

# IN-WATER BEHAVIOUR OF THE LOGGERHEAD SEA TURTLE (*Caretta caretta*) UNDER THE PRESENCE OF HUMANS (*Homo sapiens*) IN A MAJOR MEDITERRANEAN NESTING SITE

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## MOTIVATION



Greece Zakynthos Laganas bay

Laganas bay in Zakynthos island, located in the southwest part of Greece in the Ionian sea, hosts the most important breeding colony of loggerhead sea turtles in the Mediterranean as far as nest density is concerned. Approximately 1056 nests (2000-2014 average) are laid on 5.5 kilometres of nesting beaches every year [Margaritoulis 2005, Margaritoulis et al. 2011, Archelon reports 2006-2014]. The nesting season coincides with the peak of tourist season in the island (end of May-middle of August).

It has been shown through GPS tracking [Schofield et al. 2007a] and direct observation [Schofield et al. 2007b] that breeding females primarily occupy a stretch of sea that extends no more than 500 metres offshore both during the pre-nesting and nesting season (roughly red area in figure above). This area is located directly in front of and in-between the tourist resorts of Kalamaki and Laganas villages. As a result **underwater encounters between turtles and humans occur very often**. Furthermore, the wide availability of underwater digital cameras nowadays, leads to another reason for a deliberate approach of humans towards turtles.



2011 encounter 2014 encounter

A systematic approach of snorkellers towards turtles can also occur in the context of an intensive **photo identification program** [Schofield et al. 2008]. Turtles are typically identified by comparing their facial scutes. For that purpose, detailed photographs are required and as a result the researcher has to approach the turtle from a very close distance.

Since energy preservation has an important role in turtle nesting activity, it is important to have an indication of the degree of any disturbance towards turtles from snorkellers. **The objective of the present report is to introduce behavioural-based methods that quantify this disturbance and report on its distribution among turtles that were observed by the author during the period June-September 2014.**

## NATURE OF THE PRESENT STUDY

The author has been consistently snorkelling and photographing the loggerhead turtles of Zakynthos for the last 6 years (2009-2014), logging more than 180 encounters, over more than 40 hours of observation time. This report focuses on observations made during the 2014 season. Even though the nature of the snorkelling sessions was recreational in the context of amateur underwater photography, the recorded data were detailed enough to allow the extraction of reliable conclusions. A full frame DSLR camera with an underwater housing was used, combined with a 15mm fisheye lenses of minimum focus distance 15 cm.



Photo by Spiros Stogiannos

### THE 2014 SNORKELLING SESSIONS

Period: June-September 2014	No of sessions: 33	No of encounters: 69	No of unique individuals: 51
Total observation time: 12h 30 mins	Average duration/session: 1h 26 mins (min: 31 mins, max: 3h 08 mins)		
Average no of encounters/session: 2.1	Average observation time/session: 23 mins (min: 0 mins, max 57 mins)		

The objective of each session was, upon encounter with a turtle, to make a head on approach and photograph it. Physical contact was avoided and in general the strategy was to approach *as close as the turtle permits*. The behavioural responses of the turtles varied greatly and we classified them into the following four categories:

## CATEGORY 1 - HIGH DISTURBANCE

- This category is mainly characterised by the turtle's **immediate abandonment of the meeting site** upon obtaining visual-contact with the snorkeller.
- The swimming speed of the turtle is typically too high for a snorkeller to follow and very short observation times are the norm.
- Attempts from the snorkeller to approach closer, triggers further accelerating.
- Recording tag codes is not always possible and it is difficult to obtain facial photos of good quality which are useful for photo identification.

## CATEGORY 2 - MODERATE DISTURBANCE

- Even though, turtles in this category **can be followed from a close distance**, i.e., they do not belong in Category 1, they nevertheless show **signs of disturbance** of various degrees.
- Possible signs of disturbance include:
  - Abandon activities (e.g. resting, foraging)
  - Accelerating when being approached
  - Performing sharp turning movements
- Close en face photographs are difficult as the turtle will not allow the camera dome to be placed in front of her face, by exhibiting strong pivoting behaviour.

## CATEGORY 3 - SLIGHT DISTURBANCE

- This is a transition category between Category 2 and Category 4. The turtles show **no significant signs of disturbance** as these were described for Category 2. On the other hand, they **neither exhibit a Category 4 behaviour** as this is described below.
- Slow and calm swimming is typical for turtles of this category, allowing a very close approach from the snorkeller.
- In contrast to Category 2, close en face portraits are possible but unlike Category 4, placing the camera directly in front of the turtle will result to **calm but avoiding** movements.

## CATEGORY 4 - NO DISTURBANCE

- This category concerns turtles that showed **no disturbance signs at all, almost indifference** to the author's presence.
- Quite often a Category 4 turtle rests in the presence of humans, a behaviour that we consider to indicate absence of fear and comfortability.
- It is possible to position the camera, sometimes even less than 10 cm in front of the turtle's face, resulting in no significant change of swimming direction.
- This behaviour allows for highly detailed photographs and long observation time.

A video describing the above categories can be found at: <http://bit.ly/1DH1jaf>

## RESULTS

We classified 64 encounters (51 unique individuals) according to the aforementioned categories. We excluded 5 encounters, out of the total 69, as for various reasons the observation time was too short to evaluate the behaviour (and in which cases the turtle did not abandon the site in high speed). In most cases, same individuals exhibited behaviour of the same category over different encounters. In the following figures we see the diversity of the behaviours for **all the encounters** and for **all individuals**. We also show the distribution of the different categories for **tagged females** (females that have nested at least once before), **untagged females** (no visible tags), **males** and (potentially) resident females. The latter category concerns turtles encountered at the end of September, well outside the nesting season when typically the nesting females have already migrated to their foraging areas.

## RESULTS (continued)

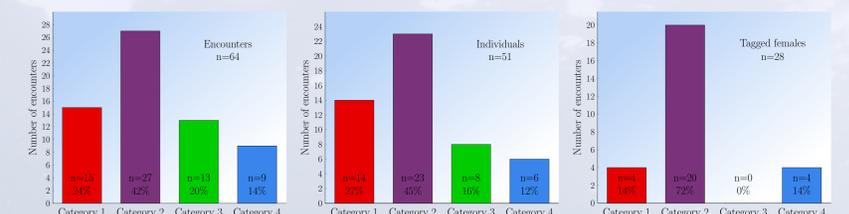


Fig. 1: All encounters

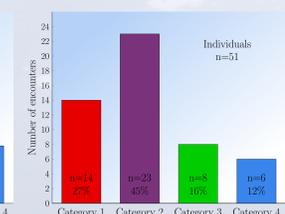


Fig. 2: All individuals

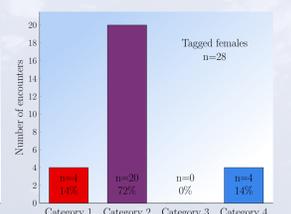


Fig. 3: Tagged females

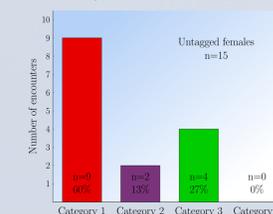


Fig. 4: Untagged females

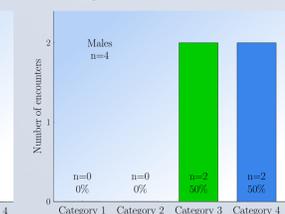


Fig. 5: Males

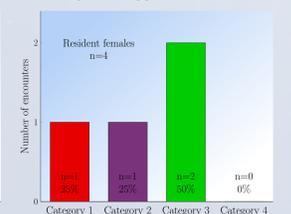


Fig. 6: Resident females

**DISCUSSION:** The most dominant behaviour among all encounters and individuals was **Category 2**, Figures 1 and 2. One notices that the greatest contribution to this category was done by tagged females, Figure 3, as 72% of them (20 out of 28) exhibited this type of behaviour. **This might indicate that most nesting females try to achieve an optimal balance between saving energy (no speeding behaviour) and avoiding the snorkeller.**

Out of 14 turtles that exhibited a **Category 1** behaviour, 9 of them had no visible tags and in fact untagged females contributed the most to this category, Figure 4. This might be due to the fact that in 6 out of 15 of these turtles, it was not possible to see clearly if they bear any front flipper tags, due to the difficulty of being closely approached. We would like however to make the conjecture, that some of these untagged females were new recruits who potentially could be more sensitive to human presence.

All the male turtles encountered, showed only slight or no disturbance, i.e., **Category 3** or **Category 4**, Figure 5. This is consistent to observations made during previous years. On the other hand, we cannot make any firm conclusions about the resident females, Figure 6.

Finally, we would like to point out that, in the context of recreational observation, the behavioural response of the turtle affects the observation time. For instance the average observation

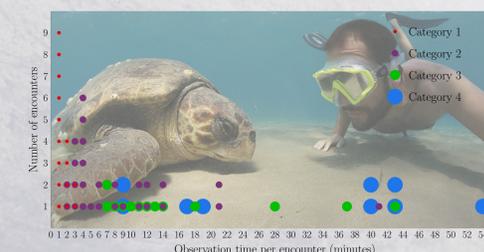


Fig. 7: Observation times for all the 64 encounters.

times were **1.5 mins**, **8.8 mins**, **16.7 mins** and **30.4 mins** for turtles that belonged to Categories **1**, **2**, **3** and **4** respectively. We provide the detailed distribution of observation times for all the 64 encounters in Figure 7. Even though this distribution is the result of the author's strategy *observe as long as the turtle permits*, it is reasonable to assume that this reflects a general trend among tourists as well.

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## REFERENCES

[Archelon reports 2006-2014] Margaritoulis D., Koutsodendris A., Dean C., Panagopoulou A. and Touloutou S. (2006-2014). ARCHELON reports on conservation efforts in Laganas bay, Zakynthos, Greece. Submitted to the European Commission and the Bern Convention.

[Margaritoulis 2005] Margaritoulis D. (2005). Nesting activity and reproductive output of loggerhead sea turtles, *Caretta caretta*, over 19 seasons (1984-2002) at Laganas bay, Zakynthos, Greece: the largest rookery in the Mediterranean. *Chelonian Conservation and Biology*, 4(4):916-929.

[Margaritoulis et al. 2011] Margaritoulis D., Rees A., Dean C. and Riggall T. (2011). Reproductive data of loggerhead turtles in Laganas bay, Zakynthos island, Greece, 2003-2009. *Marine Turtle Newsletter*, 131:2-6.

[Schofield et al. 2007a] Schofield G., Bishop C., MacLean G., Brown P., Baker M., Katselidis K., Dimopoulos P., Pantis J. and Hays G. (2007a). Novel GPS tracking of sea turtles as a tool for conservation management. *Journal of Experimental Marine Biology and Ecology*, 347(1):58-68.

[Schofield et al. 2008] Schofield G., Katselidis K., Dimopoulos P. and Pantis J. (2008). Investigating the viability of photo-identification as an objective tool to study endangered sea turtle populations. *Journal of Experimental Marine Biology and Ecology*, 360(2):103-108.

[Schofield et al. 2007b] Schofield G., Katselidis K., Dimopoulos P., Pantis J. and Hays G. (2007b). Behaviour analysis of the loggerhead sea turtle *Caretta caretta* from direct in-water observation. *Endangered Species Research*, 3(3):71-79.