Thoracic X-Strap Harness. Design and Method 1

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Tracking devices made by the following manufacturers have been fitted using this harnessing method: Ornitela, Ecotone, Microwave Telemetry, Wildlife Computers, North Star, MadebyTheo, Gpscollars (UK), Wildfind, Cellular Tracking Technology (CTT) and Vektortek LLC. Devices have been fitted using this harness design and method to the following species: African White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotos,* White-headed Vulture *Trigonoceps occipitalis,* Egyptian Vulture *Neophron percnopterus*, Hooded Vulture *Necrosyrtes monachus,* Cape Vulture *Gyps coprotheres*, Rüppell's Vulture *Gyps rueppelli,* White-rumped Vulture *Gyps bengalensis,* Turkey Vulture *Cathartes aura,* Black Vulture *Coragyps atratus,* Andean Condor *Vultur gryphus,* Striated Caracara *Phalcoboenus australis,* Martial Eagle *Polemaetus bellicosus,* Wahlberg's Eagle *Hieraeetus wahlbergi,* Lesser Spotted Eagle *Clanga pomarina,* Secretarybird *Sagittarius serpentarius,* African Grass Owl *Tyto capensis,* Lesser Flamingo *Phoencopterus minor,* Marabou Stork *Leptoptilos crumeniferus,* Saddle-billed Stork *Ephippiorhynchus senegalensis,* Southern Ground Hornbill *Bucorvus leadbeateri.*

Equipment needed

- Teflon ribbon: 11.2 mm/0.44" wide (*Gyps*, Lappet-faced- and White-headed Vultures, Andean Condor); 8.4mm/0.33" wide (Egyptian, Hooded and Turkey Vulture).
- Leather hub cross-pad perforated to size. Alternatively, it can be replaced by a flat knot tied in the Teflon.
- Scissors
- Clamp scissors
- Ringing or normal fencing pliers
- Stainless steel clamps
- Superglue
- Ruler/Measuring tape
- Neoprene pad
- Neoprene glue

The attachment harness must be prepared in advance.

Measurements and preparations: Key stages/steps

The length of Teflon ribbon will depend on the target species:

- Hooded Vulture and similar-sized species – 120 cm
- *Gyps* Vultures – varies from 150-180 cm
- Lappet-faced Vulture – 170-190 cm
- Andean Condors 150-180 cm
- Turkey and Black Vultures 110-130 cm

We recommend that measurements are taken before the harness is assembled if you are not familiar with the species. The Teflon ribbon is then cut accordingly.

1) There are two possible initial preparation methods, depending on the type of device used.
   a) If the device has two attachment lugs at the front and two at the back;
      i. the Teflon ribbon can be cut into two equal lengths and attached to the two front lugs by tying them to each lug with a sturdy knot and then securing the knot with a stainless steel clamp which is pressed flat
      ii. alternatively, the ribbon can be threaded through the two front lugs and then be knotted at the front of the device with the knot being secured with a stainless steel clamp as described above.
   b) If the device has one attachment lug at the front and two at the back, follow the same procedure as in point ii above. Ensure that the ribbon is at equal lengths before tying and securing the knot in the front.

2) Knots can be further secured by stitching through each knot using a needle and Kevlar thread or dental floss. Tie a knot in the thread. Start sewing from the top downwards (towards the bird's body) so that the Kevlar knot sits on top. Sew five stitches into each knot. Then wrap the end thread around the needle three times to pull into a knot. Cut off the ends of thread.
3) Apply superglue to the outward facing Kevlar/ribbon knots. This will help to keep the knot secure and to smooth down the edges.
4) If not already fitted to the underside of the device, neoprene padding should be glued to the device using neoprene glue to provide a soft base which will rest on the bird's back. Draw around the tag and cut the padding to fit (making sure you include a wider area to pad the undersides of the lugs and knots). Other than these wider parts of the neoprene under the lugs, the pad should fit the outline of the tag closely so that it does not fray or have excess areas of neoprene that the bird can pull at.

Fitting the leather-hub

A leather-hub pre-cut to size through which the Teflon ribbon is threaded will enable easier fitting and adjustment of the harness before it is secured to the bird. The leather-hub can be cut from suitable soft leather in advance using a sharp chisel or crafts knife. Slit lengths should match the width of ribbon used and cut as can be seen in Figs. 1.1 & 1.2. Each length of the ribbon is threaded through opposing slits on the hub. Ensure that the ribbon is flat and the there are no kinks/folds along its entire length after threading both ends through the hub.

Figure 1.1: Teflon ribbon threaded through the slits cut in the soft leather-hub. The end facing the camera should rest on the bird's sternum when fitted.

Figure 1.2: Teflon ribbon threaded through the slits cut in the soft leather-hub.

If material for the manufacture of the leather-hub is not available, a flat knot can also be tied at the appropriate length of the Teflon ribbon so that it lies on the prescribed area on the sternum of the bird. Care must be taken that both lengths of ribbon extending from the front lug/s are of equal length once the knot is tied to ensure that the harness fits properly.

Restraint and hooding

A minimum of two people (or three for larger species as Lappet-faced Vulture and Condors) should be used to restrain and hold the bird during the fitting of the harness, especially when working with larger species. One person should hold the head of the bird with one hand and use the other to manage the wings during fitting (Fig. 1.3). With larger species one person holds the head, another the wings and the third the legs, so that the person that will tag the bird is safe and can work well (Fig. 1.4). The head should be held firmly from behind with the thumb and forefinger placed under the jawbone where it meets the skull on either side to prevent the bird from moving/turning its head and biting the handlers, but allowing the bird to breathe freely and regurgitate if it wants to. The bird's head should be kept near the edge of the platform on which the bird is processed so that any regurgitation can fall on the ground or in a container placed on the ground for this purpose. Regurgitation should be safely disposed of after fitting and release of the bird.

A second person can hold the legs and feet of the bird which should lie on a table on its sternum (or if there is an extra person, they can hold them separately). The bird will need to be lifted about 20 cm from the table when the harness and leather cross-pad is fitted. This will be easier with two-three individuals holding and handling the bird. A third/fourth person will be responsible for fitting

the harness and completing any other procedures required by the relevant protocol/study.

Figure. 1.3: Two handlers holding the bird as prescribed after the head-covering has been removed just prior to the release of the bird. Note the blanket covering the surface that the bird is resting on.

Figure 1.4: Three handlers holding the bird as prescribed for a large species such as Condors (particularly juvenile males which struggle most of the time). The fourth person tags the bird. Note the knot is located in the chest, just over the beginning of the keel. (Photo: Jorgelina Guido).

In order to keep the bird calm while restrained, a loose material tube (or a sock with the toes cut off) can be used to cover the head. A hole in the end is needed so that the bird will not choke if it regurgitates food whilst hooded. Alternatively, a small towel can be placed over the bird's head to cover it while still allowing for regurgitation. The temperature should be controlled since the head covered may increase the body temperature, in that case avoid covering it.

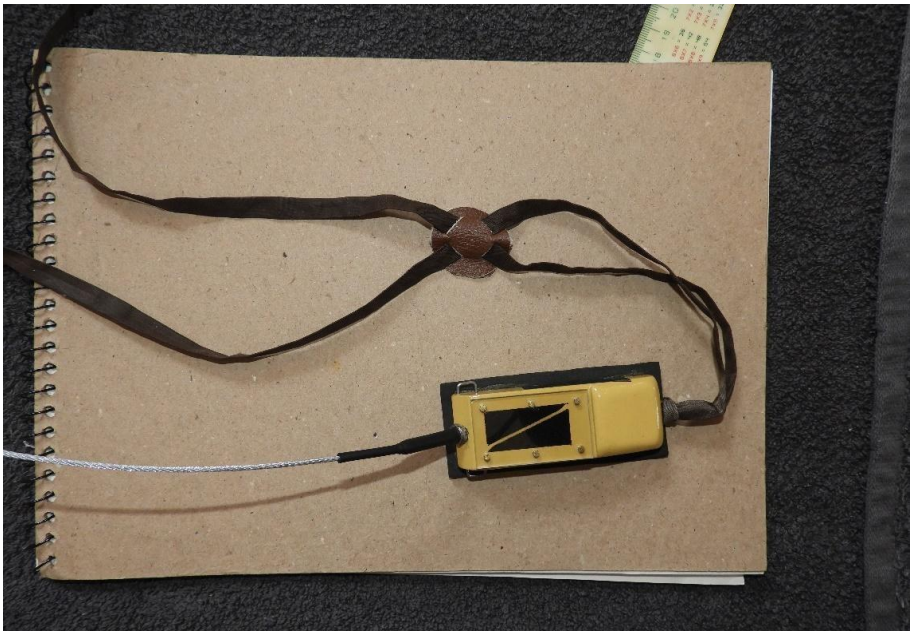

Figure 1.5: Harness fitted to a Microwave PTT without stainless steel clamps fitted.

Figure 1.6: Tracking device positioned on the bird's back with Teflon strap in the foreground being held on the back lug with clamp scissors while the second strap is threaded through the lug on the opposite side of the device.

Fitting to the bird

1) Pull the harness over the bird's head with the straps attached to the front lug or lugs passing either side of the head and with the leather-hub hanging below the neck. In the case you do use a flat knot instead of the leather-hub, pass the tied Teflon around the neck (see Fig. 1.4).
2) The device should be positioned on the back in the position where it will lie. One of the handlers can place a finger on the device to keep it in position while the straps and leather-hub or the flat knot are placed in position.
3) Front straps should be run along the two clavicular depressions on either side of the bird's neck and fed over the shoulders.
4) The bird should then be lifted at least 20 cm and the leather-hub positioned on the apex of the sternum at least 4-5 cm from the top thereof. The straps that extend beyond the leather-hub can then be spread out on either side of the bird and the bird can be placed back on the table.
5) The straps can then be pulled along either side of the bird and up onto the back while making sure that the straps run along the sides above the thighs onto the back, ensuring that no secondary or tertial feathers are trapped behind the strap.

6) Before the straps are thread through the rear lugs on the device, thread each strap through a single stainless-steel clamp.
7) Then thread the two straps through each of the lugs at the back of the device and pull them tight to allow for a comfortable fit. Clamp scissors can be used to hold the straps together on either side until all adjustments have been made and the device is positioned properly.
8) Before fastening the straps at the rear, check the position of the unit on the back to ensure that it is positioned in the middle of the back, that the straps fitting over the bird's shoulders are tight enough to prevent the harness slipping out of the clavicular-channel on either side, the position of the leather-hub on the sternum and that no flight feathers are trapped behind the straps. Also ensure that the are no folds in the Teflon ribbon and that it lies flat against the bird's body with no distortion of the body coverts.
9) The harness should not be too tight-fitting. A good rule of thumb before fastening the harness is to check that it allows enough room for the bird to breathe freely and to compensate for possible increase in weight by making sure that you can fit two fingers under the unit.
10) Leaving the clamp scissors in place on either side at the back, a sturdy knot can be tied securing the straps to each of the lugs at the back of the harness. Once this has been done, the clamp scissors can be removed.
11) Check the fit of the harness again after the knots have been tied to the rear lugs to ensure that it still is fitting properly. If not, loosen the knots, re-position the harness and fasten again.
12) Knots can then be further secured by stitching through each knot using a needle and Kevlar thread or dental floss. Tie a knot in the thread. Start sewing from the top downwards (towards the bird's body) so that the Kevlar knot sits on top. Sew five stitches into each knot. Then wrap the end thread around the needle three times to pull into a knot. Cut off the ends of thread.
13) The tip of the straps can then be thread through the stainless-steel clamp on either side and the clamp can be pulled over the knot before being clamped shut using the pliers. Ensure that the clamps are flattened properly and sit properly over the knots to prevent them from being tampered with or loosed by the bird.
14) Cut any remaining length of the Teflon ribbon off against either knot at the back and use Superglue to ensure that any exposed end of the ribbon is prevented from fraying.
15) Check the harness and device again. Once satisfied, you can proceed with other procedures such as ringing, collection of biometric and moult data and collection of relevant samples before the bird is released.

Figure 1.7: Microwave PTT fitted to an African White-backed Vulture. In this instance, the Teflon straps were attached separately to the lugs at the front of the device.

Figure 1.8: Cellular Tracking GPS fitted to an immature Andean Condor. In this instance, the Teflon was attached to the front of the device with a knot in the middle hole.

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