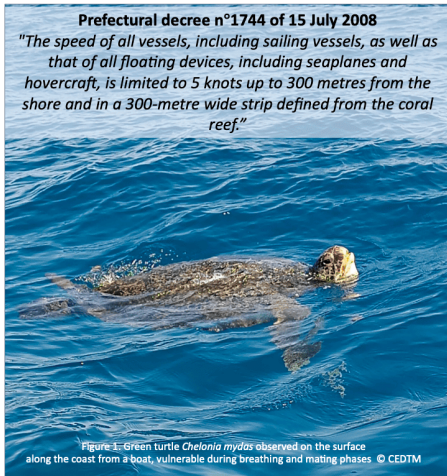


# Risk of vessel collision with sea turtles in Reunion Island: assessment and recommendations for its mitigation

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## Context

Collisions between marine wildlife and vessels can have negative consequences for species and are a growing concern worldwide (Schoeman et al. 2020). Concerning sea turtles, the risk of collision is a significant cause of mortality (Foley et al. 2019). In Reunion Island, a small French territory of 2,512 km<sup>2</sup> isolated in the south-western Indian Ocean, sea turtle populations and growing nautical activities share the same waters (Fig.1). This has led to an increase of the number of sea turtles injured by vessel strikes by +300% (N=42) since 2015, becoming their main cause of mortality (Dalleau et al. 2022 ; Fontaine et al. 2022). In 2022, a state of knowledge was established, and hypotheses were investigated in order to understand the factors responsible for the increase in collisions and to implement effective emergency measures to reduce the impact.

## Method

### Data analysis

- **Spatial distribution and probability of encounters** with sea turtles from *aerial surveys* (2001-2022; Jean et al. 2022).
- **Collisions** reported by the Kelonia Care Centre (Barret, 2022) and the photo-ID programme (Dunbar et al 2021).
- **Maritime fleet evolution** from 2000 to 2021 (DMSOI in Fontaine, 2022).

### Visual counts and categorisation of vessels

4 land-based observation points (duration=5h from 7:00 to 17:00, 28 days; Fig. 4).

### Semi-directive surveys

28 maritime professionals interviewed (Fuentes et al. 2021).

## Results

### Changes in sea turtle abundance

- **Significant increase in the sea turtle population until 2011**, then relative **stability** showing annual variations (Fig. 2).
- **Turtle densities higher in the west and south** of Reunion Island (Fig. 3).
- **Abundant juvenile** turtles using a reduced habitat located in 93% of cases within **300m of the reef**, and at a **depth up to 30 meters** in 83% of cases.
- **Mature turtles are less numerous** and appear to be located further **offshore**. They represent a very small and threatened local relict breeding population, the preservation of which is of great concerns.
- **Significant relationship between the increase in turtle populations and the number of collisions** ( $p < 0.05$ ).

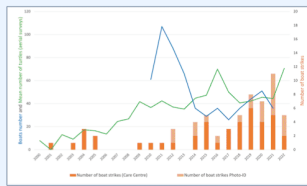


Figure 2. Annual evolution of collision cases, turtles counted in microlights on the west coast (Saint Leu - Saint Paul), and of the Réunionese fleet (Fontaine, 2022)

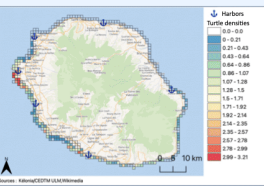


Figure 3. Density of sea turtles per km<sup>2</sup> of observation effort surveyed by CEDTM and Kelonia between 2015 and 2019 (Dalleau, 2022)

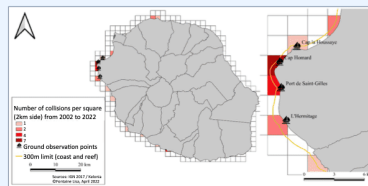


Figure 4. Distribution of collision cases recorded by the Kelonia Care Centre and location of observation points from the coast (Fontaine, 2022)

### Vessel traffic in the coastal maritime area

- Global number of **recreational and professional vessels increased by 14% and 12% respectively** since 2015 (Fig. 2).
- Two sites with high collision rates identified (Fig. 4).
- **Significant relationship between the increase in the Réunionese fleet and the increase in the number of collisions** ( $p < 0.05$ ).

### Evolution of the risk of collision

- 42 collisions recorded by Kelonia Care Centre since 2001 and 2021 by the photo-ID programme, with an **average of 1.3 collisions per year until 2014**, then **3.6 cases between 2015 and 2022**. Peaks from **4 to 6 collisions** recorded in the last 4 years (Fig. 2).
- **69% of cases identified died after a collision**
- **Evolution of injuries types**: propeller marks on the shells most of the time and appearance of straight cuts on the dorsal and ventral sides characteristic of foils since 2015 (Fig. 5).

### State of knowledge of users on regulation and the problem of collisions

- 7% of users fully aware of the current regulation and 50% partially
- 93% in favor of raising user awareness through information and communication



Figure 5. Types of collision injuries observed. A) Parallel cuts; propeller; B) Straight cut in the back or breastplate; foil © Kelonia

## Conclusion

Collisions are linked to the **increase**, albeit moderate, **of the Réunionese fleet**, to the **increase in the use of certain sites by sea users**, to the **arrival of new types of boats** (foil boats), as well as to the **increase in sea turtle populations**. Despite the fact that this represents a small number of turtles impacted, these collisions can have consequences on the population, the renewal of which is estimated at between 20 and 30 new individuals per year in the area most affected (unpublished data). Certain injuries can also reduce the capacities of future breeders.

**Improving compliance with existing regulations** would help reduce the threat, but **information and awareness** need to be improved by **clarifying and disseminating key messages** (Fig. 6). The dedicated « Quietude » team raises awareness of speed limits at sea to reduce pressure and collaborates with the Care Centre in the event of a collision. An online platform named OMEGA ([omega.upility.fr](http://omega.upility.fr)) has been developed to promote responsible observation of sea turtles and cetaceans in Reunion Island to the general public. **Speed checks at sea** are a necessary complementary action for the protection of turtles.

[omega.upility.fr](http://omega.upility.fr)



Figure 6. Awareness panel installed at major western ports

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