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First report of *Chelonia mydas* affected by cutaneous fibropapillomatis on the West coast of Madagascar

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Located at 15 to 65 km off the shore of Maintirano, the Barren Archipelago consists of 10 small islands. All these islands are less than one km² in size and six of them are covered with vegetation similar to the one found on the mainland. Because of their isolation, these islands are relatively preserved and little is known about their flora and fauna. These islands also provide important reproductive and foraging habitats for marine turtles. Two of the five marine turtle species that frequent the waters around the archipelago nest on the wild beaches of these islands.

Formerly exploited by fisheries and the extraction of guano, these islands are now frequented only by Vezo fishermen, who set up their camps for periods lasting from a few days to several months. The semi-nomadic Vezo community originates from the southwest coast of Madagascar and currently populate most of the littoral zone along Madagascar's west coast between Toliara and Mahajunga.

In October 2005, the Muséum d'histoire naturelle de la ville de Genève, with financial support from the Réseau Universitaire International de Genève

(RUIG) and the World Wide Fund for Nature (WWF) and with technical support from the Institute of Halieutic and Marine Sciences (IHSM),

initiated a program called “Melaky miaro ny tontolo andriakany” meaning “The Melaky protects his marine environment”.

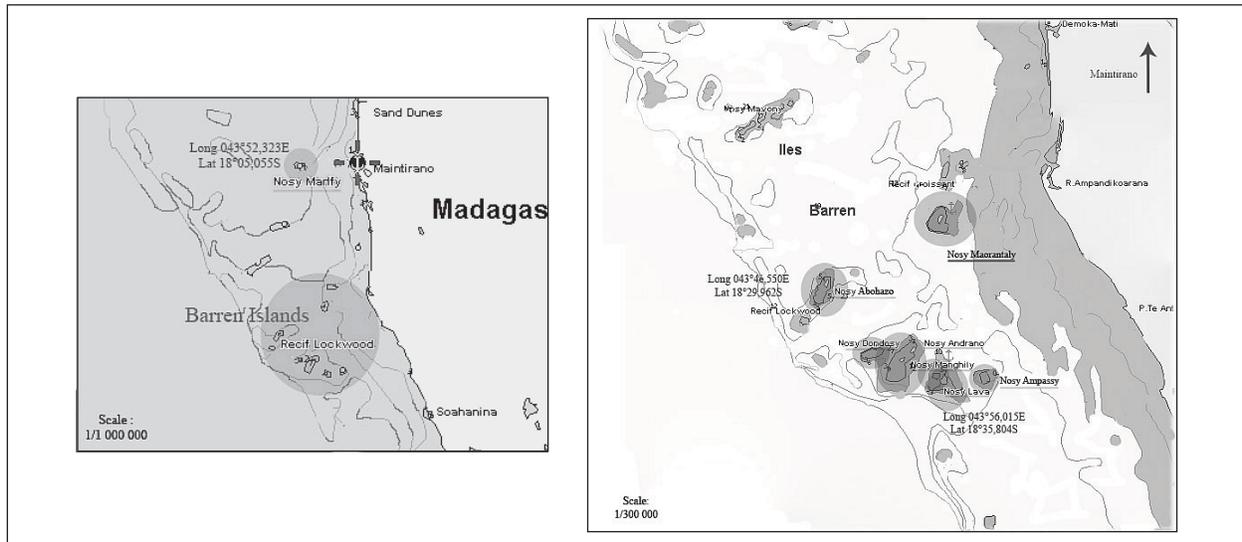


Figure 1: Barren Archipelago (west coast of Madagascar). (Source: S. Hawini, 2009)

The initial objective was to reduce the local consumption of sea turtles and their eggs. Three main axes were developed to conserve local biodiversity: monitoring, raising awareness, and the identification and implementation of development and conservation strategies adapted to the local context.

Turtle monitoring is carried out by a team of four local fishermen, which uses a capture protocol inspired by a Vezo technique. Between 30 March 2006 and July 23 2009, 1288 specimens were captured mostly on their foraging grounds but also during nesting activity. Forty-one fieldtrips were carried out with motorised pirogues that lasted on average about 60 hours (10 days), strongly depending on meteorological conditions. Turtles were tagged with Monel Tag from National Band and Tag Co. (MAL2001 to MAL3603 with the address of WWF BP 738 Antananarivo 101, Madagascar), curved carapace length and width were measured according to standard protocols (IUCN/SSC Marine Turtle Specialist Group), while species, sex, and potential pathologies or marks were also recorded.

Five species were observed during the study (*Chelonia mydas*, *Eretmochelys imbricata*, *Caretta*

caretta, *Lepidochelys olivacea* and *Dermochelys coriacea*). Capture numbers quite closely followed the relative abundance of the five species around the archipelago (*Chelonia mydas* 95.2%, *Eretmochelys imbricata* 4.5%, *Caretta caretta* 0.2%, *Lepidochelys olivacea* 0% and *Dermochelys coriacea* 0.1%). Only green and hawksbill turtles nest in the Barren archipelago (Rakotonirina, 2008), while loggerhead (*Caretta caretta*), and olive-ridley turtles (*Lepidochelys olivacea*) can be observed near the coast (the latter are sometimes caught in the shrimp fishery). Leatherback turtles (*Dermochelys coriacea*) are only found in deep water off the continental shelf.

The study recorded a high prevalence of tumors on captured turtles (Figure 2), suspected as fibropapillomas (FP). This concerned 16% percent of the 1225 green turtles captured¹.

Tumors were observed only in immature green turtles with a curved carapace length between 40 and 80 cm, with a maximal prevalence in individuals between 50 and 59 cm (Table 1).

¹ During the capture, special care was taken to separate healthy individuals from those which had tumors.

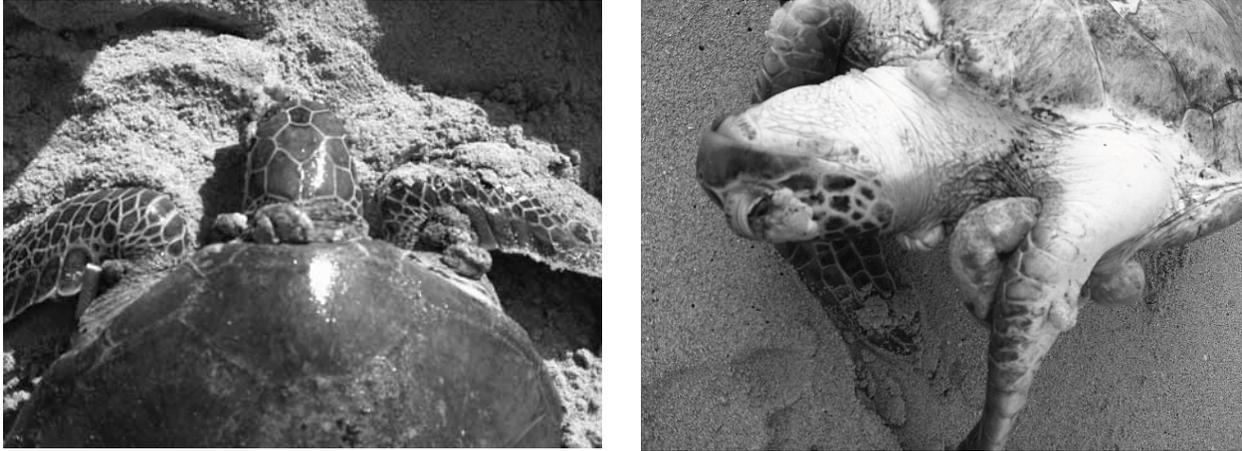


Figure 2: Tumors on immature green turtles (*Chelonia mydas*) of the Barren Archipelago (west coast of Madagascar).

Photos: G. Leroux, 2006

Curved Carapace Length (cm)	30-39	40-49	50-59	60-69	70-79	80-89	90-100	> 100
n (individuals captured)	2	315	349	276	172	42	20	44
Percentage of captured individuals with tumors	0%	15.2%	22.4%	13.8%	16.9%	4.8%	0 %	0 %

Table 1: Tumor prevalence in *Chelonia mydas* of the Barren Archipelago (west coast of Madagascar) according to size class.

These observations are similar to those reported for Australia (Limpus & Miller, 1994), Hawaii (Marakawa *et al.*, 2000) and the east coast of the United States (Foley *et al.*, 2005). Before frequenting coastal areas and remaining within benthic habitats, small immature turtles spend the first stages of their life in pelagic habitats, where FP seem to be absent. Concerning the absence of FP in mature turtles, it would seem that only the healthy individuals survive or those, which managed to overcome this disease (Foley *et al.*, 2005).

In the majority of the turtles recaptured, the progression of the tumors could be observed. However, in nine individuals we observed a regression of the tumors, as indicated in Table 2.

The distribution of the disease within the

archipelago is very uneven (Table 3). Turtles captured around the islands near the coast (Nosy Maroantaly and Nosy Marify) had a much higher prevalence of the disease (nearly 25%) than those captured around islands close to the external slope of the continental shelf (Nosy Ampassy, Nosy Lava, Nosy Andrano, Nosy Manghily, Nosy Dondosy and Nosy Abohazo; 0 to 1.5%). However the distance between these groups of islands is less than 20 km.

The water surrounding the islands close to the mainland (Nosy Marify and Nosy Maroantaly) is generally rather turbid. Its visibility - especially during the rainy season - is sometimes less than 2m, because of the significant volume of sediment transported by the rivers. It is possible that there is a link between the presence and quality of this sediment and the observed appearance of tumors in sea turtles.

Tag #	Date of 1 st capture	tumor	Date of recapture	tumor	Time interval (in days)
2153	25/08/2006	1	17/10/2008	0	778
2161	26/08/2006	1	12/10/2007	0	414
2222	10/11/2006	1	16/11/2007	0	352
2283	14/11/2006	1	08/04/2008	0	512
2682	06/08/2007	2	01/03/2008	0	207
2806	10/10/2007	1	19/03/2008	0	162
3091	16/03/2008	2	10/04/2008	0	176
2107	22/08/2006	3	21/07/2007	1	203
2734	19/08/2007	3	12/11/2007	1	216

Table 2: Observed cases of tumor regression in *Chelonia mydas* immatures of the Barren Archipelago.

0: no apparent tumor; 1: tumors of less than 1cm in size, generally found around the eyes; 2: many tumors present ranging between 1 and 4cm in size; 3: tumors greater than 5cm in size, present on all soft parts of the body; in the latter case turtles were typically slim and their carapace was covered with algae.

Island name	Abohazo	Ampassy	Dondosy	Lava	Marify	Maroantaly	Andrano	Total
Turtles captured	39	208	65	60	69	738	46	1225
Turtles with tumors	0	2	1	0	17	175	0	195
Percentage	0	0.9	1.5	0	24.6	23.7	0	15.9

Table 3: Geographic distribution of immature *Chelonia mydas* with tumors in the Barren Archipelago.

Various explanations have been put forward for the cause and origin of this disease: infectious agents (Aguirre *et al.*, 1994a), response to a parasitic trematode (Dailey & Morris, 1994; Aguirre & Balazs; 2000), pollution affecting the immune system (Aguirre *et al.*, 1994b; Aguirre & Balazs, 2000), presence of dinoflagellates on the sea-grass bed (Landsberg *et al.*, 1999; Landsberg, 2002), and the presence of *Ozobranchus* parasites in marine turtles could act as a disease vector (Greenblatt *et al.*, 2004).

Compared with Hawaiian studies that found greater prevalence in heavily urbanised areas (Aguirre, 1994), pollution could be excluded as a cause for the observed disease in the Barren Archipelago because the region of Melaky does not have any industry.

According to local fishermen, this pathological condition has existed since the 1970s, but the number of turtles affected has increased greatly. The recent

over exploitation of sharks in the region for the trade with shark fins could be a cause for the observed increase of affected turtles. The larger shark species are important predators of immature turtles. By eliminating individuals that are most affected by the disease, they might play a significant role in controlling the development of the disease. Close to the slope of the continental shelf, these sharks are more abundant and, hence, predation is more frequent. This might explain why the disease is located around the islands near the coast. The spatial attachment of immatures with their foraging habitat (Taquet *et al.*, 2006) might also limit the spread of the disease.

The limited geographical distribution of the disease in the Barren Archipelago, and observed cases of disease regression, mean it is important to develop specific research programs in the Barren Archipelago. In particular, to help better understand the origin of the disease and its evolution, and also to understand tumor regression.

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