



“C. Turtle” Data Entry App for Sea Turtle Monitoring
created for
Projet Tortues Tahiti, Libreville, Gabon
by **Sebastien J. James**

Background: Sea turtles nest on our beach below my window. Tahiti Beach in Libreville is an urban beach, polluted by untreated water runoff, trash, and chemical leaks from the adjacent airport. While Gabon is known for its nature and biodiversity, even local conservation organizations consider Tahiti Beach to be of no ecological significance.

But they are wrong. One night, directly in front of my building, I nearly tripped over a nesting sea turtle. Since then, I volunteer with **Projet Tortues Tahiti**. “Project Turtles of Tahiti” was formed last year on an all volunteer basis to systematically monitor local sea turtle activity. Our main initiative is to patrol the beach to monitor turtle nests. We find and rescue hatchlings and occasionally nesting mothers unable to make their way to the ocean due to man-made obstacles such as plastic bottles, shoes, yogurt cups, and enormous trunks washed up from Gabon’s lumber industry. I participate in beach clean-ups which benefit the whole community, and morning patrols, as my school schedule permits.

Eventually we would like to establish a visitor/public information center and a hatchery protected from poachers and erosion to which at-risk nests can be relocated. However, reliable data is needed to demonstrate and understand turtle presence and activities, raise awareness, and funds. To that end, last summer during COVID-19 confinement, I taught myself programming for iOS to make an app, *C. Turtle*, for my group’s data collection efforts. Until I created this app, photos and descriptions were posted in a voluminous WhatsApp chat, from which a volunteer laboriously downloaded, cut, pasted and copied photos and descriptions into a Google Sheets spreadsheet and Google Drive folders.

C. Turtle is tailored to the group's needs: its user interface is high contrast for use in direct sunlight. Data can be collected offline and uploaded later when the user has an Internet connection, because few in Gabon have mobile data. It can map out nests through their GPS locations. With this app I hope to contribute to the future Gabonese research and conservation efforts. Because this app is so highly tailored to this particular group's needs, I will not be offering it through the official Apple Store, but only as a beta for the group's limited number of patrollers.

A description of *C. Turtle*'s functionality follows. Note all app functionality is highly tailored to the patroller's particular needs.

I. New Observation screen: For ease of use by the beach patrollers, data entry needs to be all on one screen, and high contrast for use on the beach in bright sunlight. Thus all initial data entry is done on one scrollable screen as shown on below. All data can be saved locally on the phone and later edited or corrected, and uploaded when wifi is available.

- **Beach Zone and Lot descriptions** are selected via menus. The beach is divided into six 500 meter long zones; each zone is comprised of up to 14 individual lots.
- **Location:** The app gathers GPS location data for later mapping purposes. Generally phone GPS readings are no better than a nine meter radius.
- **Type of Observation** is also selected using menus:
 - **New Nest:** Nest, False Nest, False Crawl
 - **Existing Nest:** Disturbed, Lost or Moved due to Natural or Human Cause)
 - **Adult Turtle sighting:** Dead or Alive
 - **Species of Turtle:** Unknown, Olive Ridley, Green, Hawksbill or Leatherback
- If the observation type is a **Hatching**, further data entry options appear:
 - **Problems preventing hatchlings from reaching the sea safely:** None, Lights, Trash, Sewer, Plants, Other
 - **Number of Hatchlings:** Successfully to Sea, Rescued, Dead

The screenshot shows the 'New Observation' screen of the app. At the top, there's a status bar with signal, time (5:03 PM), and battery. Below it, a navigation bar with a back arrow and 'Home' label, and the title 'New Observation'. The main form has several sections: 'Zone A' with a dropdown menu showing 'A.2 : Lookout'; 'Location' with fields for 'lat: 0.4413372', 'lon: 9.4154491', and 'accuracy: 65.00 m'; 'New Nest?' and 'Existing Nest?' buttons; 'Adult Turtle?' and 'Olive Ridley' buttons; 'Hatching' with a dropdown menu; 'No Problems' and 'Lights' buttons; 'Trash' and 'Sewer' buttons; 'Plants' with a dropdown menu and 'Other' button; a summary row with '# Success', '35 Stranded', and '7 Dead'; a 'COMMENTS' section with a text area containing '35 babies rescued from plants to which they were drawn by artificial lights, 7 dead. Nest'; a row of six camera icons; and a 'Done/Save' button at the bottom.

- There is a **Comments** field to enter further information including via dictation, and **Photo** buttons to attach up to 5 photos using the phone's camera. Photos taken through the app will automatically be reduced from the iPhone standard 10+ MB to approximately 1 MB.
- Upon Saving, a unique identifier is generated that indicated the zone, type of observation, date, and initials of the reporting patroller. All information is stored locally for later upload, and all current entries are cleared so that the screen is immediately ready for entry of the next observation.

II. List of Observations:



Selecting “Edit Observations” first brings up a scrollable summary list of locally saved observations. The entries are color coded by Zone. The PDF is zoomable so that the photos can be more clearly seen.

Tapping on any of these observations brings up the yellow Edit screen.

One editing is done, a PDF of this list can be generated via a button in the top bar menu to post in the patrol group WhatsApp chat to keep other group members apprised of the morning's events.

III. Editing Observations:

10:56 AM

Date: 26 Dec 2020, 17:02:35

Zone: A

Property/Lot: A.2: Lookout

Coordinates: Retake GPS?

Latitude: 0.4412702788

Longitude: 9.4154871499

Accuracy: 9.63 meters

Emergence: --

Existing Nest: --

Adult Turtle: --

Species:

Hatching: Yes

No Problems: ☐ Success: 0

Lights: ☒ Stranded: 35

Trash: ☐ Dead: 7

Sewer: ☐

Plants: ☒

Other: ☐

Images (tap to change):

photo1 photo2 photo3 photo4 photo5

Comments:

35 babies rescued from plants to which they were drawn by artificial lights and tangled in fishing line, 7 dead. Nest should be monitored for further babies emerging tomorrow

Save Changes Discard Changes Delete Observ.

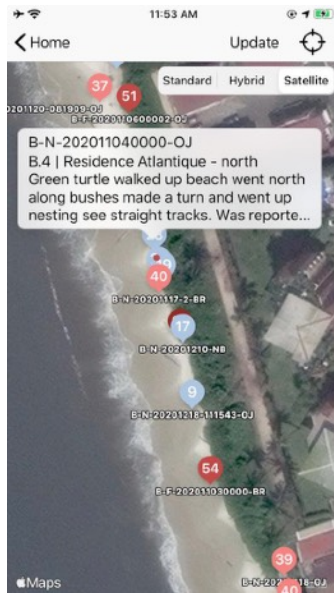
Once off the beach and with more time, the patroller edits their morning's observations via this screen.

All information previously entered can be changed on this scrollable screen, including photos, and retaking or deleting GPS coordinates. Any information skipped when originally entering can be added here.

Tapping on a photo or empty photo space allows the user to select photos from the phone's gallery to substitute or supplement the photos taken on site, take a new photo, or delete the photo from the observation. To return to the summary list without saving changes, the user can tap Discard Changes at the bottom, or Save Changes to save, or Delete Observation to delete the entire observation.

IV. Viewing Map:

All existing potential nest locations are mapped as long as they are still active (e.g. are not “aged out” and have not hatched or been otherwise disturbed or destroyed). Thus, patrollers can prepare for upcoming hatchings by keeping a close watch on the area, and clearing vegetation, trash and other debris.



Location markers are color coded by the age of the nest and show the number of days since the eggs were laid. Dark blue markers are only a few days old at most to allow patrollers to easily spot a duplicate report of the same nest from a prior day. Blue/grey markers are well before the possible hatching period. Red markers are approaching or are within the hatching period, and

darker red indicates an older nest. White indicates the nest is past due and no longer considered viable, and those markers will disappear within a few days.

Tapping on a marker reveals more information, including the Zone and Property description and the first three lines of Comments.

Map markers are locally stored so that the map is visible even offline (e.g. while patrolling), but must be updated with an internet connection.

V. Uploading: Uploading observations is achieved by tapping “Upload” on the main screen. A popup reminds the user to generate the List of Observations PDF before uploading, as all data is erased locally once upload occurs.

The data is then uploaded to Google’s Firebase Firestore, and the images are uploaded to an associated bucket. Since the group has previously used Google Sheets as the main database, Firestore is used as a temporary step to get the data into the Sheet. Another limitation is the cost, as I was trying to develop the app without using any paid services, so I couldn’t use the Google Sheets API directly from the app. So from Sheets, using Google Scripts, the observations are transferred to the Sheet, in separate tables by type of observation. The photos are downloaded to my local computer with a Python program, which puts them into folders named accordingly. They then have to be uploaded to Google Drive, again manually as to avoid costs for the API, where the previously recorded photos are. Finally, I have another Python program that **generates**

a list of the observations to post on the WhatsApp group for those who do not have iPhones, and so cannot use *C. Turtle*.

Information on past observations, including those reported by other patrollers, is limited to the map display, which shows only general location (within 9 meters), and the beginning of written comments, but no photos. Photos are therefore necessary to pinpoint nest locations. However, one reason all the photos are uploaded to a central database (Google Drive) is to not take up enormous amounts of space on users' phones; the second is for security purposes because they make the nests easier to find. The group is considering whether to add functionality within the app to view those photos.



In the *Cosmic Turtle* (*C. Turtle*) logo, the sea turtles' carapace marking are a map of the world's oceans as one unified body of water — the oceans seen from a sea turtle's perspective. The map is inspired by the Spilhaus Projection.

From Wikipedia: “The **World Turtle** (also referred to as the **Cosmic Turtle** or the **World-bearing Turtle**) is a mytheme of a giant turtle (or tortoise) supporting or containing the world. The mytheme . . . occurs in Hindu mythology, Chinese mythology and the mythologies of the Indigenous peoples of the Americas.”