

## A Plywood Nest Box for Hornbills and Other Large Cavity-nesters

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Here I describe a nest box design I have developed after studying *Tockus* hornbills in Namibia in recent years. Although my collaborators and I originally used a standard vertical box, I have since switched to horizontal boxes. One problem with vertical boxes is that hornbills tend to fill them with nest material so that the chicks can easily reach the slit in the nest plug. If the box is tall and the entrance hole is relatively high, this will require the birds to bring in large quantities of nest material. Not only is this a great deal of work for the hornbills, this material eventually decomposes into very heavy soil. This is particularly problematic if the soil facilitates the decomposition of the bottom of the box. Less nest material means drier nest material which also prolongs the life of the box. Horizontal boxes are also safer for hornbills than are vertical boxes. Although tall vertical boxes provide many cavity nesters with protection from predators, such boxes are probably more dangerous for hornbills. In vertical boxes, the female and the eggs/chicks are generally right under the entrance hole/plug; most of the volume of the box is taken up with nest material and the female has nowhere to hide if the nest plug is breached by a predator. I have found in Namibia that in vertical boxes, if a Honey Badger (*Mellivora capensis*) breaks through the nest plug, the female/eggs/chicks inevitably die. With a horizontal box, the female and/or chicks can move to the back and be out of reach of the predator.

Our original nest boxes were constructed from dolf wood (aka African teak; *Pterocarpus angolensis*), as this wood is rot- and termite-resistant. However, I have found that local carpenters can be expensive and their products can vary dramatically in quality. Here I describe how to construct seven hornbill nest boxes using two sheets (122-cm x 244 cm) of 22-mm thick exterior plywood (Fig. 1). These boxes are relatively large (perhaps larger than necessary), but the advantage of the design lay in its simplicity. At my study site in Namibia, these boxes are readily used by smaller hornbills such as the Damara Hornbill (*T. damarensis*) as well as the larger Monteiro's Hornbill (*T. monteiroi*). A circular entrance hole of 60 mm accommodates these species as well as other cavity-nesters such as Burchell's Starlings (*Lamprotornis australis*), Hoopoes (*Upupa africana*), Lilac-breasted Rollers (*Coracias caudatus*), and Pearl-spotted Owlets (*Glaucidium perlatum*).

Producing these boxes is easiest if one has access to a table saw. If a table saw is not available, a circular saw will suffice. A jigsaw may have to do in a pinch, but is not recommended because of the difficulty in cutting perfectly straight lines.

Cut the plywood in lengths shown on Fig. 1. Once the pieces are cut, separate them into piles for each box.

Each box will have:

**Top and bottom:** 25 x 61 cm

**Front and back sides:** 25 x 61 cm

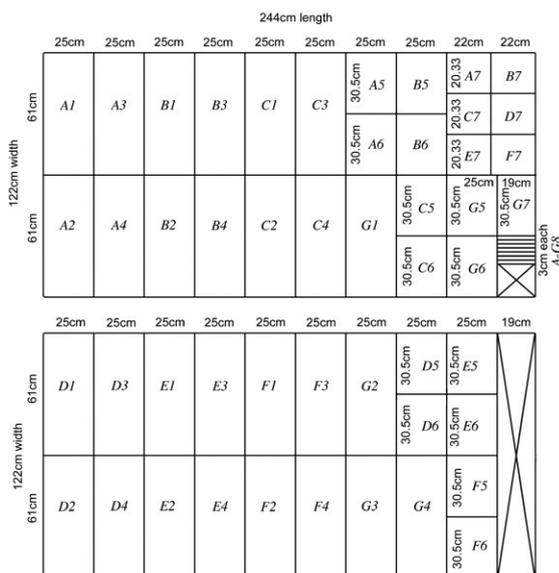
**Left and right ends:** 25 x 30.5 cm

Note that the left and right ends are one-half the size of the top/bottom/side pieces. This means that the ends “cap” the box and are attached to the top/bottom/sides with horizontally placed screws. If one has good carpentry skills and access to a table saw, another option would be to inset the ends into the box. Note that this would require substantial alteration of the plans below. Note also that six of the seven access door covers have measurements of 22 cm x 20.3 cm. One access door cover will be 19 cm x 30 cm.

Once the pieces are cut, refer to Fig. 2 for assembly. Use a pencil to mark where the 12 cm x 14 cm access door will be cut (this door will be wider than it is tall). Being right-handed, I put the door right of the center of the front side of the box. In other words, closer to the end of the box with the entrance hole (the right edge of

the access door should be 14 cm from the right end of the front side; the left edge of the access door should be 33 cm from the left edge of the front side; the top of the access door should be 5 cm from the top edge of the front side and 8 cm from the bottom edge). Because the female will probably place her eggs near the nest plug (if the box is level), this placement of the access door will ensure easy access to eggs/chicks. Additionally, because the female will typically move to the back (left) end of the box when the access door is opened, one can access eggs and chicks without having to reach over the female (females can get defensive/aggressive). However, if it is necessary to capture the female for measurements, one can easily reach one’s right arm through the access door to grab the female as she hides at the far end of the box. Note that if the box is installed so that the entrance hole is at the higher end, the female will probably put her nest at the farther (less accessible) end of the box; so try to keep it level.

Before cutting out the access door, mark a 6-cm diameter circle in the center of where the 12 x 14 access door is drawn (it’s much easier to cut a circle in a big piece of wood than a tiny piece of wood). To cut the 6-cm hole, use a small bit (~.5 cm) in a power drill to make a hole at the edge of the circle. Then use a jigsaw to cut out the circle. Once the circle has been cut, you can drill holes in two corners of the 12 x 14 cm rectangle you drew. Use a jigsaw to cut along the lines, creating the 12 x 14 cm doorway. The block created by cutting this access door can now be used to “thicken” the entrance hole at the end of the nest box. A thicker entrance will not only make it harder for reaching predators, but will also provide more surface area for a hornbill to attach its plug. Use screws (~40 mm long) and glue to attach the entrance hole block to the INSIDE of the end of the box (do this before you assemble the box). These screws



**Fig. 1.** Marks and cuts on plywood. Each letter refers to one of the seven boxes (A-G).

should be shorter than the ones used for the rest of the box; 5 cm screws will emerge out the end of the box and could cause an injury. If the block is on the outside, a honey badger is likely to simply chew it off.

Note that the entrance hole is located at or near the center of the end of the box. Because the chicks need to be able to reach the nest plug slit to get food, a high hole requires the adults to bring in a great deal of nest material to raise the floor of the nest. As mentioned earlier, this is not only more work for the birds, but is also more likely to eventually result in the presence of damp "soil" in the box. A shallower layer of nest material is more likely to remain dry ... and reduce decomposition of the nest box wood.

An additional advantage of centering the entrance hole is that honey badgers will have a difficult time gaining any sort of purchase on the entrance hole to chew at it.

To attach the top, bottom, sides, and ends, use wood glue and 5 cm deck or drywall screws. Have the top and bottom sandwich the sides, making the distance from the floor to the ceiling of the box 25 cm. This means that the screws connecting the top to the sides and the bottom to the sides will be vertical. The screws connecting the ends to the sides will be horizontal.

Connect the top to the sides with 8 screws (4 on each side). Do the same for the bottom. For the end with the entrance hole, use 2 screws on each side (8 screws), while on the opposite end use 2 on each side and one on top and bottom (6 screws).

Although the male hornbill will typically stand on the top of the box to feed the female or bring nest material, the female typically hangs vertically below the entrance when inspecting or entering the box. Consequently, I generally

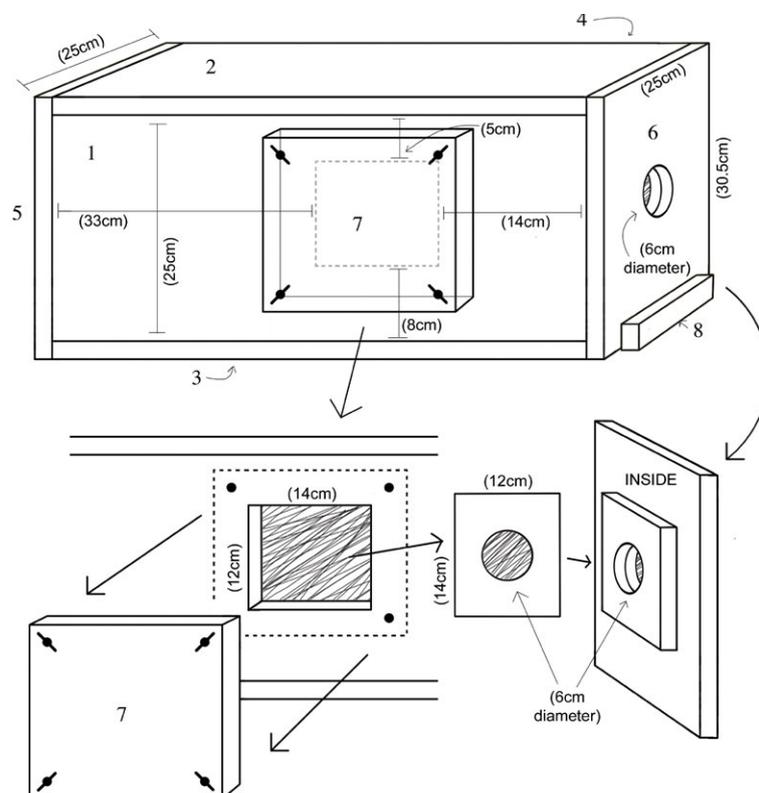


Fig. 2. Schematic of the box produced from pieces produced from Fig. 1.

add a small perch (19 cm x 3 cm) on the bottom edge of the end of the box below the entrance hole. If the bottom of the perch is flush with the bottom edge of the box end, you can screw it into the end of the box and through it into the bottom of the box using 5 cm screws. The perch will thus stick out 22 mm from the box and extend 3 cm up toward the entrance hole. Center the perch below the entrance hole and make sure that the screws that connect the perch to the box are not too close to the two screws that are connecting the bottom edge of the box end (with the entrance hole) to the bottom of the box. If you prefer the perch to be closer to the hole, use shorter screws.

Because termites are a serious problem where I work in Namibia, I coated the boxes I constructed in 2020 with motor oil (3 coats, each 3 days apart). After the final coat of oil soaked in, I gave each box two coats of tan paint. Because the access door cover is unlikely to be the target of termites, it does not need oil. However, be sure to allow the paint on the access door cover to dry before attaching the cover to the box.

Once all the paint has dried, hold the access door block over the access door opening. Make sure the opening is centered behind the block. Use a pencil to mark the position of the block on the box itself. Make sure you also know which edge (and side) of the access door cover is up. Now make 4 marks at the corners of the access door cover. These dots should be approximately 2 cm in from the top and side of the cover at each corner. They mark where the bolts will go that will hold the access door cover to the box. To drill these holes (through the access door cover and through the box), it is best to use a drill press. If not available, simply use a power drill held as vertically as possible. The holes should be the same diameter as a

standard carriage bolt (approximately 6 mm). The access door cover will fit over the carriage bolts and be held on using wingnuts.

Once you've drilled the holes through the side of the box around the access door, you will thread the carriage bolts through those four holes (from the inside out). The bolts should not slide through those holes easily. If they do, then the bolts are likely to get pushed in when you try to attach the access door cover. Hand twist the carriage bolts through the holes in the side of the box until the bolt peeks out. At this point you can use a wingnut (turning clockwise) to bring the bolt the rest of the way through. If the holes are such that the bolt does slide through easily, you will need to put a dollop of caulk around the base of the bolt before you shove it through the hole (from the inside toward the outside). Once the caulk dries, the box will have 4 well-anchored bolts emerging outward around the access opening.

The holes in the access door cover will need to be slightly larger than those drilled through the side of the box around the access door opening. This will allow the access door cover to slide over the bolts easily. One way to do this is to re-drill the holes in the access door cover with a slightly larger bit. Alternatively, you can use the same bit to ream out the holes multiple times (while angling the drill).

### **Installing the nest box**

Where I work in Namibia, trees tend to be small in stature and girth. Consequently, I generally install my nest boxes at a height of about 1.5 m. Although the installation instructions that follow assume installation at a modest height, these boxes could presumably be installed much higher and in taller trees.

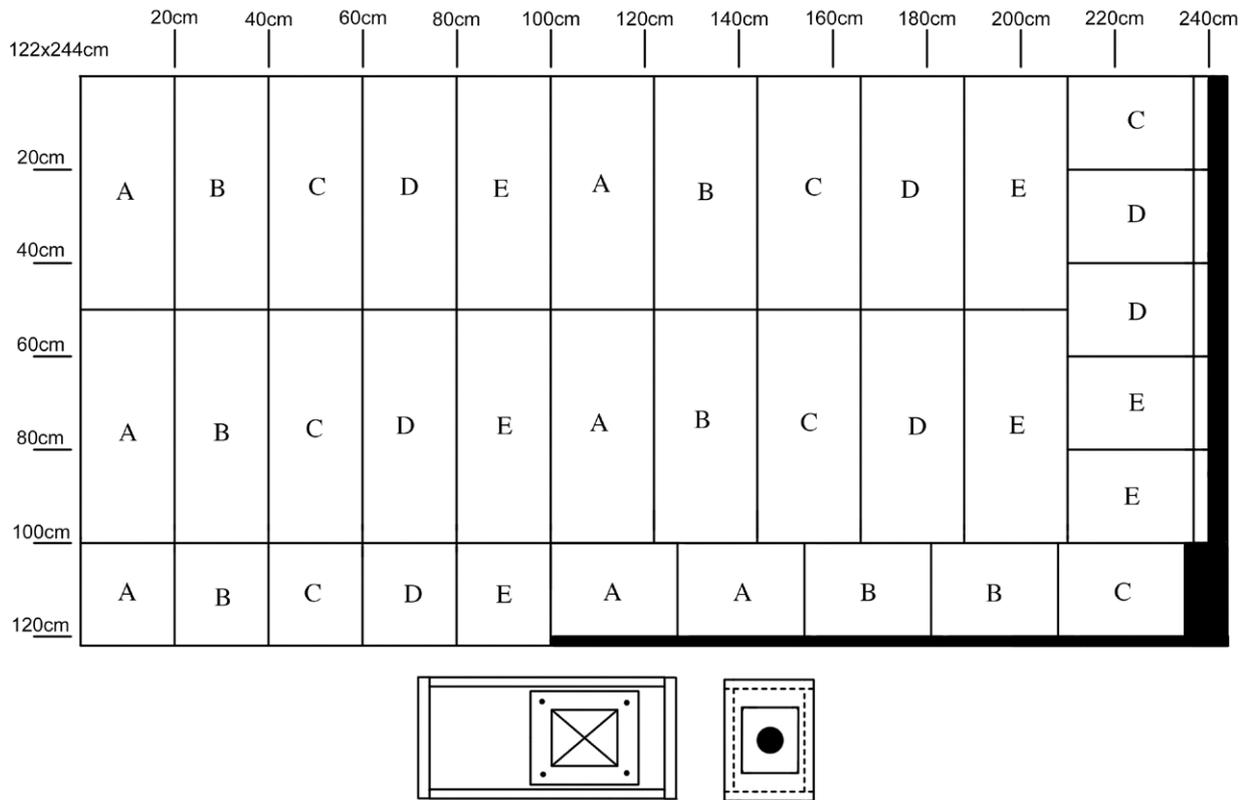


Fig. 3. Plans for a slightly smaller nest box (five from a sheet of plywood).

Find a tree in which the box will be supported by more than just the wires. In other words, the wires should secure the box to the tree, but not hold all the weight of the box. In fact, the more branches that support the box, the better. This also makes installation easier if you're by yourself (you won't have to hold the box up while you're drilling and such). Make sure that neither the entrance hole nor the access door is obstructed by a branch. Actually, it's fine if there is a branch near (but not blocking) the entrance hole. Having such a branch nearby typically makes it more difficult for honey badgers to find leverage to chew on the entrance. But make sure the access door is completely free from obstructing branches. You will need to reach your whole arm into the box through this door, so make sure there is room for that to happen.

Three anchor points makes for a very secure box. Ideally at least two of these will be a vertical

branch. Use a pencil/pen to make two marks on the box on either side of the branch to which you plan to secure the box. Use a power drill with a 5-6-mm bit to drill holes into the box through which you will thread pole wire. For example, if the back of the box is resting snugly against a vertical branch that is 8 cm in diameter, mark the back of the box with two dots about 9 cm apart (on either side of the branch). Now drill holes at the marks. Now cut a piece of pole wire to a length of about 0.5 m. Near the middle, make a 90-degree bend. Make another 90-degree bend 9 cm away. Now take the bent piece of wire and stick it through the access door. Stick one end of the pole wire through one of the holes you just drilled and the other end through the other. If you measured the distance between the holes and made the bends at the appropriate spots, you should now have your pole wire sticking out through the back side of the box (on either side of the branch) and the wire should be flush with the back of the box

on the inside. Bend the two emerging pieces of wire towards each other around the branch and cinch them on each other. Use heavy pliers to twist them tight. Ideally, if you placed your box snugly against the branch in the back and the other contact points, the box should not wobble much at this point. As I mentioned above, 3 anchor points seems to be key. If you have a vertical branch that will allow for two wires, that's fine. And remember, try to mount the box so that it is perfectly level (front/back as well as left/right). It may be necessary to make one of your contact points through the bottom of the box, but I've found it best to use the sides/ends. If the hornbills want to seal up these holes, they will. If they don't, the holes will provide some ventilation. Do not drill holes through the top of the box. Drilling holes through the bottom of the box could allow for drainage (and help keep the nest material dry), but it could also allow a site of entry for termites.

Once the box has been attached to the tree, put about 2 liters of wood chips/shavings inside. At-

tach the access door cover, tighten the wingnuts, write the box number on the access door with a permanent marker (this ensures that the cover is always on correctly). Record the GPS of the box and you're done.

For a slightly smaller nest box, see the design in Fig. 3. Although these boxes share many features with the box just described, their smaller external dimensions (27 cm x 20 cm x 50 cm) allow for five nest boxes to be produced from a single sheet of plywood.

### **Acknowledgements**

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