap to construct and maintain, and after 18 months of hard use, the rig has had no serious breakdowns nor shown signs of deterioration. More than 1200 birds of 18 species were caught in the first 12 months of operation.

ACKNOWLEDGMENTS

I wish to thank J. E. Hilton who helped to construct the prototype and gave valuable advice on "mountaineering", and R. L. Edgar who provided ground support. Dr. J. A. Gibb, R. H. Taylor and B. M. Fitzgerald kindly read earlier drafts of this paper.

Ecology Division, Department of Scientific and Industrial Research, Lower Hutt, New Zealand.

Received 30 April 1971, accepted 7 December 1971.