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## A Harness for Attachment of Satellite Transmitters on Flatback Turtles

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A specially developed harness was used to attach satellite transmitters to flatback turtles (*Natator depressus*) to track the movements of females in their inter-nesting habitat near Bare Sand Island, Northern Territory (12°32' S, 130°25' E) (Guinea *et al.*, in press) and Curtis Island, Queensland (23°45' S, 151°17' E) (Sperling, unpublished data), Australia. The conventional method of gluing transmitters to hard-shelled turtles using epoxy resin will fail on flatback turtles as they, similarly to leatherback turtles (*Dermochelys coriacea*), have a carapace covered by a soft and easily abraded skin. In addition, one of the aims of this project was the multiple deployment of a small number of satellite transmitters on a number of individuals and thus easy removal was also a concern. The harness described herein is comparable to a harness system widely used for carrying equipment by leatherback and green turtles (*Chelonia mydas*) (Chan *et al.* 1990; Eckert & Eckert 1986; Eckert *et al.* 1986; Eckert *et al.* 1989; Liew *et al.* 1992).

The transmitter (Kiwisat 101 PTT with built-in VHF transmitter) was bolted to a 250 mm x 155 mm x 3mm polycarbonate plate, which was placed behind the median anterior nuchal scute. To construct a well fitting plate previous design work had been carried out. A slightly bigger mould of sheet aluminum shaped to conform the profile of a flatback turtle carapace was made, using a flatback turtle skeleton (J14463), and a plastic casting of this specimen, both from the Queensland Museum, Brisbane, Australia. The polycarbonate plate was then placed on top of the moulded aluminum sheet and placed in a commercial

oven at 60°C. After 15-20 minutes it had partially melted and required the preferred shape. The gap between the moulded plate and the transmitter was filled with a sealer to prevent possible drag effects. Six slits in the plate were made for the attachment of the harness straps, and a piece of 3 mm thick neoprene wet suit material was used between the plate and the carapace as padding. The built-in VHF transmitter proved useful when retrieving the unit on the beach and was also intended as a way to retrieve the unit should it detach from the turtle while at sea.

Nylon seat-belt webbing (2.5 cm in width) was used to make six straps radiating from a central ring, with two running cranially over the shoulders, two running caudally, one on either side of the tail, and two running laterally around the middle of the turtle. A strap holding the two caudal-straps together prevented the harness from sliding forward (see front cover). Each strap was fastened to the ring by fashioning attachment loops which were manually sewn on for the first deployment, and secured with multiple cable zip ties for subsequent deployments. The ring, destined to be in a central location on the underside of the turtle with the six straps running dorsally towards the attachment package, was made of a magnesium alloy and was intended to function as the corrosive link for the harness:

(<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?photo=471>). The dimensions of the rings were based upon those previously used in a study of green turtles (Papi *et al.* 2000). The ring is rectangular in section (8 x 5 mm) with an outside dimension of 80 mm. The aim was to allow the harness stay on for at

least the maximum inter-nesting interval (*ca.* 20 days), but not much longer, so that the harness would detach in the event that a turtle was not recaptured to remove equipment. Given nest site fidelity, high patrol effort and monitoring for radio transmissions from the VHF unit, this was unlikely.

Several experiments with the rings were carried out in the water off Bare Sand Island before deployment on the turtles, and these showed a corrosion rate that was greater than predicted. Two rings glued together with a silicone sealer appeared that they would last longer, but results were equivocal. Because of this ambiguity, small self tapping screws was used to attach the webbing to the edges of the carapace when deployed on turtles for the first time, in addition to the glued double rings holding the straps together. Four deployments were performed and when all the turtles returned 17 – 19 days later the state of the rings ranged from only demonstrating surface corrosion to almost full-thickness corrosion. As the rings were placed underneath the turtles they could easily have been subject to varying degrees of wear and tear when in contact with different substrata. Differences in the turtles preferred inter-nesting location may have played a role. For the subsequent four deployments at Curtis Island, the magnesium rings were exchanged with stainless steel rings and no screws were used. Here only the Zinc staples together with the Velcro fastenings, as described below, would be the weak points of the harness allowing eventual detachment after a period of time at large. It was felt that this was acceptable because the very high fidelity and well known breeding history of the specimens chosen meant it was very unlikely that the turtles would not return for a subsequent nesting or fail to be detected for any other reason.

Different types of flotation material on the plate were trialed in the water off Bare Sand Island before deployment, in order to allow the whole harness to be slightly positively buoyant if detached, preferably with the two antennae protruding above the water's surface maximizing chances of retrieval should harnesses detach at sea. Adding steel plates of different thicknesses as a means of trimming the ballast was trialed, resulting in the need of adding even more flotation. High density foam was cut to fit around the transmitter and glued to the underside of the plate using gasket sealer (Loctites Blue Maxx) for the deployments at Bare Sand Island. The foam was highly compressed on return and time-depth recorder data show that the transmitters had been down to a maximum depth of 40 m (Sperling, unpublished data) resulting in higher pressure than the

foam could withstand. At Curtis Island neoprene wet suit material was added for buoyancy instead, but should detachment at sea have occurred would have yielded insufficient buoyancy to allow surfacing of the antennae. Neoprene material seemed to withstand the depth and showed no sign of abrasion could be seen on the carapace where the plate had been after detachment. More work needs to be done to make any unit float with the antennae clear of the surface.

Attachment was undertaken by placing the magnesium ring and six straps on top of an overturned 60 cm long 40 cm wide 39 cm high square plastic bin (Nally Limited, Australia). The turtle was then placed on top of the bin, with the ring in the middle of its plastron. While the turtle was held in position the six straps were attached over the carapace and through the slits in the plate. Each strap was tightened by pulling and secured on itself with Velcro (<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?photo=470>), pre-sewn onto the straps beforehand with Poly A/bond thread (V138, Barbour Campbell Drybond). Zinc-covered staples were used to further secure the straps. These did not affect the integrity of the straps, and they were easy to pull out with a pair of pliers when removing the harness.

The strap system on the harness seemed to work well, as all three attachments that came back using the stainless steel ring and no self-tapping screws, were very firm and secure when returning. One turtle did lose its harness only a few days after deployment, and the reason for this is not known. Some abrasion of the skin occurred at the back of the turtles close to the hind flippers, but there was no sign of bleeding or broken skin.

In conclusion, although the basic 6-strap design seems to be well suited to the size and shape of the flatback turtle, more experimentation is needed in order to make the flatback harness more advantageous. However, the actual method of attachment worked well, and could easily be performed in 30-40 minutes by two people. It did not require the overturning of sea turtles, and being carried out at the end of the laying sequence, caused minimum disturbance to the natural nesting behaviour. Likewise, detachment of the harness was carried out after laying of a subsequent clutch. This required only the removal of a few staples before it could be loosened, allowing the turtle to simply walk out of the harness. It did not require moving the turtle and was accomplished in less than 2 min.

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## Nesting of the Hawksbill Turtle at Shidvar Island, Hormozgan Province, Iran

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Shidvar Island of the Islamic Republic of Iran, with an area of 80ha (26°48'N, 53°25'E) is located in Hormozgan province, in the Persian Gulf. It has a coast line of 5.5km of which 2km are sandy beaches suitable for marine turtle nesting. This island has been reported as one of the most important nesting sites for hawksbill turtles (*Eretmochelys imbricata*) in Iran. For this reason, as well as its importance as a nesting site of bird species (lesser crested tern *Sterna bergii*, crested tern *Sterna bergii*, bridled tern *Sterna bergii*) it has received nomination as a protected area, including RAMSAR status.

Although this island has profound importance, regular studies have not been undertaken. To gain an insight to the biology of hawksbill turtles nesting at the site the island was visited for 1 week from 6-11 May 2003. This was thought to be good timing for a short trip as nesting in the region is thought to be largely between March and June. During our stay, 30 female hawksbill turtles emerged for nesting but only seven of them successfully laid a clutch of eggs. No other nesting

marine turtle species were identified. Morphometric data on nesting females and eggs were gathered and thirteen of these individuals were tagged using metal flipper tags. Of 23 females measured, mean ( $\pm$ SD, range) curved carapace length was 71.0 cm ( $\pm$ 3.1, 64-75cm), mean curved carapace width was 65.6cm ( $\pm$ 2.5, 60-71cm) and mean body weight was 37.7kg ( $\pm$ 4.1, 30-45kg). The seven clutches examined had an average of 98.4 eggs per clutch ( $\pm$ 15.8, 79-118 eggs) with mean of mean egg weights 27.8g ( $\pm$ 2.0, 25.7-31.6g) and a mean of mean egg diameter of 37.0mm ( $\pm$ 1.0, 36.2-38.9mm).

These limited data confirm that Shidvar Island is of tremendous biodiversity importance. This is enhanced by the fact that it is not subject to human habitation and is free from other mammalian predators. The likelihood that successful conservation of this island can play a positive role in safeguarding regional hawksbill populations is high. It is hoped that more extensive studies will be possible in the future to allow a more detailed population assessment and insights into the biology of the hawksbill turtle in this region.