

Title: Photo-identification of marine turtles: an alternative method to mark-recapture studies.

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Abstract: Identification and tracking of individual marine turtles is mostly achieved through invasive methods using artificial tags (metallic or PIT tags). These methods require capture and handling of the animals and may induce stress or even cause damage. They are also difficult to apply to large individuals that forage outside the reef barrier. Photo-identification, relying on natural marks on the body, can be used in complement with these methods (e.g. if a tag is lost), or it may even eventually replace them. We investigated the suitability of this method for green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) at Reunion Island, Mayotte, and Glorieuses (South West Indian Ocean). For individual identification we developed a code which is based on the position and shape of scutes in the facial profile of turtles. We also developed a database to manage photographs and sighting reports, furthermore permitting quick individual identification using code recognition. Analysis of pictures showing the facial profile of marine turtles at the three study sites proved adequate for individual identification and site fidelity studies. The method was validated using green turtles that were both flipper-tagged and photo-identified. Population monitoring using Photo ID requires the participation of scuba divers providing pictures and sighting information from different locations at different times. Such active participation may also help to raise public awareness about the conservation status of these endangered species.

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INTRODUCTION

Successful conservation of a species depends on the ability to identify individuals within a population and to collect reliable information on distribution, habitat use, or life history traits. Most studies on marine turtle tracking rely on the usual "capture-mark-recapture" method based on tagging (metallic or PIT tags), which is costly, induces stress, and uses tags that do not last for a lifetime. Photo-identification, using natural marks on the body, has proven to be effective over the entire lifespan and is an alternative method with many advantages: animals are not captured physically and stressed, physical characteristics are stable over time, and are independent of sex or age. This technique is of interest for foraging grounds or for sites like Reunion Island, where marine turtles cannot be caught easily and tagged because of low nesting activity.



METHOD

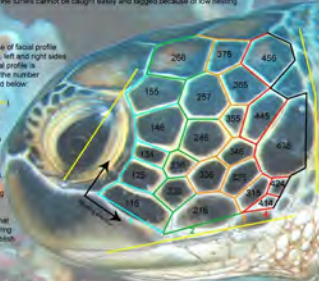
This photo-identification method is based on the use of facial profile photographs of marine turtles. As often as possible, left and right sides are used to characterize each individual. Each facial profile is transformed into a code based on the location and the number of sides of each scale, following the steps described below:

1. Identification of the facial profile boundaries ()
2. Identification of scale rows (| | |)
3. Count of the number of post-ocular scales (□)
4. Determination of the code for each scale of the profile (numbers) = row number - place of the scale in the row - number of sides

Final Photo-ID code for the left profile:

5-115-125-134-146-155-216-225-236-246-257-266-315

A database has been developed to manage sighting information and convert images into fingerprints. Our database allows quick individual identification using code recognition with a percentage of error that reduces the number of photos to compare. Comparing new data with those of the database allows to establish whether a marine turtle has been seen previously.



RESULTS

This recognition method was initially defined from green turtle (*Chelonia mydas*) profiles. It was validated with green turtles encountered in Mayotte and Glorieuses, and with hawksbill turtles (*Eretmochelys imbricata*) encountered in the Seychelles (cooperation with MOSS) that were both flipper-tagged and photo-identified.

The method was applied for Reunion Island, where marine turtles cannot be caught easily. Since 2005, nearly 150 photographs have been collected from local scuba divers. Based on this, we identified 60 green turtles and 20 hawksbill turtles. Of these, 14 green turtles and 2 hawksbill turtles were resighted at least twice in the same location, many months apart. The longest interval between the first and last observation was 4 years for a juvenile green turtle, encountered twice at the same diving spot. Most of the turtles observed were juveniles or sub-adults. Our results indicate a strong fidelity of turtles to their foraging habitats.



CONCLUSION

This technique was validated for both green and hawksbill turtles. It appears to be more suited for underwater pictures rather than for pictures taken on the beach as sand may hide parts of the head. The use of this method in Reunion Island, where marine turtles cannot be conventionally tagged, should considerably increase our knowledge regarding how long turtles of the resident population remain on their foraging habitat and how fidel they are to particular sites.

Photo-identification can become extremely tedious when matching is processed manually in large catalogues of images, therefore inducing loss of accuracy. The technique presented here is based on a non-subjective process, albeit requiring personal training to assign accurate profile codes to each photograph. It allows to narrow down the search for any particular individual to a maximum of 10 images selected from the database according to the input profile code. One advantage for green turtles is that a wide range of photographs can be used as long as post-ocular and bottom-central scales are visible, even if photographs are blurred. However, the entire profile and a relatively good quality image are required for the identification of hawksbill turtles. Thus, the participation of scuba divers is a great opportunity to collect images at any time and location, allowing continuous and long-term studies. It is also a good way to increase public awareness for the conservation status of this endangered species.

