Supplementary Material

Protocol for making weak-link harnesses for deployment of GPS tracking devices on large gulls

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Supplementary Material 1

Instructions are provided here for the construction of weak-link wing loop harnesses suitable for use on large gulls as used in our study. We trialled three different weak-link materials (cotton thread, cotton piping cord and nitrile rubber). The cotton weak-links are shown as examples here. Exact methodology may not be definitive as continual improvements are sought.

This document does not detail correct fitting procedure for these harnesses and training in the field is essential for their safe and effective application. The authors are happy to be contacted directly to discuss harness fitting as well as design.

MATERIALS

1. Marker pens
2. Tubular Teflon ribbon (6.35mm flat diameter, Bally Ribbon Mills 8476-.25", Pennsylvania, USA)
3. 1mm braided nylon wader mist-net shelf string (British Trust for Ornithology, Thetford, UK)
4. Small sharp scissors
5. Polyester thread
6. Needles of various sizes (including plastic needles)
7. 3.75 mm knitting needle;
8. Rulers
9. Weak-link material – a) 2mm Piping cord (Tootal Craft, Hungary); b) Stranded cotton thread (DMC 117MC-E, Mulhouse, France)
10. Superglue
11. Small file (not shown)

PROTOCOL

If making:

Cotton thread design follow method A;

Cotton piping cord design follow method B;

Initial tubular Teflon harness strap lengths (guidance to reduce material wastage):

Lesser Black-backed Gull (*Larus fuscus*)
Neck loop = 250mm Wing loop = 320mm

Herring Gull (Larus argentatus)
Neck loop = 290mm Wing loop = 360mm

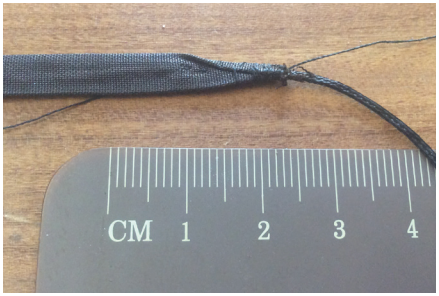
A) COTTON THREAD WEAK-LINK

1. Cut four pieces of Teflon to the appropriate length. Take care not to handle the very ends of the cut sections of Teflon as they fray very easily. Straps were made to different sizes for neck and wing loops to save on excess material usage as well as making it easier to fit (less unnecessary material getting in the way).

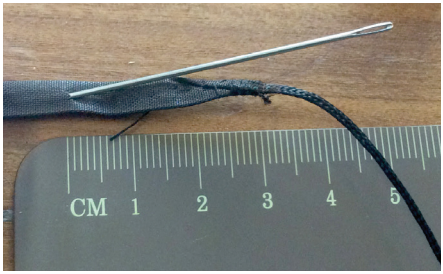
2. Cut four pieces of wader shelf string to form the core of the Teflon. These should be c. 100mm longer than the Teflon.

For each of the four straps – creating looped ends;

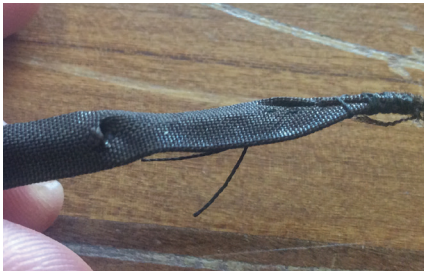
3. Insert the shelf string into one end of the Teflon c. 20mm and stitch into place using needle and thread. Ensure there are several stitches directly through the shelf string first then fold the Teflon in half along its length and stitch to create a tapered secure end. The tighter and more tapered the end, the easier it will be to achieve step 5. A gentle pull on the shelf string will ensure it is attached securely and will not pull free.

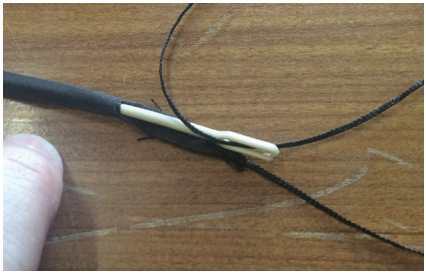


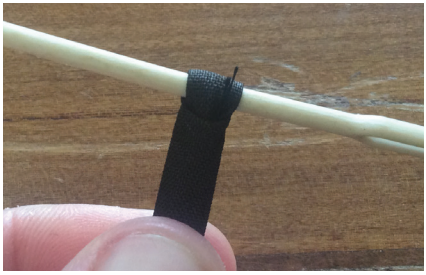
4. Create a hole beneath the tapered end c. 20-30 mm down using a sharp large needle. Take care to make the hole only through one side of the Teflon and not through both sides of the tube. Once there is an initial hole, it can be enlarged with a plastic needle without risk of causing any fraying. A hole of 4mm diameter maximum should be large enough.



5. Tie the loose end of the shelf string through the eye of the plastic needle and feed through the length of the Teflon. Place a second plastic needle through the loop now created at the tapered end of the Teflon and pull from the shelf string at the opposite end to house the tapered end within the Teflon tube creating a neat eye at the end of the Teflon strap. It may take some manipulation to get the tapered end into the hole. The desired diameter of the Teflon eye will depend on the type of weak-link being used and may be constructed around a weak-link at this stage if the link is a fixed loop.







WEAK-LINK

6. Take the cotton thread through the loops of the four Teflon straps using a plastic needle, ensuring that the straps of the same length sit adjacent and the orientation of the strap loops are all the same (to allow smoothest sided to sit against the bird when fitting). Then tie the weak-link securely in a reef knot which brings the straps together in a circular position. The reef knot in the weak-link is secured using a small drop of superglue and sharp excess ends trimmed off.

7. Repeat, if required, threading additional strands of weak-link material through the four Teflon loops from different directions so the glued and tied knots will sit in between different pairs of straps.

8. Each glued knot is then pulled inside a Teflon loop and pulled securely to ensure it does not rub directly against the bird. It is very important if using multiple weak-link strands not to glue them together to ensure the link breaks correctly and all straps detach separately.

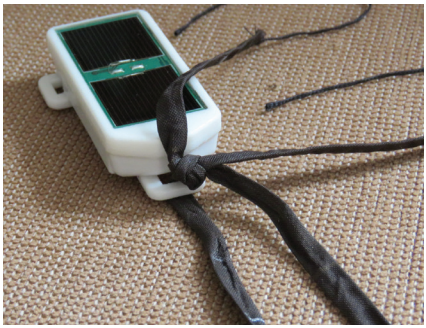
FINISHING THE HARNESS

9. Once the weak-link is finished. Stitch through the tapered end of the strap loops, now housed within the Teflon tube, to ensure the diameter is fixed. Apply a small amount of superglue to secure this on the outward facing side of the strap and trim off any sharp bits of thread when dry.

10. Next stitch and bind the loose shelf string at the opposite end of the strap to prevent fraying and make it easier to thread the straps through the attachment points of the device.

11. Place identifiable marks along the length of the harness using an extra fine metallic permanent marker. These are used as reference points to quickly measure the size of harness when fitted to a bird. For adult Lesser Black-backed Gulls we use marks at 80mm and 100mm on the neck loop and 100mm, 150mm, 200mm and 250mm for the wing loops. It can be helpful to use a different colour for each side of the harness strap to help prevent twists during fitting.

12. The harness can now be tied to the front of the device (3-point attachment shown) using a reef knot ready to fit.Ensure reference markers line up and are symmetrical. The knot at the front of the tag when using this weak-link harness needs to be stitched and glued as an additional step during fitting once the neck loop size is correctly determined for each bird. To prevent the neck loop running free through the attachment point each strap should be fixed together by placing one directly on top of the other and stitching as close to the attachment point as possible.



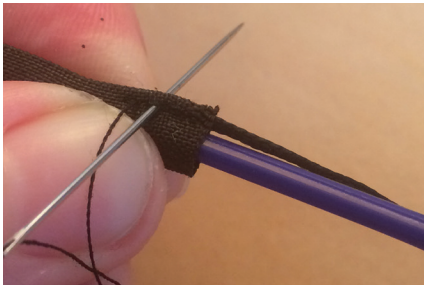
B) PIPING CORD (2 MM) WEAK-LINK

1. Cut Teflon and shelf string material to required lengths.

2. For the two shorter neck loop straps follow steps 3-5 from cotton thread weak-link section above to create loops in the end of the Teflon.

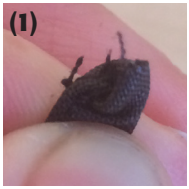
3. For the remaining wing loop straps create an inverted c.20mm of Teflon at the end of the material as follows:

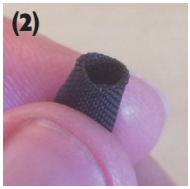
a. Place c.20mm shelf string into the Teflon tube and push to the side. A plastic needle can be used to trap the shelf string against the side. Stitch securely ca. 2mm from the top.



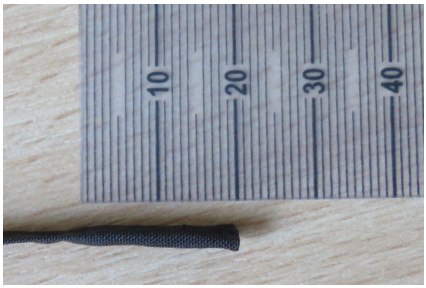
b. Thread the shelf string through a plastic needle and thread down the length of the Teflon.

c. Start folding over the stitched end of Teflon by pulling the shelf string from the other end (1), a plastic needle or forceps can be useful. Pinch the fold with your fingers and pull firmly on the shelf string at the other end, until the entire top edge inverts inside the tube (2).



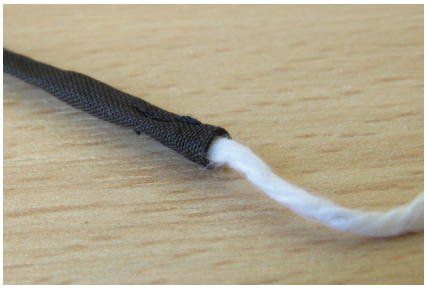


d. Continue to pull the inverted Teflon to c.20mm (double thickness in image), and use a plastic needle or knitting needle to tidy any wrinkles.

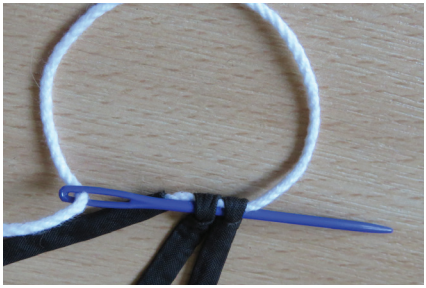


WEAK-LINK

4. Stitch very securely c.15-20mm of piping cord down one inverted strap. A 3.75 mm blunt needle is helpful to keep the aperture of the Teflon open. It can be helpful to put some superglue on the piping cord before you cut it, to unsure the ends don't unravel, and can't pull through the stitching. You must use a file to soften sharp superglue edges before placing it inside the Teflon, or it may cause the Teflon to rip and fray.



5. Thread the piping cord through both looped straps, then around again a second time.



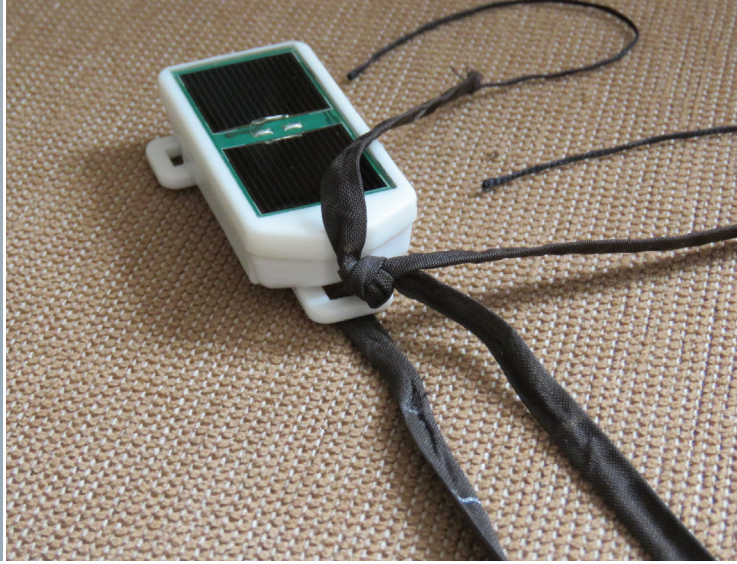
6. Pull the piping cord link as tight, with no gaps between each strap, then cut to leave c.20mm exposed, which can then be placed in the other inverted strap and sewn. Again, superglue on the cord before cutting stops the ends fraying, though they must be filed down. Ensure the link is not able to run freely for more than 1-2 mm which could lead to unbalanced fit after release.

FINISHING THE HARNESS

7. Repeat steps 9-12 from cotton weak-link above.

REFERENCE

Thaxter, C.B., Ross-Smith, V.H., Clark, J.A., Clark, N.A., Conway, G.J., Marsh, M., Leat, E.H. & Burton, N.H.K. (2014). A trial of three harness attachment methods and their suitability for long-term use on Lesser Black-backed Gulls and Great Skuas. *Ringing and Migration* **29**: 65–76.



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