# Photo-identification of *Aetomylaeus bovinus* (Geoffroy St. Hilaire, 1817). The forgotten giants of the shallow.

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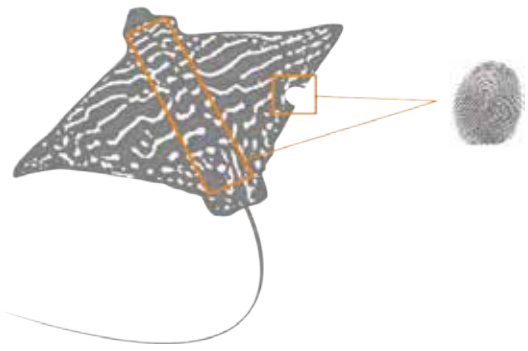
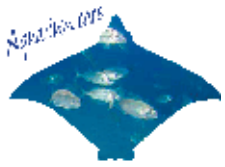
## OBJECTIVES

**How to monitorise the stability of *A.bovinus* natural markings and scars ?**
**How can photo-identification be applied to the species?**



## INTRODUCTION

The Bull rays, **is a poorly studied species** of Myliobatiformes with a large body size, **Max. 220 cm** disc width, occuring Such size in a **coastal and narrow depth range** (0-30 m deep). Threatened by habitat degradation and unselective fishing practices, it has been classified as **Critically Endangered** in the Mediterranean Sea. Its proximity to anthropic pressures also makes it very accessible to study using simple **snorkelling surveys and photo-identification.** As a bentho-pelagic feeder, Bull rays spend extensive periods of time lying on the sea floor, exposing the natural patterns of their back. The uniqueness of such patterns inspired a **new non-invasive, photo-identification method.**

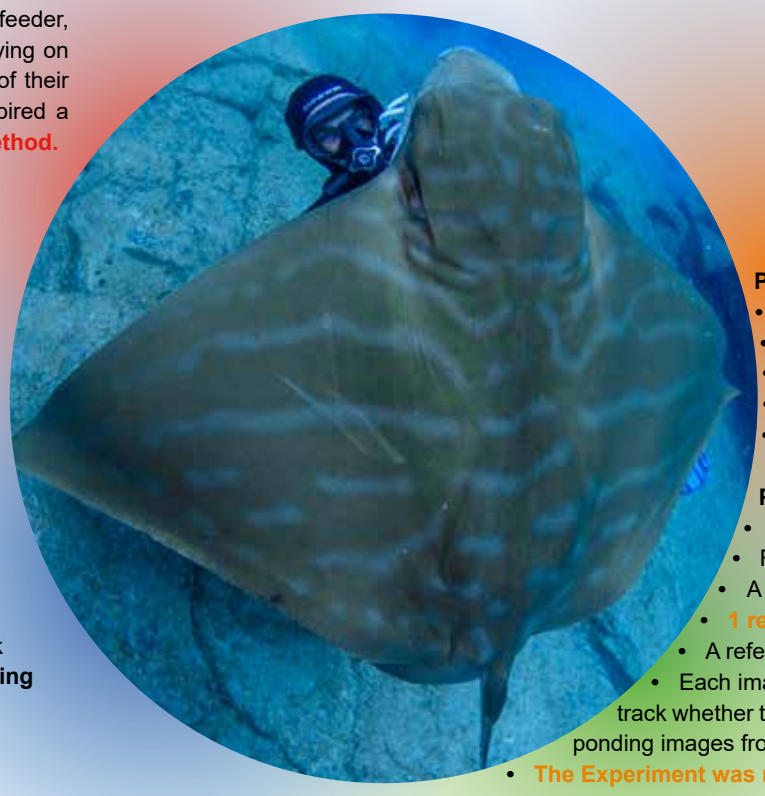




## METHODS

**DATA GATHERING**

- Two current study regions, **Malta**.
  and **Canary Islands**, for a total of **eight main study areas** (four in each region).
- Buddy team snorkelling surveys using the **Roving Diver Technique (RDT)** underwater census.
- Towed **GPS, tracking** each survey.
- **Camera Olympus TG5** equipped with external underwater strobes.
- **Laser photogrammetry** to scale pictures.
- Two collaborations, **Oceanario de Lisboa** and the South African Association of Marine Biological Research (**SAAMBR**).
- Close monitoring of **six individuals** under aquarium care, four females and two males.



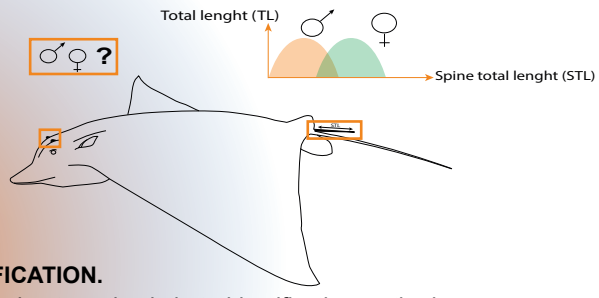



**PHOTO-IDENTIFICATION.**

- A **two step** semi-automatised photo-identification method.
- A consistent and semi-automatised **binary treatment** using **Image J.**
- A semi-automatised **pattern identification** using the software **I3S.**
- **Two sexual dimorphisms** visible from a dorsal vew.
- Sexual maturity reached around **90 cm disc width.**

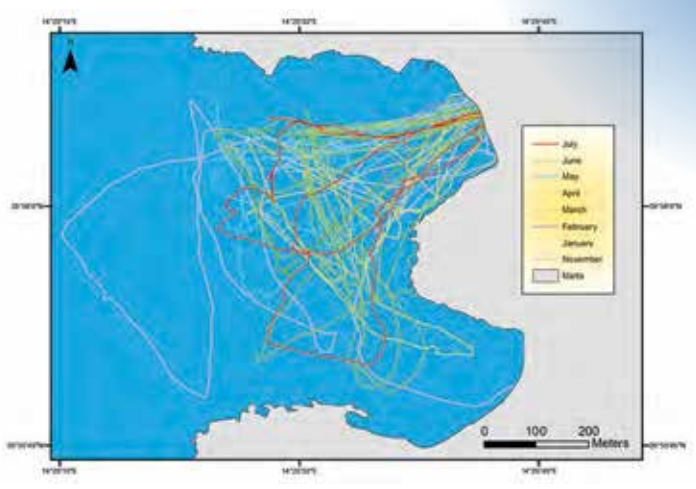
**PRELIMINARY VALIDATION**

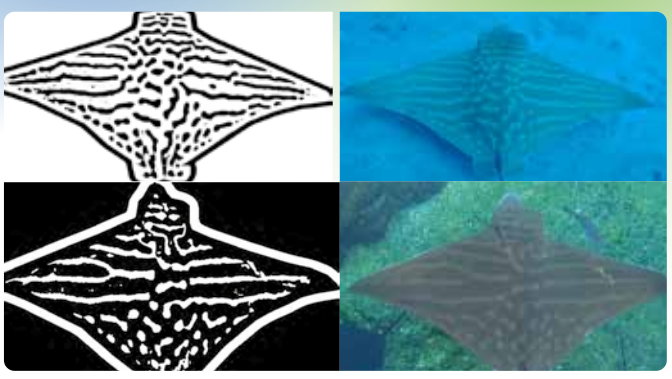
- **82 pictures from 28 individuals** analysed.
- Range of one to six pictures available for each individual.
- A **representative sample** of good, medium and bad quality pictures.
- **1 reference image per individual** randomly selected.
- A reference set of 28 images, for a test set of **54 images.**
- Each image from the test set was **compared to the entire reference set** keeping track whether the top 1, top 3, top 5, top 10, or top 20 contained at least one of the corresponding images from the reference set.
- **The Experiment was repeated 1000 times** to average out any random effects.


## RESULTS

**PHOTO-IDENTIFICATION**

- **16 individuals** identified in Malta (75 surveys since November 2017)
- **6 individuals** in the Canary Islands (10 surveys since July 2018)
- **963 pictures** collected since 2011, including close to 700 of poor quality ones.
- **Several re-sightings** in less than three months.
- **One re-sighthing of four years,** indeed the same individual was identified on July 2012, June 2013 and July 2015 in the **same study area, Golden Bay (Malta)**.
- From November 2017 until April 2018 snorkeling surveys took place for the first time **during winter**, with **one single sighthing** along 10 surveys.



| | Number of correct matches | Probability to find a correct match |
|---|---|---|
| Top #1 | 36042 | 66,74% |
| Top #2 | 39394 | 72,95% |
| Top #3 | 40927 | 75,79% |
| Top #5 | 43500 | 80,56% |
| Top #10 | 47691 | 88,32% |
| Top #20 | 52210 | 96,69% |

**PRELIMINARY VALIDATION**

- **54000** tests in total (test set of 54 pictures X 1000 repetition).
- Ratio, reference data set / test data set of **0,5.**
- **Only 3,31%** chances to not have a correct match in the **top 20** .
- **Only 11,68%** chances to not have a correct match in the **top 10**

*Tests data availabe here:*
*https://drive.google.com/drive/folders/1rLu4_tLZbFXKWxBTZG--ZrytEBhWZwTai?usp=sharing*

## DISCUSSION

- **Site fidelity?**
- **Seasonal migration patterns?**
- I3S is **not affected by the size of the database.**
- These preliminary **results are satisfactory,** compared to the 8.1% error probability in whale shark data (J. den Hartog & R. Reijns (2012).
- Identification errors may arise from:
  - **A less accurate selection of the three reference points** needed by I3S.
  - **A paralaxis error** due to a non-vertical position of the divers in relation to the ray, this bias can **affect the selection of the identification area.**
  - The main bias factor is the **quality of the original picture.**
- The effect of **multiple observers remains to be tested.**
- **Separated databases by picture quality** should be tested to define a minimum quality threshold.

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Oceanário de Lisboa