

STUCK ON TURTLES: PRELIMINARY RESULTS FROM ADHESIVE STUDIES WITH SATELLITE TRANSMITTERS.

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The role of satellite telemetry in the investigation of sea turtle ecology is growing rapidly. Because of the high cost of transmitters, attaching a Platform Transmitter Terminal (PTT) to a turtle quickly, safely, and firmly is of primary concern to researchers. This eighteen month study at Sea World - California was undertaken in order to fulfill specific needs of researchers attaching PTTs to hard-shelled sea turtles while on board a research vessel which is underway. Primary objectives were to devise a method of attachment that: 1) involves a short application and curing time for quick release of the turtle near the point of capture, 2) is not chemically/mechanically harmful to the turtle or the researcher, and 3) will remain firmly attached for one year. Presented here are preliminary results and caveats for the three different methods tested on captive turtles: 1) fiberglass resin with a polyurethane molded transmitter base, 2) a two part epoxy which acted as a molded base, and 3) a light-cured resin based glass composite dental adhesive with an orthopedic fiberglass cast as a molded base. As of 26 Feb. 1991 all attachments were still secure to the turtles after 142 days. Application and curing times were: fiberglass: two hrs; Epoxy: 1 hr, 40 min; Dental Compound/Fiberglass cast: 40 min. Evaluations of the three methods and recommendations for other attachment-base combinations are discussed in detail. A modification of the dental compound/fiberglass cast was used by Beavers and Cassano on an olive ridley (*Lepidochelys olivacea*) in the eastern Pacific and preliminary results are encouraging.

BACKGROUND

Byles began the initial transmitter attachment study on captive-born Kemp's ridleys at Sea World - Texas using a combination of polyester resin, fiberglass and a cloth strip harness. It was soon apparent that the resin was adhering better than the harness, which was discarded. The dummy transmitter remained attached for four months. Byles attributed the earlier than hoped for shedding to the flaky build-up of keratinaceous material which often occurs on the carapacial scutes of long term captive ridleys. In this study we selected three loggerhead turtles (*Caretta caretta*) between 60-80 cm with relatively non-flaky carapaces. The selected turtles and their habits were known individually by the curator's staff. The daily observations by the staff enabled us to monitor any gross behavioral changes in the turtles that might be due to the attachment of the dummy transmitters. One of the drawbacks of using turtles of this size is that they each still had prominent vertebral scute spines which raised the profiles of the dummy transmitters by at least one inch. We recommend harmlessly filing the spines down, if encountered, to lower transmitter profile and reduce drag.

METHODS

Because the bottom of the PTT is flat and carapaces often aren't, it is necessary to supply a base which is molded to the carapace of the individual turtle. Each carapace is distinct, and this can cause some difficulty in deciding what base to use. Types of bases are discussed for each technique. The methods of attachment were similar for each technique: dummy transmitters were attached approximately over the second nuchal scute after the area had been lightly sanded and cleaned with acetone. In the case of the dental compound Geri-Stor, the scutes were cleaned with Dry Bond, a drying/degreasing agent.

POLYESTER RESIN & FIBERGLASS/CASTALL BASE

Polyester resin and fiberglass have been used with success by several researchers; the longest attachment to date was 10.5 months (M. Renaud, pers. comm.). Initially, we found fiberglass resin and cloth difficult to work with but it became more manageable as our experience grew. The use of fiberglass requires a pre-molded base. We pre-cast bases from polyurethane resin made by Castall Inc. using a plaster inverse mold of a turtle shell. The procedures to make the initial mold and the bases are time consuming and labor intensive (but does not affect actual attachment time). In addition, Castall is a two part mixture containing isocyanates which is a contact poison and requires at least twenty four hours to cure. Once cured, the material is inert. This type of base can be carved with a knife in the field to fit turtle and has been used successfully by Byles.

SPECIFICS

TOTAL ATTACHMENT TIME:	2.5 HOURS
SHEDDING TIME:	142 DAYS THUS FAR
SHEDDING EFFECT ON CARAPACE:	UNKNOWN
EFFECT ON TURTLE:	NO CHANGE IN BEHAVIOR OBSERVED
WEIGHT:	abt. 314 g

EPOXY

We used a two part Epoxy, Epoxy 1240, made by Yale Enterprises, San Diego, California. This epoxy compound is the type used for highway lane markers and is also used successfully by Sea World Inc. in many of their underwater exhibits. The epoxy is easy to work with. We unfortunately increased our setting time by not mixing the proper proportions correctly. We tested the heat generated by Epoxy 1240 by applying setting time by applying it first to an empty carapace and monitoring the temperature on the underside of the bone by touch.

SPECIFICS

TOTAL ATTACHMENT TIME:	1 HOUR, 50 MIN. (SHOULD BE SHORTER-1 HR)
SHEDDING TIME:	UNKNOWN; 142 DAYS THUS FAR
SHEDDING EFFECT ON CARAPACE:	UNKNOWN
EFFECT ON TURTLE:	NO CHANGE IN BEHAVIOR OBSERVED
WEIGHT:	abt. 350 g
STRENGTH:	SHEAR: 3000 psi (aluminum-aluminum)

DENTAL COMPOUND / FIBERGLASS CAST BASE

We used a two part, light-cured resin based glass composite dental adhesive: Geri-Stor, made by DenMat Corp., Santa Maria, California in conjunction with a base of polyurethane impregnated fiberglass casting tape, Scotchcast Plus, made by 3M Corp., St. Paul, Minnesota. Geri-Stor appeared to be the solution to a quick adhesion time (it will cure in darkness in eight minutes), and a very little (6 oz) was sufficient for PTT attachment. However it did not adhere to the PTT housing (Lexan) and so a base was necessary. The Scotchcast Plus worked well as a base. Essentially it is a polyurethane impregnated fiberglass bandage and will set in about three minutes if it is immersed in 70^o F water and squeezed. Setting time can be lengthened by using colder water. It must be allowed to dry completely before placing it in the ocean and this can add considerable time to the attachment process. If electricity is available in the field, a hair dryer can be used after thirty minutes.

SPECIFICS

TOTAL ATTACHMENT TIME:	40 MIN. (CAN TAKE LONGER WITH CASTING TAPE)
SHEDDING TIME:	UNKNOWN
SHEDDING EFFECT ON CARAPACE:	UNKNOWN
EFFECT ON TURTLE:	NO CHANGE IN BEHAVIOR OBSERVED
WEIGHT:	abt. 342g
STRENGTH:	SHEAR: 1600 psi (to dentin)
PRESSURE:	TESTED TO 220'

ATTACHMENT CONCLUSIONS AND RECOMMENDATIONS

Each method had positive qualities and some drawbacks. Based on our experiences, Beavers and Cassano chose to use the dental compound, Geri-Stor, over the fiberglass/resin and epoxy when tagging a turtle at sea.

Fiberglass resin has proven successful in the field for 10.5 months. CAVEAT: The primary drawbacks of polyester resin and fiberglass are that it has a long curing time, can be difficult to work with, the curing is harmful, and requires an additional base be made to properly fit the turtle. The process of base making currently used is potentially harmful to humans and very time consuming. RECOMMENDATION: may not be very useful in studies where attachment time is a limiting factor but has worked well for beach attachment. We recommend a different material for a base with this method: Thermoplast molding plastic can be molded to fit individual turtles and sets instantly. Its drawback is that it requires 142^o F water for softening. Thermoplast has not been tested on a turtle.

Epoxy was simple to work with and can have a relatively short attachment time. CAVEAT: Epoxy will set within 20 minutes but may remain tacky for up to 8 hours (we returned the turtle to the pool while the epoxy was still tacky and have had no problems), is relatively heavy, is harmful before curing, and generates some heat. RECOMMENDATIONS: We have no recommendations at this time in the study.

The Dental compound met our objectives of rapid attachment time and is non-toxic. We were impressed by the bond between the casting tape base and the carapace considering the small amount that was used. The compound would work well for beach attachment at night. CAVEAT: Curing time is very fast and leaves no room for errors. It is also dependent on a base material. Casting tape was a bit bulky. RECOMMENDATIONS: Thermoplast may work as a base, though it hasn't been tested. Some other light epoxy such as Ten-O-Set can be used to smooth edges flush to turtle.

We are continuing to monitor the condition of each of the adhesives at Sea World - California on a weekly basis and plan to report our findings in the Marine Turtle Newsletter upon completion of the study. At that time any dummy transmitters still attached to the turtles will be removed. Results of the field tracking study will be written up by Beavers and Cassano and submitted for publication by a refereed journal at a later date. A study to examine the amount of drag added to a sea turtle by a PTT is planned for March 1991.

FIELD TECHNIQUE

Since Geri-Stor adhered so well to both carapace and casting tape during the study attachment, we (Beavers and Cassano) felt that it was the best of the methods investigated to apply to field (shipboard) conditions. To eliminate the bulkiness of the backpack-base we wrapped the transmitter with Scotchcast Plus, leaving overhanging flaps on either side for increased surface area. We then painted it with anti-fouling paint. The PTT was attached (total time of turtle on board: 1 hour, 30 minutes) on November 26, 1990 and is continuing to transmit. We experienced some attachment problems in that too much Geri-Stor was used initially and began to harden early, the result being that the PTT is built up higher than is necessary. We feel that this can be overcome with practice.

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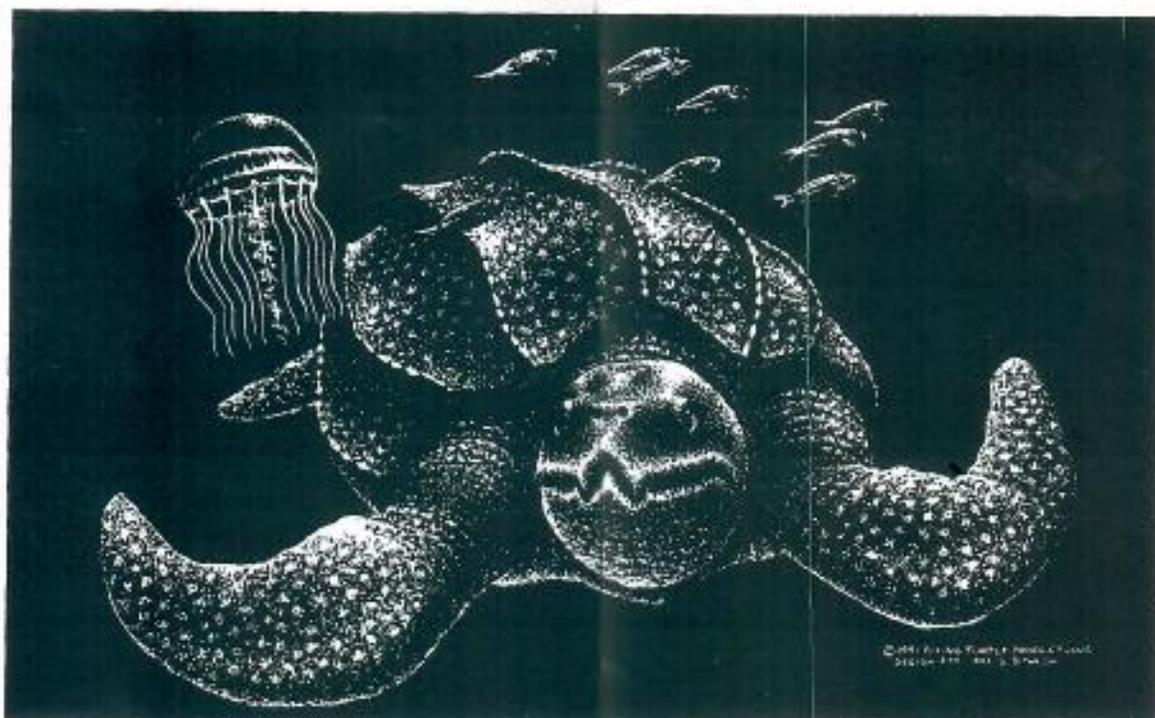
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