The use of stable isotopes and trace elements as ecological tracers in Atlantic leatherback turtle

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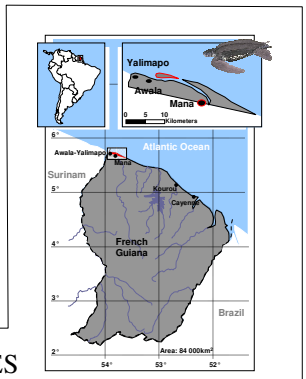
Introduction

Dietary studies in marine vertebrates are widely performed with stable isotope analysis that offers insight in long term feeding preferences and location. Indeed, $\delta^{15}N$ and $\delta^{13}C$ values are known to vary with ocean basins, latitude or oceanic vs neritic habitats. Trace elements have also been shown to informs on spatial variation.

Coupling stable isotope and trace element analysis as ecological tracers may offer several benefit to add information on dietary and feeding grounds. This approach is moreover very important when dealing with species difficult to study in lab as in field, when dispersing over large scale in their life history cycle. This is the case of the leatherback turtle, *Dermochelys coriacea*, which migrates over several thousand kilometres between nesting sites and foraging grounds.



Site & Species

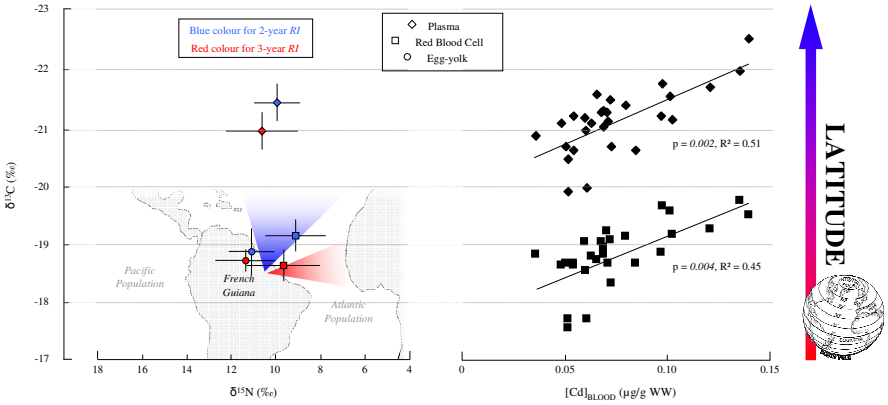
French Guiana is one of the major nesting site in Atlantic Ocean for leatherback. Females come to nest in average 7 times from March to July and then leave nesting beach to reach foraging grounds to feed upon gelatinous zooplankton. As feeding ecology in leatherback remains poorly known, there is a clear need to improve knowledge on location of feeding grounds used by females during the interval between two successive nesting seasons, called remigration interval (*RI*).

We examined therefore the spatial variation in composition of stable isotope ($\delta^{15}N$ and $\delta^{13}C$) and trace element in blood and eggs of leatherback in French Giuana

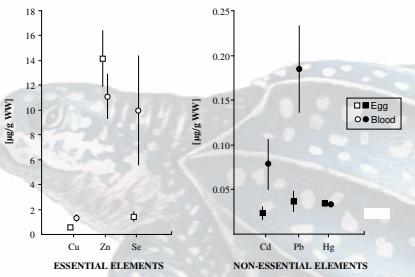
Results

Low $\delta^{15}N$ values reflect a diet oriented towards low trophic level prey (mainly jellyfish). $\delta^{15}N$ signatures were similar between turtles with (*RI* of 2 and 3 years, resulting in the location of the foraging situated in the same ocean basin.

In blood, Red Blood Cells (RBC) have a longer turn over rate than plasma; therefore, $\delta^{13}C_{RBC}$ offers insignt on a longer term (several months) than does $\delta^{13}C_{plasma}$. $\delta^{13}C_{RBC}$ values differed significantly between turtles displaying a 2-years *RI* and those with a 3-year *RI*, likely resulting in spatial variation several months before sampling, i.e differences in feeding grounds used. This dichotomy has already been mentioned with telemetric studies showing that females left nesting beaches following two main ways (represented in in blue and red triangles on the figure).



Trace element analysis confirmed the isotopic results with a low metal accumulation (<20ppm and <0.1ppm for essential and non essential elements respectively in the whole blood) reflecting the low trophic level. Among trace elements, only Cadmium (Cd) concentration in blood were negatively correlated with $\delta^{13}C$ measurements in RBC and Plasma. This indicates a northward Cd-enrichment. However, the different between Cd concentrations according to *RI* of females was not significant (P=0.052).



Discussion

Telemetric data have already highlighted the use of different foraging grounds but those results concerned the first year after the nesting season. Our data are complementary and inform on spatial variation several months before the nesting season. Moreover, $\delta^{13}C$ values are known to be higher in species from coastal compared to pelagic food webs. This coastal-versus-pelagic effect may be combined with the tendency of $\delta^{13}C$ values to decrease from low to high latitudes due to oceanographic processes. Our observation of lower $\delta^{13}C_{RBC}$ values in the 2-years remigrant females suggests therefore that the carbon source of these turtles is situated in a more northern and/or oceanic area than that of the 3-years remigrant turtles. The increased Cd levels found in turtles having a low $\delta^{13}C$ signature is likely to be related to their foraging grounds too. Our result confirm a link between *RI* and feeding habitats (pelagic or neritic, high or low latitude).

Conclusion

Coupling isotopic and trace element analysis have first highlighted low $\delta^{15}N$ values and low trace element concentrations reflecting the low trophic level of leatherback and a weak exposure to pollutants.

Then, using isotopic ratios and Cd data to make inferences about the feeding ecology of leatherback females have been useful in determiningdifferences in feeding grounds.

The identification of leatherback turtle foraging grounds in the North Atlantic Ocean would be relevant in terms of conservation and management of these populations and would need further field studies.