Comparison of Monel 49 and Inconel 681 flipper tag loss in green turtles, *Chelonia mydas*, nesting at Tortuguero, Costa Rica

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INTRODUCTION

Low tag loss is desirable for long-term studies of sea turtles because it will allow researchers to follow individual turtles for longer time periods (Balazs 1999). Green turtles have been tagged with flipper tags at Tortuguero, Costa Rica, since 1955 (Carr et al. 1978). The monitoring protocol for Tortuguero (CCC 1998) establishes that nesting sea turtles are tagged in order to: a) identify individual sea turtles for research purposes; b) monitor hunting pressures in feeding, migratory, and internesting habitats via tag returns; c) identify developmental habitats and migratory corridors for populations of sea turtles that nest at Tortuguero via tag returns; d) determine the longevity of sea turtles; e) determine how long female turtles are reproductively active; f) determine the retention time of tags.

The objective of the paper is to compare tag loss for Monel #49 and Inconel #681 flipper tags, both manufactured by National Band and Tag Company, KY, USA and used to tag green turtles at Tortuguero, Costa Rica.

METHODS

Since 1998, at least 1,000 new green turtles are tagged each year at Tortuguero (CCC 1998). This represents a sample of the green turtles that come ashore to nest. Tags are applied to each front flipper, axillary, inside the first scute on the trailing edge of the flipper.

Probability of tag loss was calculated for double tagged green turtles that were subsequently encountered with one or two tags (Wetherall 1982). Within-season tag loss was calculated from the first to last sighting and between season tag loss was calculated from the date of tagging to the first sighting two, three, four or five years later. The probability of tag loss is defined as:

$$1\text{-}K_i = 1\text{-}((2r_{di})/(r_{si}+2r_{di})), \text{ where}$$

K_i is the probability of retaining a tag during the interval i
r_{di} is the number of individuals encountered carrying two tags at interval i
r_{si} is the number of individuals encountered carrying one tag at interval i
Confidence limits (95%) were calculated according to the methodology presented by Bjorndal et al. (1996).

RESULTS

The probability of within-season tag loss varied between 0.019 and 0.169 (Table 1). Between season tag loss was consistently lower for Inconel #681 tags used during the 1998-1999 nesting seasons than for Monel #49 tags used in 1996-1997 (Fig. 1).

DISCUSSION

Explanations for the lower tag loss for Inconel #681 tags include less corrosion than for Monel tags, easier to check locking mechanism for Inconel #681 tags and thorough selection and training of Research Assistants during the 1998-2001 nesting seasons. Limpus (1992) concluded that tag loss was greater for the more distal tagging positions on the front flippers. The placement of tags (axillary, next to the first scale) may have contributed to the relatively low tag loss seen at Tortuguero. Passive integrated transponder (PIT) tags are being increasingly used in sea turtle tagging projects because of their perceived low tag loss. Godley et al. (1999) reported that 93% of PIT tags were detected within-season in renesting green turtles, which would suggest a 7% within-season tag loss. This is higher than the within-season tag loss observed for Inconel #681 at Tortuguero (Table 1). Metal flipper tags also have the added advantage of being externally visible so that non-experts can identify tags and provide tag return information. Parmenter (1993) reported 8% tag loss over two years for PIT tags used on the flatback turtle (*Natator depressus*). The tag loss is lower than the loss observed in Inconel #681 tags in this study. However, the sample size (n=37) was small and there may also be species differences that make comparisons between Parmenter's and this study inappropriate. Bjorndal et al. (1996) did not find a difference in tag loss for Monel #49 and Inconel #681 tags used in Tortuguero in 1989. It may be that the explanations mentioned above, especially the selection and training of Research Assistants may have confounded their or our study. Based on the difference in corrosion rates observed in removed Monel and Inconel tags (pers. obs.), we think that the advantage of the more resistant Inconel #681 tags will become more apparent as the study period increases to four or more years.

The most important consideration when choosing tag type should be to ensure that the tags employed will fulfill the research objectives of the study. Currently, we consider Inconel #681 tags to be adequate for the Tortuguero Green Turtle Program (CCC 1998).

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LITERATURE CITED

Balazs, G.H. 1999. Factors to consider in the tagging of sea turtles. In: K.L. Eckert. K.A. Bjorndal, F.A. Abreu-Grobois, M. Donnelly, eds. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. p. 101-109,

Bjorndal, K.A., A.B. Bolten, C.J. Lagueux, and A. Chaves. 1996. Probability of tag loss in green turtles nesting at Tortuguero, Costa Rica. J. Herp. 30:567-571.

Carr, A., M.H. Carr, and A.B. Meylan. 1978. The ecology and migrations of sea turtles, 7. The west Caribbean green turtle colony. Bull. Amer. Mus. Nat. Hist. 162:1-46.

CCC. 1998. Monitoring protocol for the green turtle program at Tortuguero. Unpublished protocol for the Caribbean Conservation Corporation. 13 p.

Godley, B.J., A.C. Broderick, and S. Moraghan. 1999. Short-term effectiveness of Passive Integrated Transponder (PIT) tags used in the study of Mediterranean marine turtles. Chel. Cons. Biol. 3:477-479.

Limpus, C.J. 1992. Estimation of tag loss in marine turtle research. Wildl. Res. 19:457-469.

Parmenter, C. 1993. A preliminary evaluation of the performance of passive integrated transponders and metal tags in a population study of the flatback sea turtle, *Natator depressus*. Wildl. Res. 20: 375-381.

Wetherall, J.A. 1982. Analysis of double-tagging experiments. Fish. Bull. 80:687-701.

Table 1. Probability of within-season tag loss from first-to-last encounter.

Nesting season	Tag type	Turtles with two tags	Turtles with one tag	Prob. of tag loss	Confidence limits (95%)
1996	Monel #49	332	135	0.169	± 0.029
1997	Monel #49	421	52	0.058	± 0.016
1998	Inconel #681	281	11	0.019	± 0.012
1999	Inconel #681	278	34	0.058	± 0.020
2000	Inconel #681	371	24	0.031	± 0.013
2001	Inconel #681	339	23	0.033	± 0.014

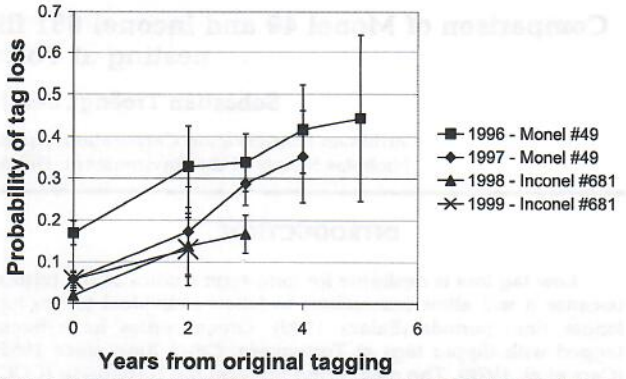

Fig. 1. Annual probability of tag loss for Monel and Inconel tags.

Sea turtle research and conservation: filling knowledge gaps, capacity building, and networking on the central Caribbean coast of Columbia. Phase II, 2001

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Some of the oldest and more important nesting areas for loggerheads (*Caretta caretta*) in Colombia are found within the Departments of Magdalena and la Guajira on the central Caribbean coast of the country. The nesting rookery that occurs in the beaches of Buritaca, Don Diego and Palomino has been assessed during 1999, 2000, and 2001. Biological data including reproductive behaviour, threats and hatchling success for nesting females has been collected during these three consecutive annual seasons. Collaborative networking involving government agencies, NGOs and local communities has improved research, protection and conservation activities along the coastal line that encompasses these beaches. Public awareness, a mass media campaign and follow up workshops have been carried out with all stakeholders of sea turtle conservation in the region. Results from the last three years demonstrate a decline in the number of females, although beach protection and nests relocation has been implemented and strengthened in this area. Comparative data from the beaches of Buritaca, Don Diego and Palomino surveyed during the 1999, 2000, 2001 nesting seasons will be presented in a poster at the symposium.

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Community-based marine turtle conservation at Punta Banco, Costa Rica

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The beaches along the Pacific coast of Costa Rica provide nesting habitat for various species of marine turtle. While harvesting marine turtles and eggs is illegal in most of Costa Rica, turtle eggs are part of the livelihoods of many coastal communities, where they are used in household consumption and/or for commercial selling. This paper draws on interviews, household surveys, and participant observation undertaken from July and August, 2001, during the olive ridley and green turtle nesting season in Punta Banco, Costa Rica. The research addresses the extent of community participation in and support for a marine turtle conservation project, promoted since 1996 by a local environmental NGO and the Sea Turtle Restoration Project. Community participation is critical for the success and continuation of marine turtle conservation projects, and results of this research may be applicable beyond the immediate case study.

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