Hard Shell Sea Turtle PTT Attachment Protocol

Michael Coyne
Seaturtle.org

Matthew Godfrey
NC Wildlife Resources Commission

Brendan Godley
Marine Turtle Research Group

Kevin Lay
Sirtrack Ltd.

The following process describes an attachment method used by the authors and their collaborators to epoxy bond PTTs to hard shelled sea turtles with good results in a number of species and study sites (Blumenthal et al 2006, Broderick et al 2007; Godley et al 2002; Hawkes et al 2006, 2007; Rees et al unpublished; Mangel et al unpublished). See Appendix A for performance statistics.

For nesting turtles, be sure that the turtle has completed laying, covering and disguising the nest before you begin. Be sure to carefully mark the nest and avoid stepping on top of the egg cavity. Turtle may be placed in an open box or some other method of immobilization used. Where logistically possible, four slotted boards can be interlocked to create a box around the turtle (below left; Appendix B). For large turtles it is helpful to push sand up around the box to provide additional support. In areas where vehicular access is limited a lighter weight construct of two metal poles with a crossing bar at one end (below right, called a “para tortuga”) may be used to inhibit forward motion of the turtle by placing the two poles on either side of the turtle’s head (i.e. against the “shoulders”). Some patience and practice is required to restrain a turtle using this method. Be sure the keep the turtle cool when attaching during the day.

Turtle restraints

It is advisable to test all PTTs before deployment, particularly if the deployment location is a long distance from the location where the PTTs were previously tested (eg at the manufacturer or your office or lab). The accuracy of Argos locations depends in part on the location of previous uplinks. To test your PTTs turn them on and place them outside with an unobstructed view of the sky. You may wish to use a tool such as NASA’s J-Track (http://science.nasa.gov/realtime/jtrack/Spacecraft.html) to determine when Argos equipped satellites are passing overhead to minimize battery usage. View the NOAA weather satellites and determine when they will pass over your location. You can also use the J-Pass Generator to have future pass predictions sent by e-mail (http://science.nasa.gov/RealTime/JPass/PassGenerator/). Care should be taken to minimize testing time and conserve battery. Ensure that transmitters are switched off once testing is complete. With proper planning tags need only be switched on for 15 minutes for testing.

Materials:

- PTT, magnets, PTT tester
- Epoxy Adhesive: Sika AnchorFix 3. Note that similar epoxy adhesives can be used but attention should be paid to cure temperature, epoxy viscosity and gel/cure times. Note that Sika epoxy tubes fit in a standard caulk gun, so there is no need to buy a separate proprietary and expensive dispenser. One tube of epoxy will be needed for each PTT.
- Cartridge gun and epoxy mixing tubes (may be supplied with epoxy).
- 150 grit sandpaper or sanding blocks.
- Heavy (rubber) mallet, pliers, scouring pads (e.g. steel wool, scotch-brite), plastic or metal paint-scraper, bucket (for water), acetone, cleaning rags, gloves, and spatula, tongue depressor or stiff piece of cardboard.
- Anti-fouling paint (e.g. Micron 66), and brush. One brush per deployment is recommended. Screwdriver and paint stirring sticks.
- Strong flashlight or headlamp (red LED should be used while turtle is still nesting), tarpaulin or other clean surface for equipment, camera, data sheets, pencils, garbage bags, and tagging and sample gear.

Process:

1. Record the ID of the PTT and switch the PTT on. Ensure that the PTT is functioning using a tester supplied by the PTT manufacturer. Pay careful attention to the mechanism for turning your PTT on and off, which varies by manufacturer. Record the date, time and GPS location of attachment.
2. Check and record flipper tags, PIT tags and any unique markings on the turtle. Measure curved carapace length (before beginning attachment). Experience has shown that both of these are likely to play a significant role in the future interpretation of tracking data, and are easily forgotten in the excitement of deployment!
3. Use scrapers, steel wool and water from bucket to remove and rinse all epibiotic growth from the attachment area. You may wish to place a towel lightly over the head and eyes of the turtle, to avoid accidentally spilling water or acetone on the head and to help calm the turtle.

Removal of epibionts

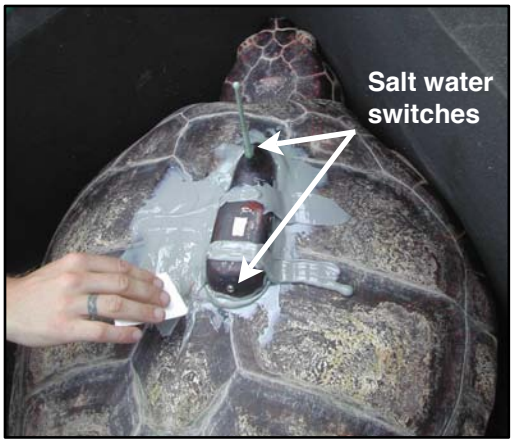
4. Pour acetone into cleaning rags and thoroughly wipe the attachment area to remove oils and obtain a clean dry working area. Within reason, the larger the area, the stronger the bond will be. Nail polish remover (without moisturizers or other additives) may be substituted where pure acetone is not available

Cleaning with acetone

5. Lightly sand the attachment area with 150 grit sandpaper. (Avoid excessive sanding on some species such as olive ridley or Eastern Pacific green turtles, as the carapace can be oily and may leach body fluid).
6. Wipe again with acetone and allow to dry. Repeat until cloth comes up clean.
7. Sand the bottom of the PTT and wipe with acetone to obtain a clean rough surface. Note that the PTT should be attached with the antenna nearest the turtles head and on the highest, flattest part of the carapace. The front end of the PTT will typically fall in the first or second vertebral scute. Turtles with a prominent ridge along the midline may require that the PTT be placed slightly off-center. Some recommend placing the PTT with the antenna facing the rear of the turtle in situations where there is a significant danger of the antenna shearing off (e.g. because of the species or location).
8. Cover the salt water switches to avoid covering them with epoxy. Masking tape or well-chewed gum work well in the field.
9. Attach the mixer nozzle to the epoxy tube and dispense approximately 10 cm of epoxy to be disposed of (this will not be well mixed).
10. Use the cartridge nozzle and a spatula to apply and smooth a portion of the mixed epoxy onto the bottom of the PTT. Place the PTT on the attachment location. You may wish to wait for the epoxy to firm a bit before placing on the carapace to prevent slippage as the turtles moves around.

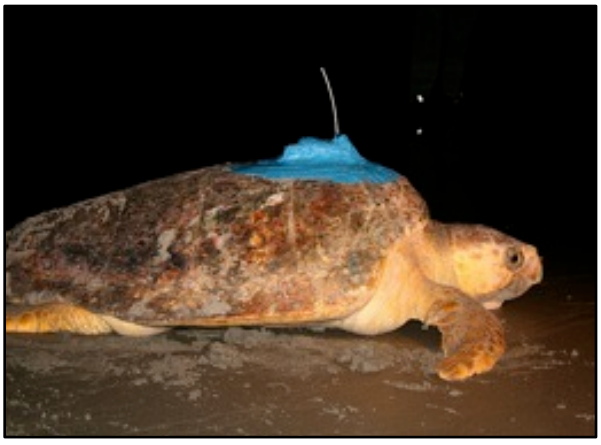
PTT placement on carapace

11. Apply beads of epoxy around and over the PTT and smooth with the spatula. Flare the epoxy in a large oval around the PTT to maximize surface area and adhesion between the epoxy and the carapace. Push epoxy into any gaps under the PTT and smooth out. Make sure there are no spaces where water can pool around the salt water switches. We recommend applying epoxy in two to three thin layers. Wait 10-15 minutes between layers to allow each layer to begin to set and to avoid excessive heat production during curing. Pay particular attention to the hydrodynamics of the attachment. Leave a 1 cm area clear of epoxy around each Salt Water Switch terminal.



PTT bonded to carapace

12. Wait at least until epoxy does not adhere to the finger when touched. Paint the epoxy and PTT with an antifouling paint. Micron 66 from International paints is one option. Be sure to leave a 1 cm space with no paint around each Salt Water Switch terminal – the metal sensors used to determine when the PTT is out of the water – and the antenna. Paint should not come in to contact with the switches or the antenna. Take care not to get paint directly on the carapace. Turtle may be released once paint does not adhere to the finger when touched.



PTT coated with Antifouling paint.

13. Pre-release checklist:
    - ☐ Turtle ID is recorded (flipper tags and PIT tag).
    - ☐ Turtle has been measured.
    - ☐ Release location has been recorded.
    - ☐ PTT ID has been recorded.
    - ☐ PTT is switched on and tested.
    - ☐ Salt water switches are clear, free from epoxy, paint, tape or gum.
    - ☐ Epoxy and paint are dry
14. You may now release the turtle! Remove the para tortuga or lift the box up and away from the turtle. All team members should retreat to a higher section of beach and stay quiet with all lights switched off to allow the turtle to orient to the ocean.

Travel:

Where possible it is recommended that you have the manufacturer ship tags to the country of deployment. Note that some countries have very stringent customs processes for shipping, which may hold up a package for a significant amount of time. Be sure to inquire about the potential for customs problems in advance and budget for import duty which can be quite high in some countries.

If you must travel with your PTTs you should carry them in your hand luggage - airlines will not be able to compensate you for the value of your tags if lost. Be prepared to show security officials all paperwork received from the manufacturer with your PTT shipment (including commercial invoices and receipts), as well as a detailed product description available from the manufacturers website (download and print before travel). It is also advisable to carry an example photo of your tag attached to a target animal (see the SEATURTLE.ORG image library) and an example of a publication that used the tags, to demonstrate quickly and effectively what your tags are for. If you own an iPod or similar media player, load a video of the tagging process to demonstrate how the tags will be used. Note that carrying satellite tags through airport security is not prohibited - it won't take long until a security manager will allow you on your way!

Where possible epoxy should be purchased in the country of deployment or shipped in advance. If you must travel with epoxy it should be included with your checked luggage with the cartridge gun. Place the epoxy in a separate bag or case inside a checked bag to protect your other luggage contents in case a tube fails. Place a simple description of the epoxy (in all appropriate languages), a photo of a tagged turtle, and a copy of the materials safety data sheet (MSDS; available from manufacturers website) on top of the epoxy so that it will be the first thing an inspector sees if they open the bag containing the epoxy.

Notes:

You may find it useful to take photos of the turtle throughout the tagging process, both for documentation purposes and to share with partners, sponsors and the public. A good quality digital camera that is capable of auto-focusing in the dark is highly recommended!

The formulation for Power-Fast Fast Set epoxy has changed (also known as Power-Fast Quick Set). It now cures more slowly and at a higher temperature than the old formula used by many tagging projects.

Epoxy manufacturers recommend that epoxy should remain dry until cured. Curing times vary with products and temperature. It may not be practicable or ethical to hold the turtle until the epoxy is fully cured so it is up to the individual researcher. Sika AnchorFix 3 should be adequately cured within 30-60

minutes. High temperatures and humidity may increase the time required for curing. Before using a new epoxy, be sure to test how hot it becomes during curing, before use on a turtle. Some epoxies may be unsuitable for PTT attachment.

Follow the safety instructions provided with the adhesive. Use disposable gloves and avoid skin contact and breathing epoxy vapors. Epoxy degrades over time. Carefully note provided storage suggestions and always test your epoxy if it has been sitting on the shelf for more than a year.

Do not panic if the turtle throws sand on the wet epoxy. Brush off as much as you can, but it will not impact the attachment.

Do not panic if the epoxy seems to take longer to cure than expected. Weather conditions, age of epoxy and other factors may increase the cure time. Epoxy does not need to be completely hardened before release. If you have used the correct epoxy type it will complete the curing process in the water.

Shorter retention times than those presented in Appendix A may be expected when tagging smaller animals, which may slough off the tag more quickly because of faster growth.

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Appendix A:

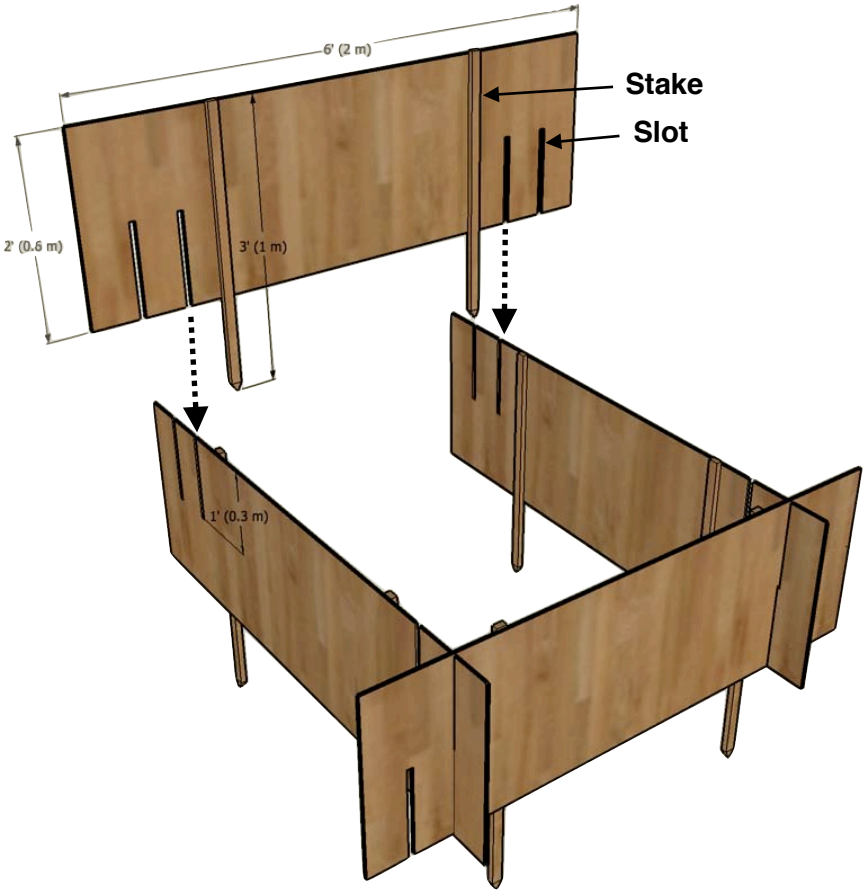
Performance statistics of epoxy attachment protocol on a variety of species in different locations. Number of PTTs deployed and minimum, maximum and average number of days transmitting are presented.

Species	Location	PTTs	Days Min	Days Max	Days Avg	Reference
Green	Cyprus	6	28	293	207	Godley 2002
Green	Cayman Islands	8	67	281	164	Blumenthal 2006
Loggerhead	Cayman Islands	3	379	1000	685	Blumenthal 2006
Loggerhead	Cape Verde Islands	10	57	566	249	Hawkes 2006
additional unpublished data		12	27	741	312	seaturtle.org/tracking/?project_id=162
Loggerhead	North Carolina, USA	12	127	652	432	Hawkes 2007
additional unpublished data		8	152	475*	396	seaturtle.org/tracking/?project_id=158
						seaturtle.org/tracking/?project_id=227
Green	Cyprus	10	43	424	291	Broderick 2007
Loggerhead	Cyprus	10	59	1356	322	Broderick 2007
Loggerhead	Masirah, Oman	10	85	669	268	Rees 2006 (unpublished)
Olive ridley	Masirah, Oman	9	71	213*	161	Rees 2008 (unpublished)
Loggerhead	Peru	7	7	248	111	Mangel 2007 (unpublished)

*Project has active tags at time of writing (26-Oct-2008)

Appendix B:

The “turtle box” is made up of four interlocking panels. Plywood or similar material may be used and cut to approximately 2 ft (2/3 m) high by 6 ft (2 m) wide. You may wish to increase or decrease the panel width based on the size of your target animals. Two panels should have slots cut in the top and two with slots cut in the bottom. Cutting multiple slots in each panel will allow you to adjust the size of the box as needed. Two stakes should be screwed to each panel. A minimum of 3 people will be needed to set up the box. Just before you are ready to capture the turtle, lock three of the panels together. With one person carrying each panel, place the three connected panels in the path of the turtle. As the turtle enters the box, quickly lock the fourth panel in to place and use a mallet to pound the stakes in to the sand. Push sand up against the outside of each panel to provide extra support.



Turtle Box