OCTOPUS
FOUNDATION

Adress	29 Avenue de Cour 1007 Lausanne Switzerland
Phone	+33.6.22.88.55.23 +41.78.668.17.05
Email	jpfyffer@octopusfoundation.org

TECHNOLOGY

USE OF DRONE FOR MARINE TURTLE OBSERVATION

Caretta Caretta - GREECE

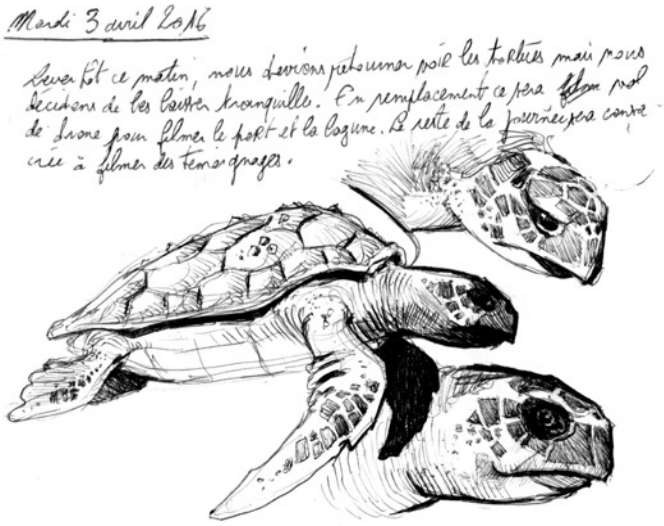
May 2016

Pictures : Philippe Henry - Drawings : Antoine Bugeon

OCTOPUS
FOUNDATION

1) INTRODUCTION

During one of the OCTOPUS Foundation's missions to support the surgical clinic for marine turtles in Lampedusa (and towards the general study of marine turtles in the Mediterranean sea), we have been lucky to witness a rare occurrence: the mating of *Caretta Caretta* marine turtles. With this document, we wish to explain the experimental method we developed to locate and approach them, so that any scientist who wishes to can replicate it or modify it to suit his or her needs.



2) SITUATION

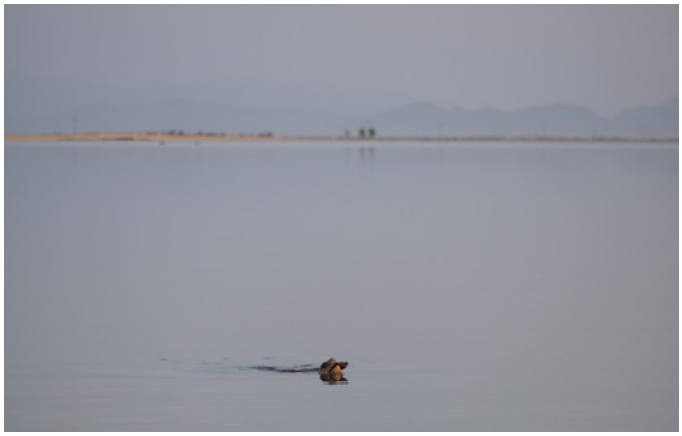
Apart from few yachts who transit from the Ionian Sea to the Aegean Sea, almost nobody knows about the small port of Messolonghi in Greece. This little provincial town, located at the entrance of the Gulf of Patras, harbors a biological singularity: a stretch of sea water approximatively 3 square kilometers at the end of a long canal is the home of a dozen marine turtles almost all year long.

The port of Messolonghi is split in three different areas: the marina, the small fishing harbor and a large stretch of water where transit yachts use to anchor. At first glance, the presence of a small city (appr. 13'000 inhabitants) and the human activity related along the port would deter wild animals to approach, let alone live, feed and mate in this area. But the marine reptiles in Messolonghi have apparently adapted to this unusual situation.

3) SURFACE OBSERVATION

It is tricky to observe marine turtles from above the surface, because they are true apnea champions. Some turtles can dive during 30 or 40 minutes while holding their breath. This skill has a physiological explanation: marine turtle blood has a hemoglobin rate seven times higher than man's blood (this is why it is purple and not red). For an observer on land or on a boat, the only chance to see a marine turtle is during the few seconds when it comes back to the surface to take its breathe.

For a few days, we have tested a technique for the localization of marine turtles, in order to approach them as calmly as possible and observe them in their natural habitat. In the next few pages, we will explain the different steps necessary to achieve this and what were the results for this particular situation, hoping that it will help future research.



OCTOPUS FOUNDATION

4) METHOD

a) Teams

We separated in two groups:

- The first one, on land, consists of the drone pilot and his assistant who will give him general directions and observations.

- The second group, on an inflatable boat, consists of the pilot of the boat, an observer who has access to the drone's video feedback and a snorkeler with mask, tuba, fins and an underwater camera.

No more than 5 people are necessary for this method, and it proved efficient in the field.

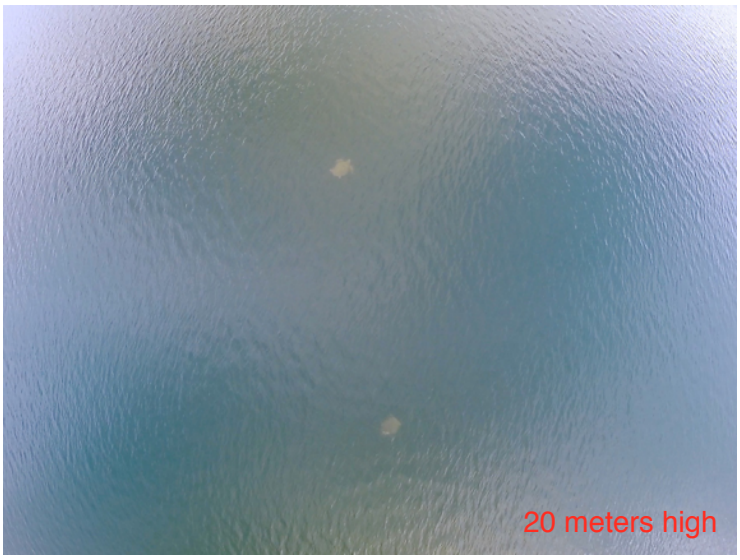
b) Up in the sky

Considering the specifics of the location and the observation zone (approximatively 3km2), we decided to try and locate the turtles from the sky first, with the help of our drone.

Our drone is equipped with a small camera and a live video feedback that allow us to easily locate several marine turtles that are between the surface and depths up to 4-5 meters.

Despite the parasites and the algae that covers some of the turtles' shell, it proves fairly easy to spot the animals in the blurry water (the seafloor is most probably covered with seaweed).

All of the observations took place while the weather was overcast to clear, and winds between 0 and 20 knots. The drone proved to be stable in these conditions.

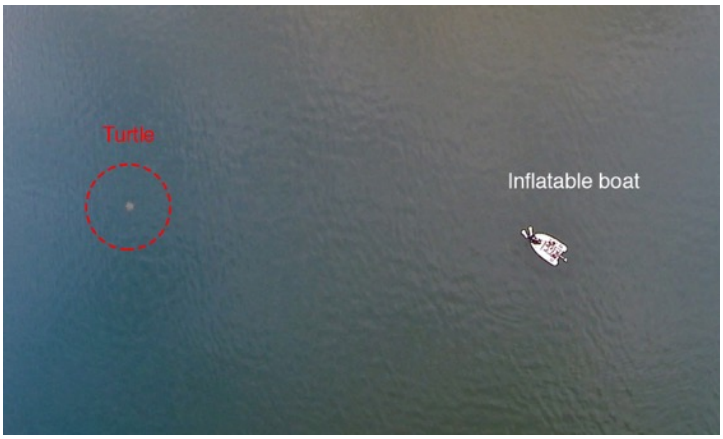


In order to prevent the noise of the drone's four engines to frighten the turtles, we flew between 20 and 80 meters above the sea level.

Once a turtle was spotted by the pilot, he would make the drone hover in position above it, marking the general position of the animal for the team on the inflatable boat without need of radio communication.

c) Above the surface

In the inflatable boat, the observer has access to the drone's video feedback (the exact same image that the drone pilot has) on a small monitor. Actually, once the drone is up in the air and emitting, anybody with a receiver and the correct frequency can see what the drone pilot sees.



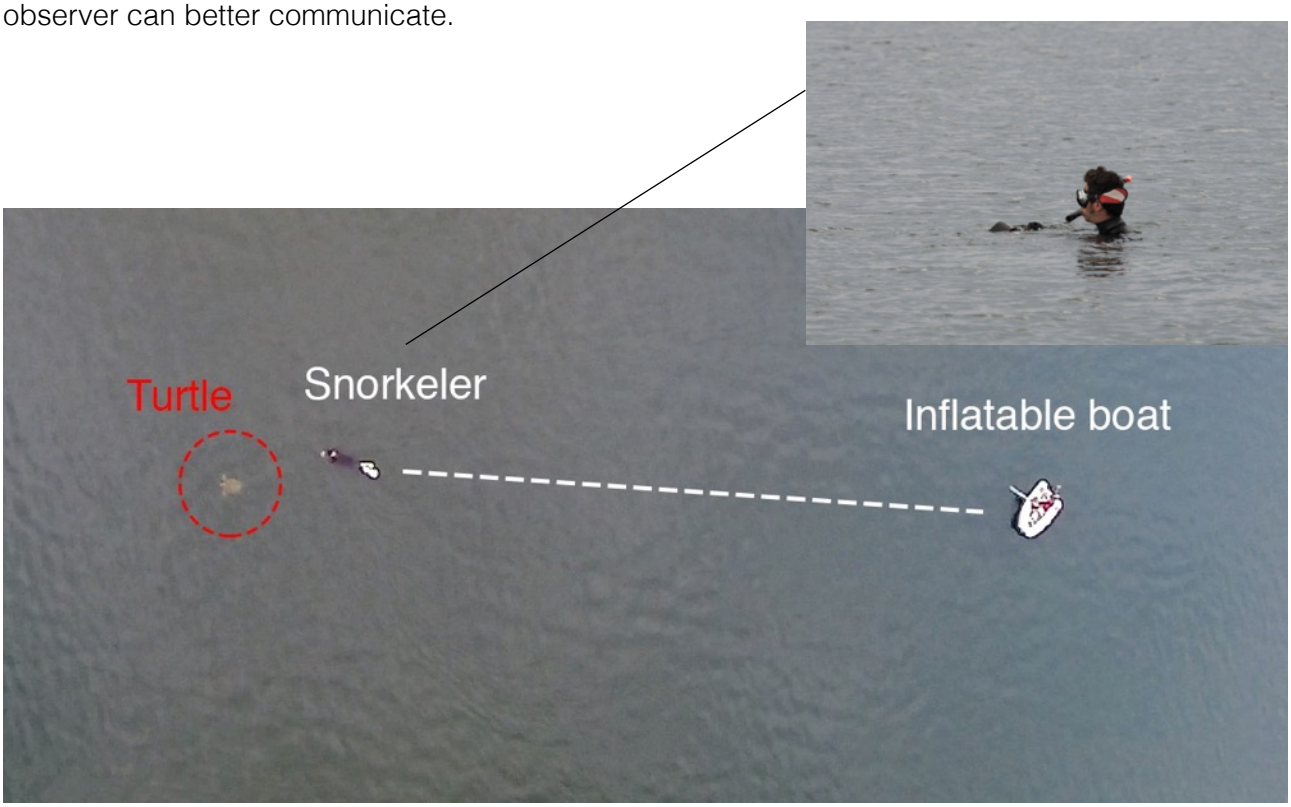
Once the drone hovers over a turtle, the inflatable boat's pilot can use it as a point of reference to quickly move forward with the engine.

As soon as the boat enters the drone's field of view, the observer informs the boat's pilot who can stop the engine, and finishes the approach in silence with the oars.

d) Under the surface

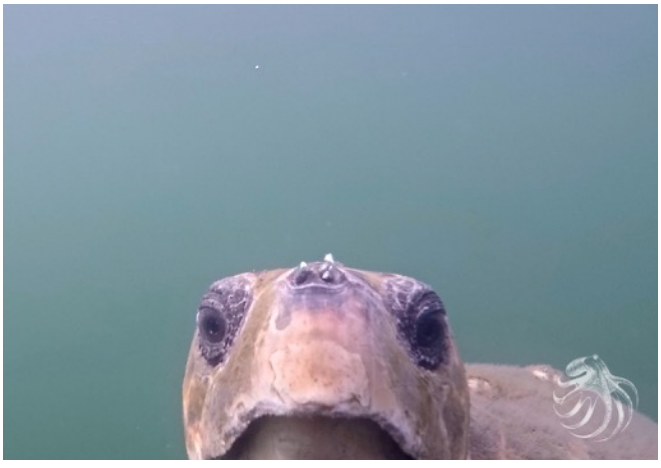
Once the inflatable boat is about 20 meters away from the spotted turtle, the snorkeler with his waterproof camera can slip quietly in the water. He then follows the direct instructions from the observer on the boat, who can still see everything on his screen with the video feedback.

The drone then gains a bit of altitude in order to limit the noise, so that the snorkeler and the observer can better communicate.



5) RESULTS

This method allowed us to approach several turtles. Each of them reacted differently to the snorkeler's silent approach and presence in the water. Some stayed in the same place, others slowly moved away at the same depth, and some decided to dive. In all cases, we never attempted to chase them down, or block their passage in any way. Moreover, our observation operations above the port of Missolonghi never lasted more than one hour every half day.



OCTOPUS
FOUNDATION

6) EQUIPMENT

a) DRONE AND PILOT'S VIDEO FEEDBACK

For each of our missions, we use the DJI Phantom 2 quadcopter. Thanks to its compact body (40cm in diameter without propellers, 30cm wide and 18cm high) and light weight (1.47kg), this drone is easy to transport in a plane or car.

To record, we use a GoPro 3+ (black model), that is stabilized with a 3-axis gimbal (DJI H3-3D model). In order to have a better view of what happens below the surface, we equipped the GoPro with a polarizing filter (SRP model). Because of the weight of the filter, we had to counter balance the gimbal with coins and hot glue.

Finally, in order to see from the ground what the drone sees in the sky, we equipped the GoPro with a small and lightweight analogical transmitter (5,8 ghz in 25 mw), which allows a good image in a radius of 1 km around the pilot.

All of this flying equipment is not waterproof, so we equipped it with a "Water Buoy" capsule that when in contact with water, chemically triggers the inflation of a small balloon capable of bringing back to the surface an object weighing about 1kg. The "Water Buoy" is smartly equipped with a flashing light when the balloon has inflated, which allows an easier retrieval of the waterlogged equipment, should it happen during nighttime.

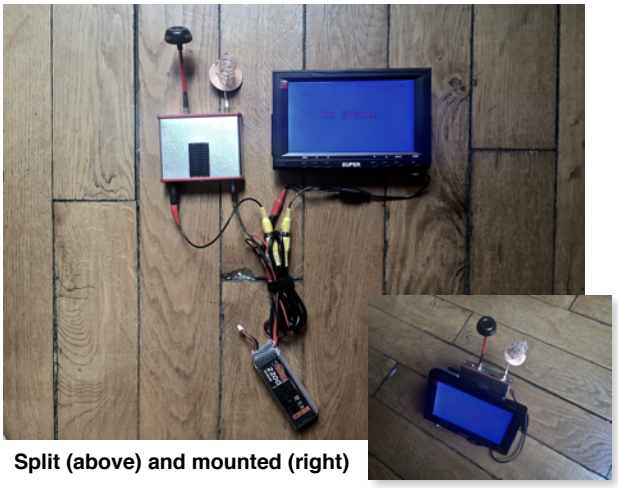
In this configuration, we could fly the drone for 12 to 13 minutes with each battery. We were equipped with three batteries, which allows a total of 35-40 minutes of flying during each session. It is recommended for the drone to take a 5-minute break in between each flight.

In the pilot's hands is the drone's radio control, and over his eyes are immersive goggles (powered by a separate battery), this way it is like sitting in the drone's cockpit. It is recommended not to use the immersive goggles during take-off and landing, but only during flight.

* Total cost of the equipment (drone + gimbal + GoPro + video transmitter + immersive goggles + batteries + charger) = approximatively € 1'500.-

###

b) VIDEO FEEDBACK (on board inflatable boat) :



Split (above) and mounted (right)

The observer on the boat has access to the live video feedback with a small monitor equipped with a diversity analogical video receiver, two antennas and a battery that powers simultaneously the monitor and the receiver.

* Total cost of the equipment (monitor + receiver + antennas + battery) = approximatively € 250.-

###

c) UNDERWATER CAMERA

For all of our underwater images, we use the Nikon D800 with a 20mm (F/2.8) Nikon lens, inside an Ikelite underwater housing.

* Total cost of the equipment = approximatively € 4'000.-

###

The whole crew warmly thanks Fabien Madore, our technological specialist, for his help and patience.

##########