Whale of a Turtle

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On the night of June 18th, 2009 a dinosaur was sighted in Kill Devil Hills. The moon was in the third quarter and the tide was flooding as the largest species of reptile on earth hauled itself out of the Atlantic Ocean and began its arduous journey across the beach. Instincts nearly as old as life itself pulled it further and further into the alien world of terra firma. This was the farthest north a leatherback sea turtle had ever been recorded to nest.

The beaches of the Outer Banks are no stranger to nesting sea turtles. In the spring and early summer, their tell tale tracks can be a regular sighting in places like Pea Island National Wildlife Refuge and the rest of Hatteras Island. To the untrained eye, these "turtle crawls' would look as if some eight year old kid had tried to drag himself up the beach while laying on his boogie board. But each crawl, identifiable by both size and pattern of strokes as the turtle laboriously drags itself across the sand with flippers, can be used to determine the previous night's visitors. It was this crawl that first tipped off Christian Guerreri of the North Carolina Aquarium, and Karen Clark of the Wildlife Resource Commission, that they were dealing with something special.

The loggerhead sea turtle (Caretta caretta), the most common turtle to nest on the beaches of North Carolina, leaves something of a zigzag pattern in the sand. As this creature swims with a sort of freestyle action of Olympic swimmers, pulling itself along one flipper at a time, the characteristic track is easily identifiable. The green turtle (Chelonia mydas) on the other hand does something more like a breast stroke and so its crawl has parallel flipper marks with the drag from the plastron interspersed with a rhythmic drag of the tail. For the leatherback (Dermochelys coriacea) however, well, lets just say this looks like someone rolled a giant monster truck tire up the beach.

To say that the leatherback is big, just doesn't quit do it justice. Imagine a turtle that can grow to lengths of seven feet long, have a flipper span of nine feet, and way up to two thousand pounds. This places the leatherback in the category of being the largest wild reptile on earth. Yet the uniqueness of these turtles does not simply end at the length of their leathery shells. Pretty much everything about these creatures puts them into a class (or should I say a genus) all to themselves.

For starters, the leatherback doesn't have a shell like other turtles, hence its name. Instead of a rock hard carapace, its "shell" if you will, is actually a leathery tissue that overlays the underlying dermal bones. Considering that leatherback sea turtles have been known to dive to depths greater than 3900 feet, deeper even than most whales, the somewhat soft and pliable shell may be an adaption so as not to implode from the 1,800 pounds per square inch of pres-

sure at such depths of the abyss.

In order for the leatherback to plummet so far into the darkness of the ocean deep, it has developed an ingenious way of handling oxygen in its body. Common sense would say that the more oxygen needed, the bigger the lungs, right? But with the leatherback, its lungs actually collapse at a mere three hundred feet. Instead, the leatherback holds more oxygen in its blood and tissue than in its lungs. To do this, these turtles have the highest red-blood cell density of any reptile. In other words, at three hundred feet, their lungs collapse, which helps free them from buoyancy, and their body stores all the oxygen in their blood to be used up while diving. To increase the efficiency of this, the leatherback can slow its heart rate down to around one beat a minute.

Now to really stretch the limits of believability and the imagination, leatherbacks have been documented swimming around ice burgs in Alaska, Norway, and well above the Arctic Circle. As marine biologist Carl Safina discovered, there has even been soapstone carvings of leatherbacks found on the Baffin Island! Its not that reptiles don't live in places like this, its that they simply can't – except for the leatherback.

The thermoregulation capabilities of the leatherback (their ability to regulate their own body temperature) completely turns everything we thought we knew about reptiles on its head. Reptiles are ectotherms, meaning they regulate their body temps from the surrounding environment. Yet here we have an endothermic sea turtle, regulating its own body temperature from within like a mammal. In fact, the leatherback can maintain an internal body temperature between 77 and 84 degrees Fahrenheit even in water as cold as 41 degrees. This immediately raises two questions: how and why?

The ability of leatherbacks to thermoregulate is multifaceted. First off, these turtles are huge. As noted above, they are the largest wild reptiles on earth. Well, the bigger the body, the more insulated the internal organs due to the ratio of volume to surface area, and the slower the metabolism. This aspect of their physiology is called gigantothermy and allows them the widest distribution of any animal on earth, rivaled only by the great whales.

Second, leatherbacks not only conserve heat, they also generate it as well. To accomplish such a feat, these turtles have both an outer insulating layer of blubber like marine mammals, as well as a layer of brown fat networked with blood vessels. This brown fat is unique in that it actually produces heat. Reptiles aren't supposed to have stuff like this though.

Third, the circulatory system of leatherbacks is highly specialized for dealing with temperatures that would stun and kill any other reptile. Like mammals, these sea turtles have the ability to shunt warm blood away from the outer extremities and conserve it where it counts the most, around the organs. Leatherback sea turtles also have a unique sort of countercurrent heat exchanger in both of their front flippers in order to keep heat in the body, and the cold, out on the flippers which are the thinnest part of their body and therefore the easiest

way for them to loose heat.

Even the chemical reactions that occur in the leatherbacks muscles are designed for the cold. When your fingers get cold and you your hands get stiff and clumsy, this is because the chemical reactions in your muscles are not as efficient at lower temperatures. The rate of metabolic reaction in the leatherbacks muscle cells remains constant however, even in temperature swings of 40-100 degrees Fahrenheit. This means that these sea turtles could literally swim right out of a tropical waters, into the arctic, and their swimming muscles would continue to work the same.

All of this brings us back to the question of why. Why would a leatherback develop these cold water characteristics? Most likely this has everything to do with migration, which, as is the case for all animals, has everything to do with either food or sex. These modern day, highly specialized dinosaurs, have evolved in such a way so as to exploit both prime feeding grounds in the colder waters of the north, as well as the prime breeding grounds for sea turtles in the tropics. An ecological niche tapped by few.

Really it's the best of both worlds for these leatherbacks. The frigid water off the coast of Nova Scotia and the Grand Banks is far more biologically productive than the relatively nutrient poor warm waters of the tropics. Having the size and the ability to make a trans-oceanic migration like this puts them into the same sort of category, again, with whales such as the humpbacks who spend the summer gorging themselves in the cold water buffets of the northern Atlantic, only to migrate south to the sub-tropics to breed in the winter. Its this notion of breeding that ultimately brings us back to Kitty Hawk.

In 1966 there was an unconfirmed report of leatherback hatchlings on the beach of South Core Banks in Cape Lookout National Seashore. The report may not have been taken seriously considering that the furthest north a leatherback had ever been recorded nesting prior to this was Florida. However, in 1998 when two leatherback nests laid on Cape Hatteras National Seashore were discovered, the text books had to be rewritten. Many of course thought this was a fluke, an accident of course certainly nothing to come to expect. Yet, in 2000 it happened again, then again 2002. Year after year the number of nests continued to increase. While loggerhead sea turtle nests have suffered an annual 1.3% decline in nests since 1983 (nearly a 40% drop), the leatherback's nesting success continues to grow.

It is estimated that the world's oceans have 15 to 20 times the amount of heat going into them than the atmosphere. Oceans are giant thermal masses in this since and many argue that they are a much more reliable indicator of such things as climate change than air temperatures. It is therefore interesting to note that the same year that the first two confirmed leatherback nests found in North Carolina was also, by that time, the hottest year ever recorded. Of course this could simply be a coincidence. However, considering there was no known leatherback nests north of Florida until the early 1980s, and the northern limit to nesting has continued to expand ever since, climate change and the subsequent increase of ocean tempera-

tures has not been ruled out as a possible cause.

The leatherback sea turtle is roughly 100 million years old, making us look like mere infants as a species. They have witnessed changes on this planet that we can barely even begin to wrap our minds around. They have adapted. They have survived. Some biologists even argue that their unique ability to thermoregulate quite possibly was an adaptation to the ice ages as it freed them from the shackles of competition within those ecological niches typically afforded sea turtles. As the waters cooled, and the air temperatures plummeted, reptiles were confined to areas in the tropics for which competition was fierce for finite resources. Leatherbacks on the other hand evolutionarily joined the likes of the great whales and pushed north into unchartered waters for the reptilian world in order to exploit the bountiful resources of the sub arctic ocean. The leatherback is nothing if it is not adaptable.

Only time will tell as the why these giants of the sea have become annual visitors of the wind swept beaches of our barrier islands. Or, it is entirely possible that we may never know what has driven them north in their pursuit of nesting habitat. Either way, leatherback sea turtles have become a welcomed and anticipated part of the litany of species that choose to utilize the Outer Banks for the continuity of their species.