Project proposal to study the migration patterns of endangered nesting Green Turtles (*Chelonia mydas*) using GPS satellite transmitters on the Alphonse group, Seychelles

In collaboration with the 'Luth' Association

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July 2016

1. Introduction

Alphonse Island lies at 7° S 52°44' E, isolated from the main Amirantes Islands, is located 400km south-west of the main island of Seychelles, Mahé. The group consists of St. François atoll, the tiny island of Bijoutier, and Alphonse itself. Alphonse and St. François have large lagoons supporting high levels of invertebrates, fish and corals. The sea grass beds and the reefs are one of the most important foraging areas for immature turtles in the Western Indian Ocean (WIO).

In 2007 Island Conservation Society (ICS), in partnership with the Islands Development Company (IDC) and the Alphonse Island Lodge (AIL), established a Conservation Centre on Alphonse Island in order to improve understanding and protection of the wildlife and ecosystems of this small and remote group of islands situated in the WIO. Programmes of research, monitoring and habitat management have been initiated based on standard methodologies developed by ICS. The scientific and monitoring programme is overseen by ICS's science committee.

Nesting turtles and their habitats are monitored using a combination of track counts and flipper tagging throughout the year to determine population size and trends, define seasonality of nesting, and better understand other parameters of the biology of the animal (long-term monitoring programme).

2. Justification for the study

In Seychelles, the flipper tag has been a standard research tool of sea turtle biologists, its key features being a 'unique' identification code on the front of each tag and return address on the back. Much of what we know about turtle migration derives from data obtained when turtles, tagged on a nesting beach or foraging ground, are subsequently observed at distant feeding or nesting sites, and the tags are recorded and/or removed and returned to the address on the back of the tag.

ICS is currently monitoring and conserving the nesting populations and habitats of the critically endangered and endangered species of sea turtles on the IUCN Red List of Threatened Species, the Hawksbill (*Eretmochelys imbricata*) and the Green Turtle (*Chelonia mydas*), respectively.

Research into the behaviour and life cycle of marine turtles has discovered that these creatures do not generally nest and feed in the same area. We now know that sea turtles are highly migratory, often traveling hundreds or even thousands of miles between the beaches where they lay their eggs and the foraging (feeding) grounds where they spend much of their time at sea.

The use of GPS satellite transmitters will add a new dimension to our conservation work to achieve a better understanding of the post-nesting migrations of the Alphonse nesting Green Turtles. The GPS

satellite transmitter sends signals to orbiting satellites each time the turtle surface to breath. The data is collected and downloaded to posteriorly be analysed by researchers.

Funding from the 'Luth' Association will allow ICS to attach GPS satellite transmitters to nesting females Green Turtles on Alphonse Island to adequately protect them in all their habitats, investigate their migratory behaviour (patterns), including foraging grounds and migratory routes that turtles travel between habitats.

The information gained from this study will improve to identify movement patterns, expand the knowledge on feeding ecology and enhance the ability of conservationists in their effort to protect Green Turtles, both in Seychelles waters and through international conservation efforts.

Educational migration maps will show the best location points of the turtle's movements and locations. It will allow the members of the 'Luth' Association to watch along as we discover where the turtles travel after nesting. This provides a unique opportunity to engage students in a fun and exciting way. GPS satellite tracking can be also a powerful online educational resource for the Association to learn more about these amazing animals, about geography, Earth science and conservation all-in-one.

3. Methods

To better understand movements and migratory behaviour of the nesting Green Turtles it is proposed satellite tracking Green Turtles using GPS satellite transmitters due to over 90% of a sea turtle's life is spent in the water- feeding, mating, migrating and doing whatever else a sea turtle does when no one is watching, missing important information that will help scientist better protect them.

Satellite tracking, also known as 'satellite telemetry', involves attaching a special piece of tracking equipment, called a Platform Terminal Transmitter (PTT) to a sea turtle's carapace (shell). The PTT sends a signal full of information to an orbiting satellite each time the turtle surfaces for air. The satellite re-transmits the data to a receiving station on earth. We then receive messages via the satellite regarding the location of the turtle and plot them onto a map. Generally, after a year or more the transmitters quit working and fall safely off the turtle.

PTT is a small, low wattage transmitter controlled by a micro-processor which is programmed by a computer before it is attached on the turtle shell. The program tells the microprocessor how to store information and hen to transmit it to the satellites. Polar orbiting satellites are operated by the U.S. National Oceanic and Atmospheric Organization (NOAA). Attached to these satellites are special instruments operated by a French company, ARGOS CLS., which are designed to listen for transmitters (like those we place on sea turtles) to determine where the turtles are located.

The data received from the turtle's transmitter comes in the form of digital codes, which must be deciphered. The codes allow researchers to determine, with varying degrees of reliability, the latitude and longitude location of the turtle, the number of dives taken during the last 24 hours, the duration of the most recent dive.

Using computer mapping programs researchers can then visually see where the turtles are, the route they have travelled, and how fast they are generally swimming. Depending on the detail of the map one is using, a researcher can also determine the habitat characteristics at the turtle's location. Sometimes, data available may not be 100% accurate. This limitation really doesn't detract from the overall value of the research. While a particular location point may actually be miles off a given turtle's

actual location, the accumulation of data stills tells us where the turtles are generally moving and where their primary foraging areas are located. Using this information, we can understand their migration patterns and begin to focus conservation efforts where they are most needed.

4. Equipment

Assuming the above method as the technique to be used in this study, it is necessary to know the available resources (*budget in hand*) of the 'Luth' Association in order to contact the manufacturers to discuss our needs, objectives and proceed:

1. Setting up an ARGOS program through ARGOS.
    - Carried out through CLS: http://www.cls.fr/html/argos/welcome_en.htmal
2. Selecting and buying hardware suitable for attachment to marine turtles.
    - A list of suppliers: http://www.argosinc.com/documents/list_manufs.doc
3. Determining the power cycle or duty cycle of the transmitter.
    - Transmitters come with salt-water switches that conserve the battery life by ensuring that transmissions are made only when the turtle is at the water surface. However, we can conserve the battery power even more by programming some transmitters to turn off during certain times e.g. 24 hours on, 48 hours off.

Satellite tracking is the most sophisticated technology available to sea turtle research and the equipment reflects this. Each transmitter has to be individually programmed and set up for each project. Once you have the transmitter itself, you will be required to pay time for the satellite that your location and or dive information is sent to.

5. Budget

The main costs for this study will be the acquisition of:

- **Satellite transmitters**
  Depending on the model and functions that the PTT performs. There are a range of options that vary in price. Cost increases with battery life and with complexity of data collected and transmitted.
- **Data acquisition**
  Depending on time spent communicating with the satellites (ARGOS).
- **Data analysis software**
- **Materials to restrain and attach**
  Uncovered wooden "box" and materials to attach the transmitter (variety of ways: gluing by epoxy and/or fiberglass resin, by tether, by harness or by screws)
- **Consultant fee**
  Depending on time spent managing, analysing and amount of outputs produced.