

# Assessing sperm whale (*Physeter macrocephalus*) occurrence, distribution and group size in Southern Tyrrhenian Sea through photo-identification

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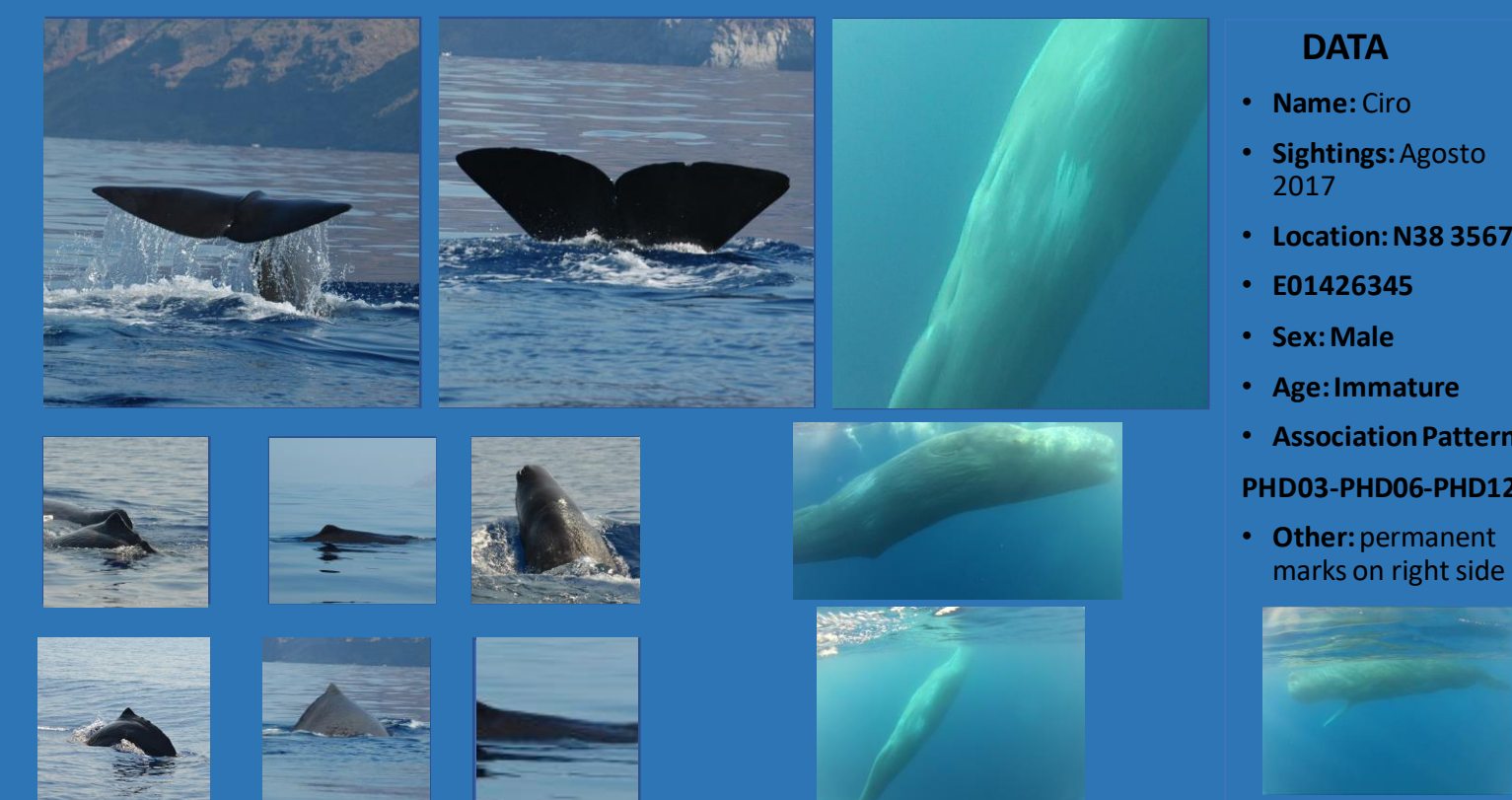
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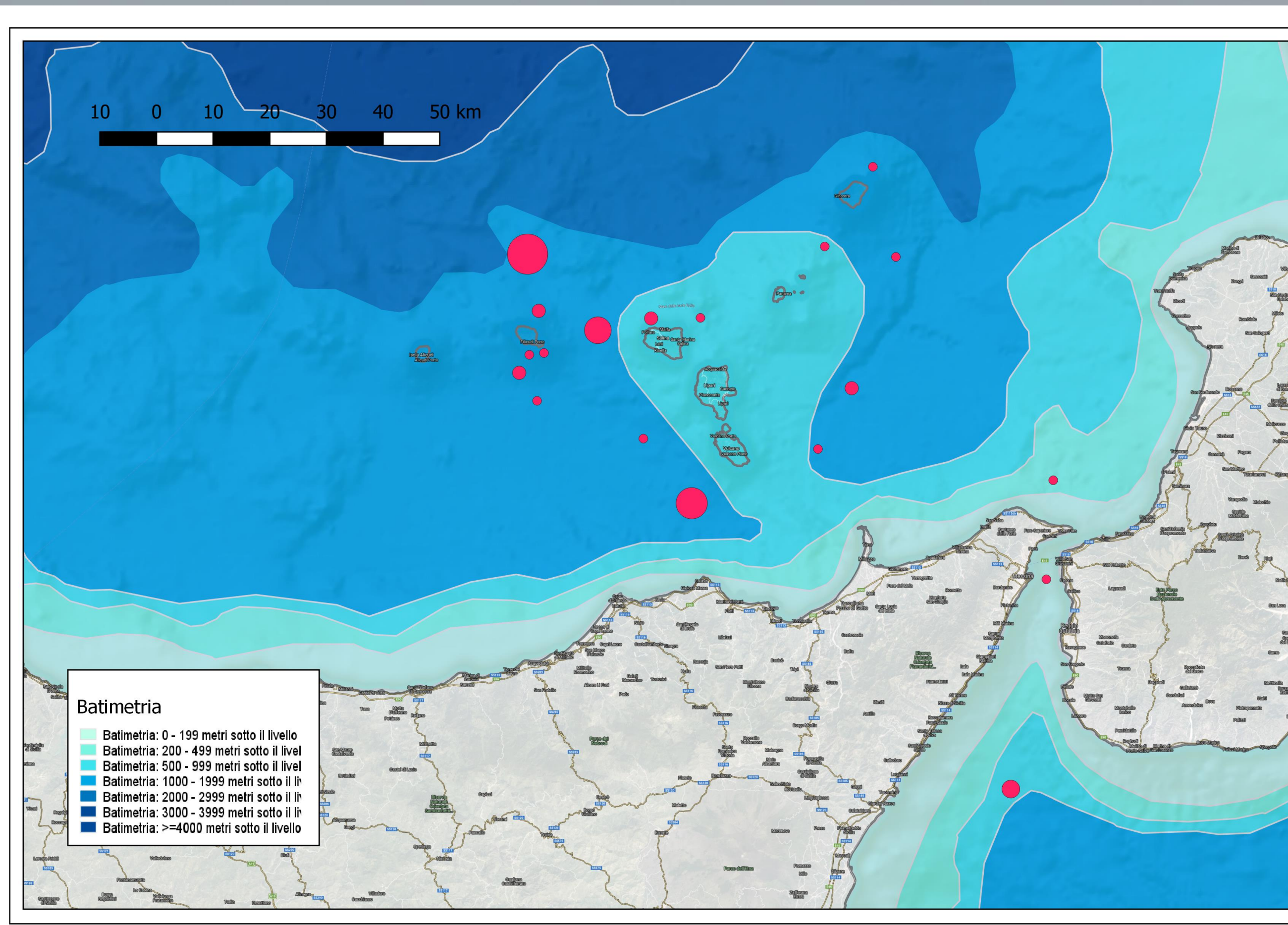
## INTRODUCTION

The sperm whale (*Physeter macrocephalus*) is one of the common cetacean species of the Mediterranean Sea but few information are available on the real abundance and movements of the population. Comparisons between photo-ID data from different Mediterranean areas show that sperm whale individuals may move around the western area of the basin, but very few studies analysed sperm whale movements and abundance in the Tyrrhenian Sea. In this study we analyze, for the first time, the annual/seasonal occurrence, distribution, group size and type of sperm whale groups around the Aeolian Archipelago located in Southern Italy (Figure 1).

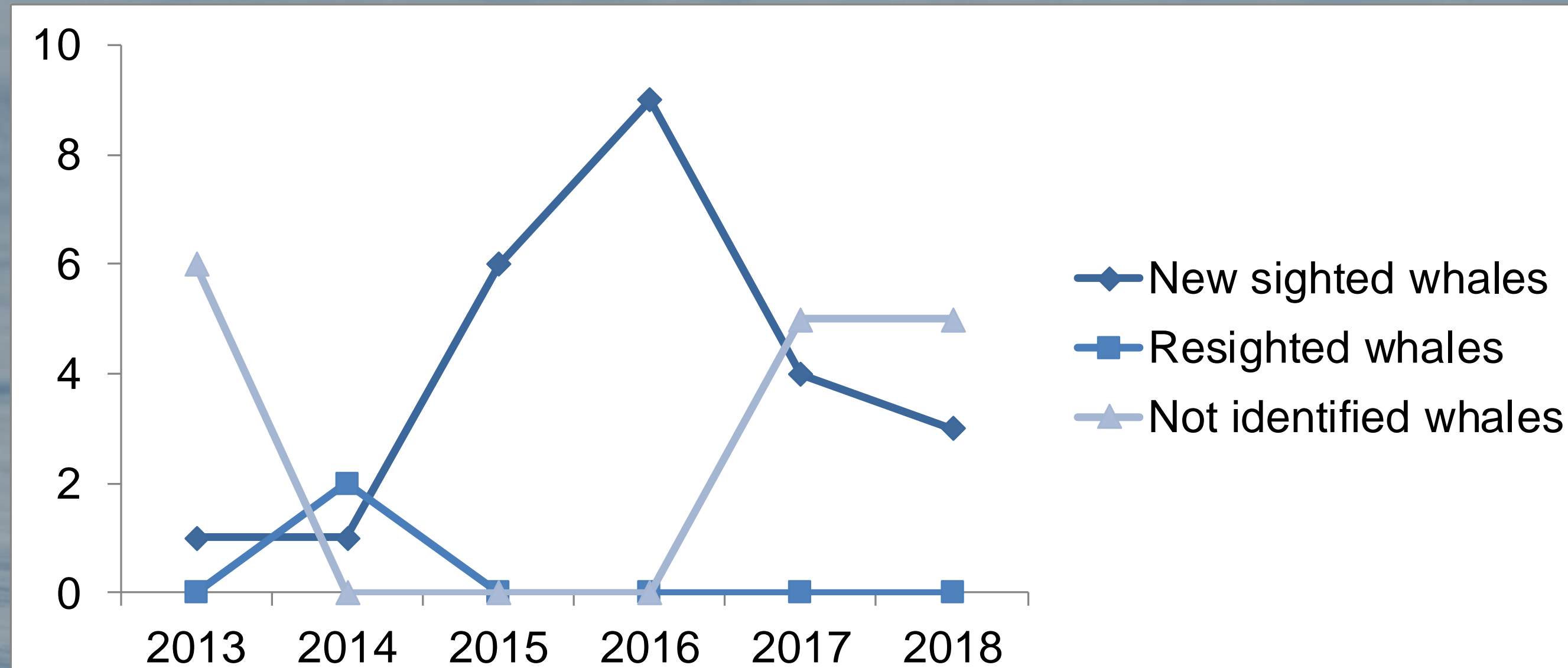
## PHD 20



**Figure2.** The model of the catalogue, with photos of the tail and marks in the body. A brief summary of the sightings is also shown.



**Figure 1.** The study area and location of 19 sperm whale sightings. The size of dots is proportional to the group size of the sightings, ranging from 1 to 8.



**Figure 3.** New sighted, re-sighted and not identified sperm whales for year.

## MATERIALS AND METHODS

Photo-identification data and video of sperm whales in the Aeolian Archipelago were collected by dedicated boat surveys and reports from tourists (Figure 1). We performed 1483 dedicated boat surveys (random tracks) in the study area from 2013-2018 in different seasons. Once sighted, individuals were slowly approached to record their positions (using the GPS) and the behaviour (cameras and hydrophone). Individuals were included in a catalogue with a progressive code (PHDn) from permanent marks of tail, fin and other body regions. Sperm whale groups were also classified by type in: 1. *solitary individuals*, single individuals with no others visually or acoustically detectable around; 2. *social units*, all whale groups with at least four individuals, including calves or juveniles; 3. *bachelor group*, aggregations of similar sized/aged sperm whales comprising immature and sometimes mature males; 4. *clusters*, any other types of aggregations. The age class and sex of individuals were also classified: 1. *calves* (< 6 m length); 2. *immature males* (7-11 m length); 3. *adult males* (11-15 m length); 4. *immature females* (6-7 m length); 5. *adult females*, (7-11 m length).

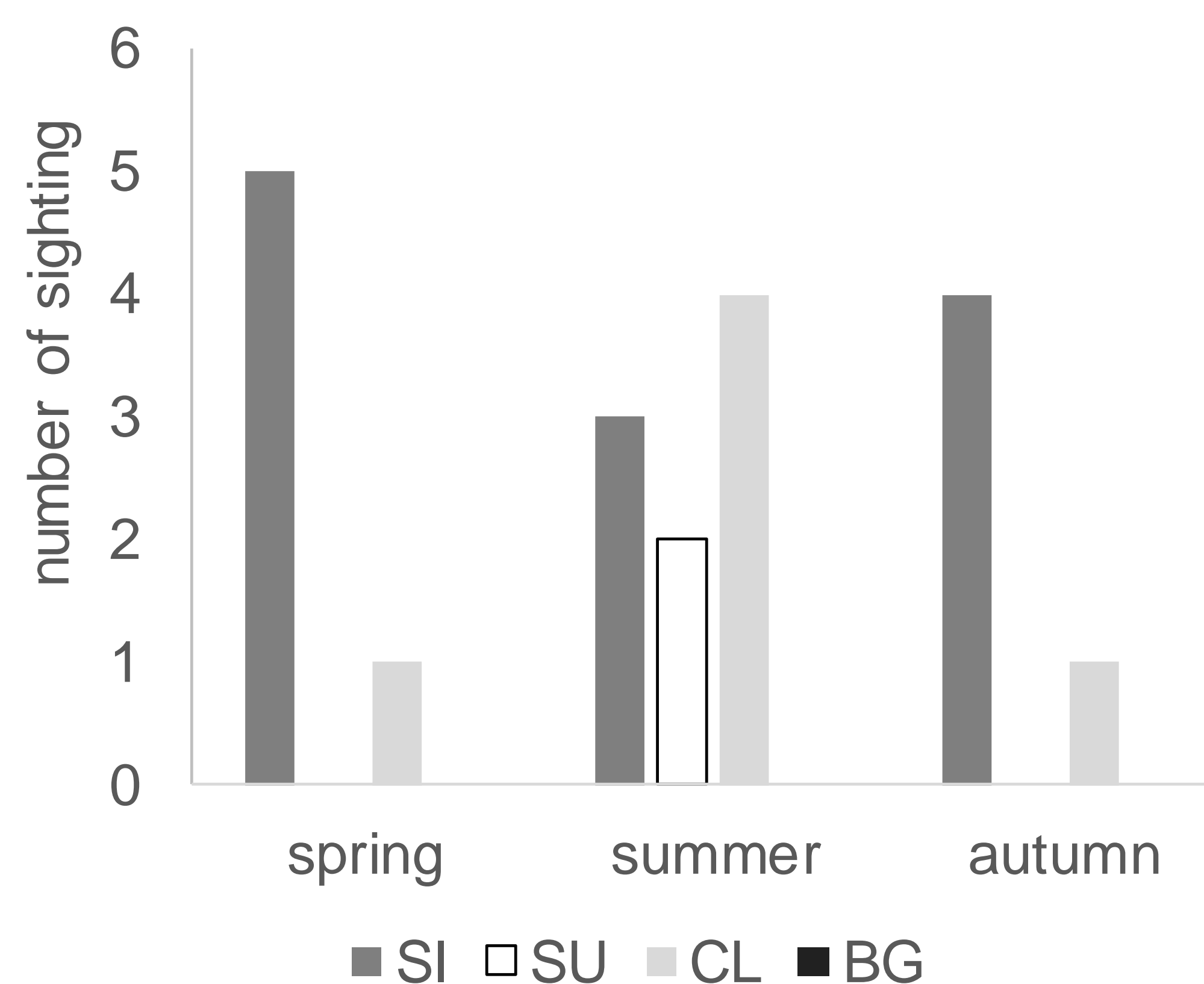
Sex/Age class	2013	2014	2015	2016	2017	2018	Total
Calves	2	0	0	2	0	0	4
Immature females	0	0	1	0	0	0	1
Adult females	2	0	0	3	0	0	5
Immature males	1	2	3	0	4	2	12
Adult males	0	0	0	0	0	0	0
Unknown	2	1	2	4	5	6	20
Total	7	3	6	9	9	8	42

**Table1.** Age and sex of sperm whales determined for 22 individuals.

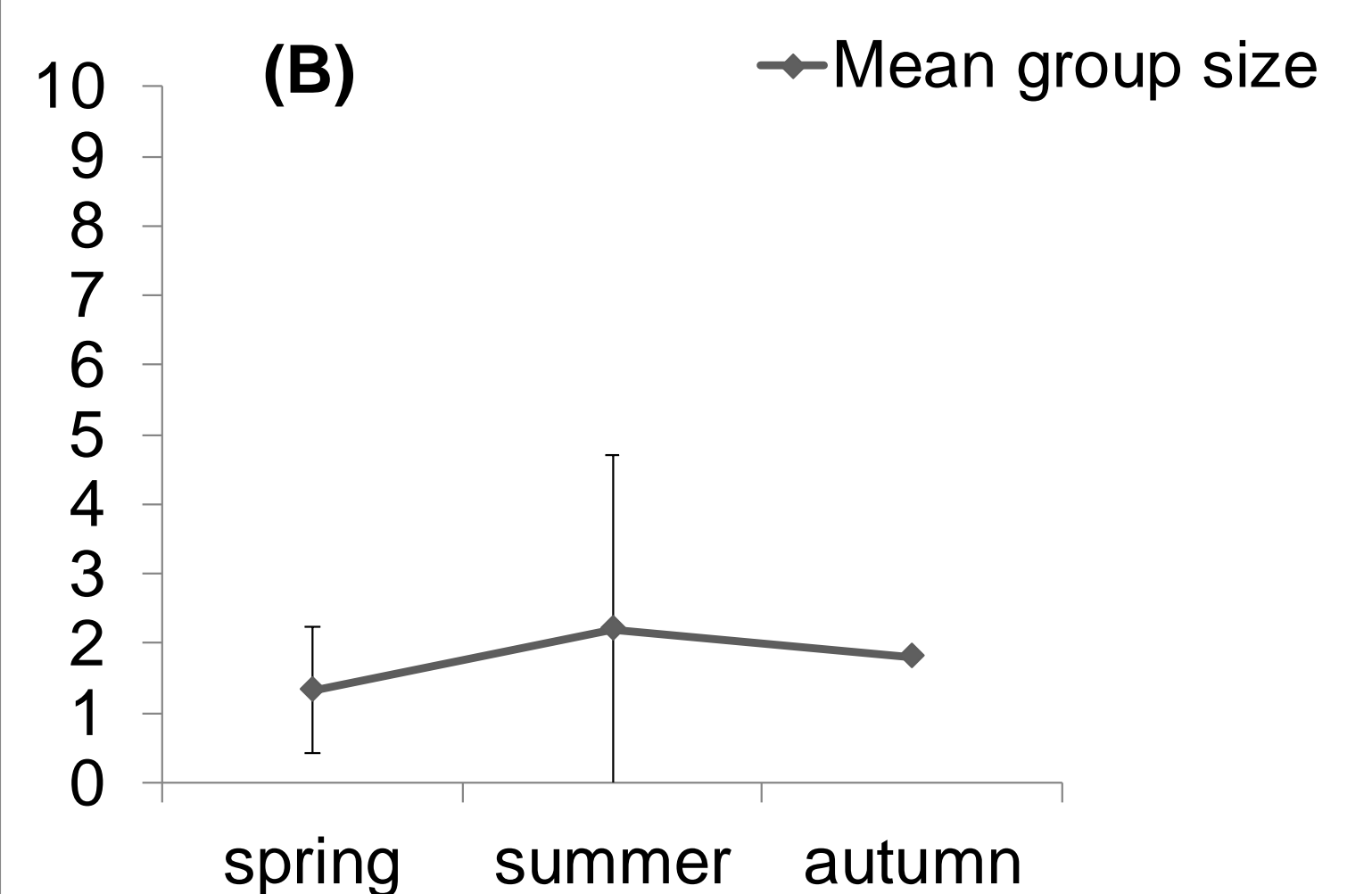
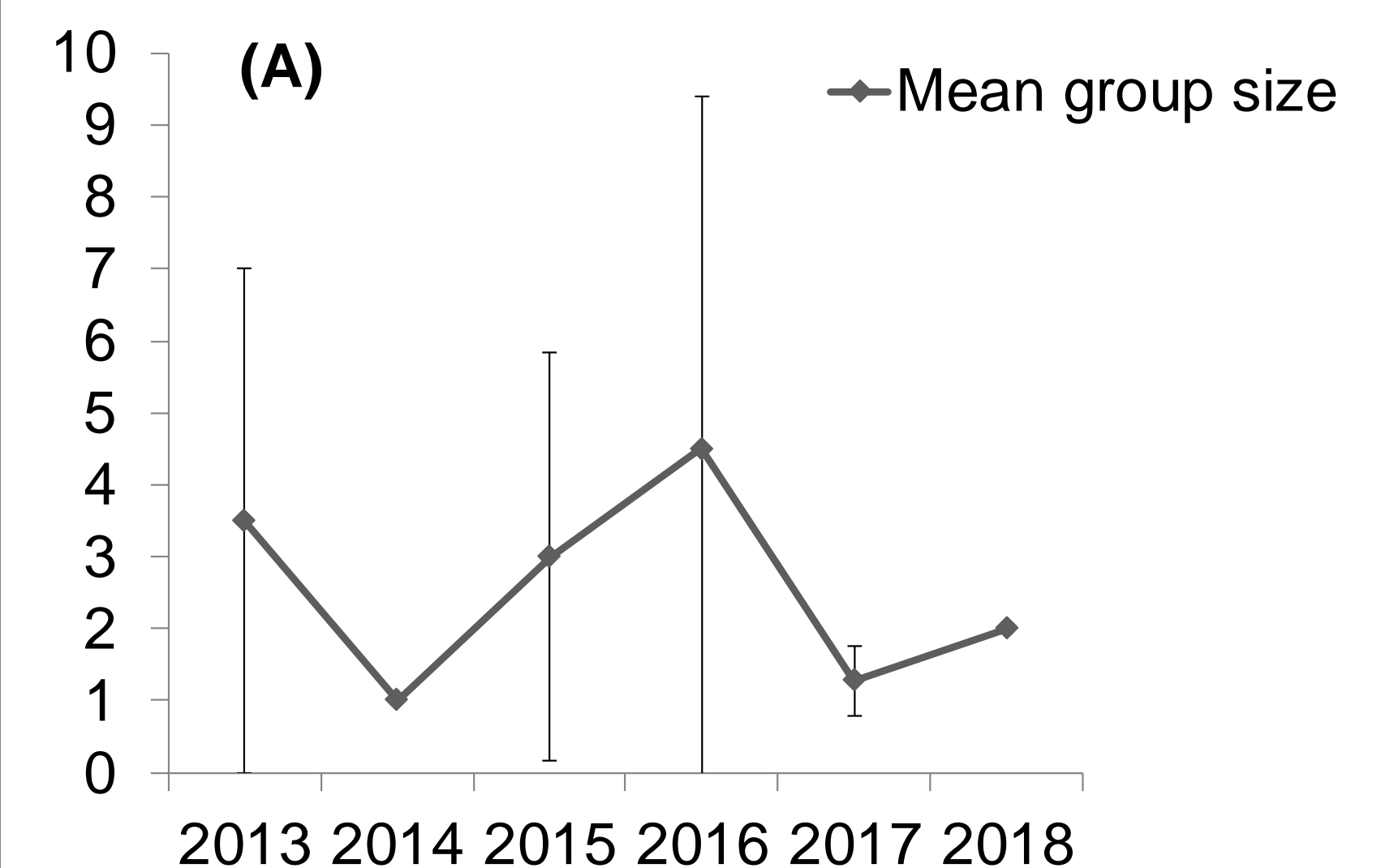
## RESULTS AND CONCLUSIONS

Totally 42 sperm whales were sighted on 20 sightings and 24 individuals photo-identified and included in the catalogue (Figure 2). Only 1 sperm whale was resighted in 2013 and in 2014 (in June and September) (Figure 3). The mean ( $\pm$  St. Dev) group size was  $2.10 \pm 2.01$ , ranging from 1 to 8, with the larger groups sighted on summer season (6 individuals in 2013 and 8 individuals in 2016) (Figure 4). The occurrence was higher in summer ( $n=9$ ) than in spring ( $n=6$ ) and autumn ( $n=5$ ) ranging from March to November months (Figure 5). Of 19 located encounters, 68.4% ( $n=13$ ) were at depth > 1000 m. Only 2 encounters in early spring were recorded in shallow waters (depth < 500 m), near the Strait of Messina (Figure 1). The sex and age of the individuals was determined for 22 whales (52.4%): 9.5% ( $n=4$ ) were calves, 31% ( $n=13$ ) immatures (12 males and 1 female) and 11.9% ( $n=5$ ) adults (only females) (Table 1). The most frequent type of encounters were solitary individuals (60%) followed by clusters (30%) and social units (10%); no bachelor groups were observed (Figure 5). These results suggest that the Aeolian Archipelago, in Southern Tyrrhenian Sea, is an important stepping-stone and potential breeding ground for Mediterranean sperm whales. Further results will be needed to estimate sperm whale distribution, abundance and behaviour in this area. Long-term photo-id efforts and comparison of data from other Mediterranean areas are also needed.

## Sperm whale group for season



**Figure 5.** The different types of encounters were analysed for season.



**Figure 4.** The mean group for (A) year and (B) season.