



**OLIVE RIDLEY PROJECT**

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# Coming out of their shells: Repeatable social preferences in Green sea turtles *Chelonia mydas*

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## Introduction

Social behavior profoundly influences animals survival and reproduction, yet the study of social behavior has primarily focused on certain vertebrates. Reptiles, often deemed non-social, are understudied due to their elusive behaviour compared to their bird and mammal counterparts (Doody et al. 2023). Recent observations challenge this notion of non-sociality, specifically in sea turtles, highlighting courtship interactions (Schofield et al. 2022). However, there remains a gap in understanding non-reproductive social behavior, particularly in the context of resting sites.

This study dives into the social behavior of resting sea turtles, aiming to address two hypotheses: firstly, investigating the tolerance to grouping, particularly among different life stages; and secondly, exploring the repeatability of social associations to determine if specific individuals consistently interact with each other. Conducted at Hithadhoo Corner, Laamu Atoll, in the Maldives, this study used photo identification (Fig. 1) to understand specific individuals social behavior during resting.

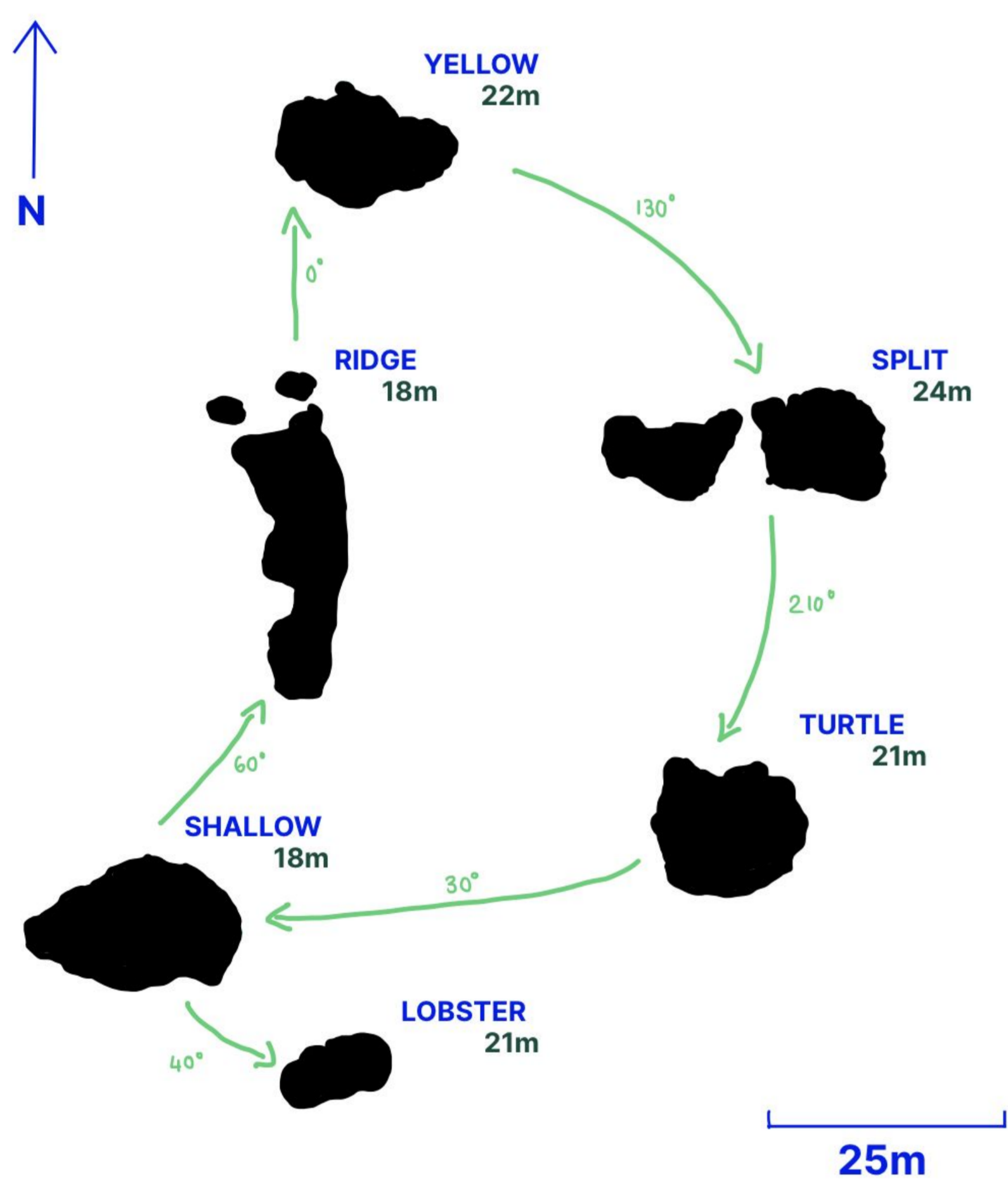


**Fig 1:** Researcher taking photos of facial scales of an individual encountered at Split block, Hithadhoo Corner, Laamu Atoll, Maldives.

## Methods

Data collection occurred at Hithadhoo Corner, Laamu Atoll, a site consisting of six distinct coral bommie cleaning stations, hereafter named blocks (Fig. 2), conducted under permits issued by the Maldivian Environmental Protection Agency and the Ministry of Fisheries and Agriculture (permit numbers EPA/2023/PSR-T05, FishAgri: NRP2023/35). Each encountered sea turtle at this site was photographed for identification, noting their resting block, estimated straight carapace length, sex and life stage.

Associations were defined as instances where two turtles were observed resting on the same block during the same dive event. Bayesian analysis via MCMC GLMM examined the influence of different life stages and genders individual associations. The Simple Ratio Index (SRI) calculate the strength and repeatability of associations, considering the frequency of observed associations, the instances they were observed at the site alone, or both at the site but on different blocks (Hoppitt and Farine, 2018). This was completed for each associating pair of turtles observed throughout the study.



**Fig 2:** Map of Hithadhoo Corner, (1°47'53.76" N 73° 24'35.99" E), the study site, to scale. The black shapes refer to the coral bommie block, on which the turtles rest, with labels and depths.

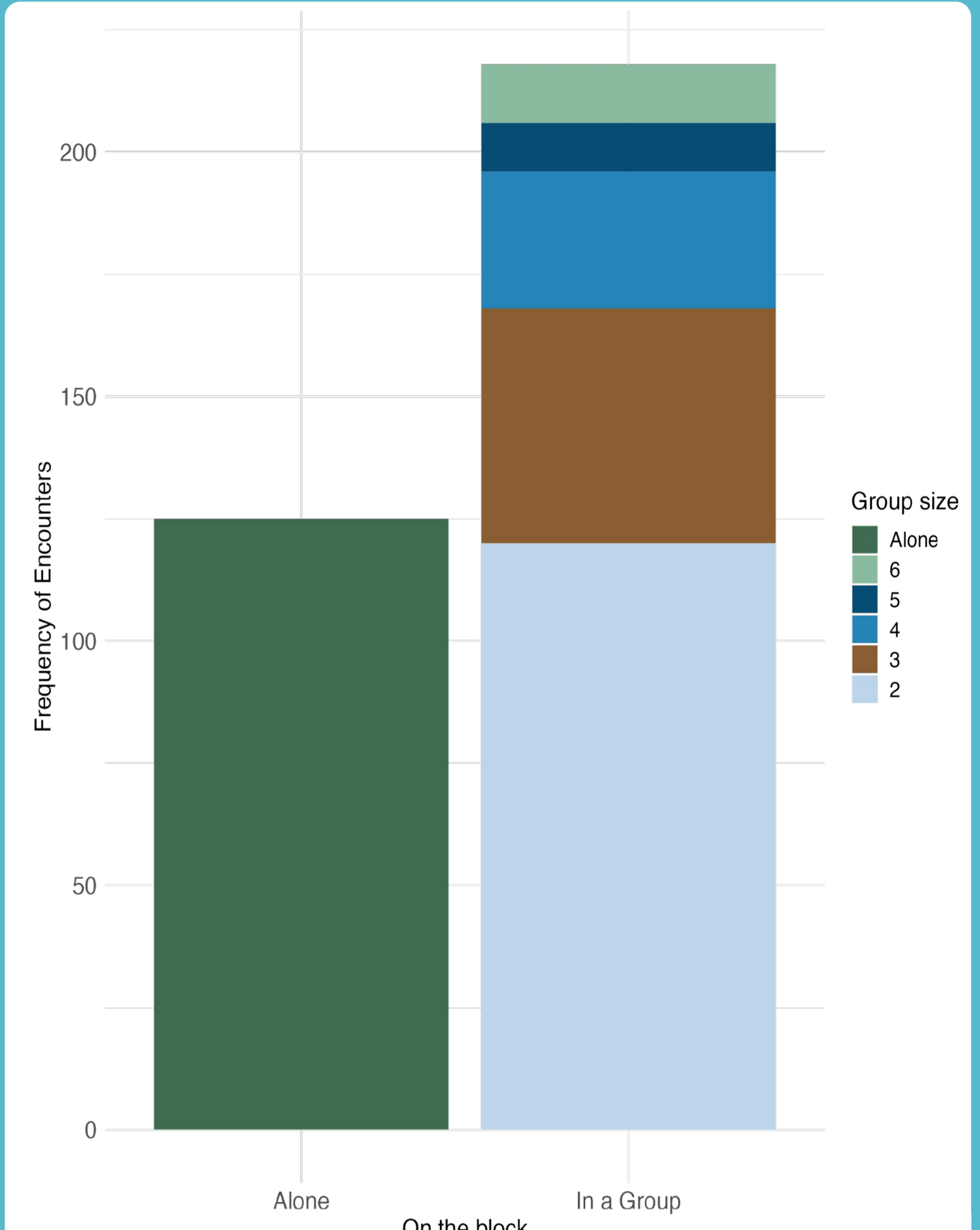
## Results

During 76 surveys at Hithadhoo Corner, 51 individuals were recorded across 332 encounters, averaging 6.51 sightings (SD = 1.07) per turtle. Turtle block emerged the most frequented resting site. 64% of the sighting involved adults turtles, reflecting the population demographics observed at this resting site.

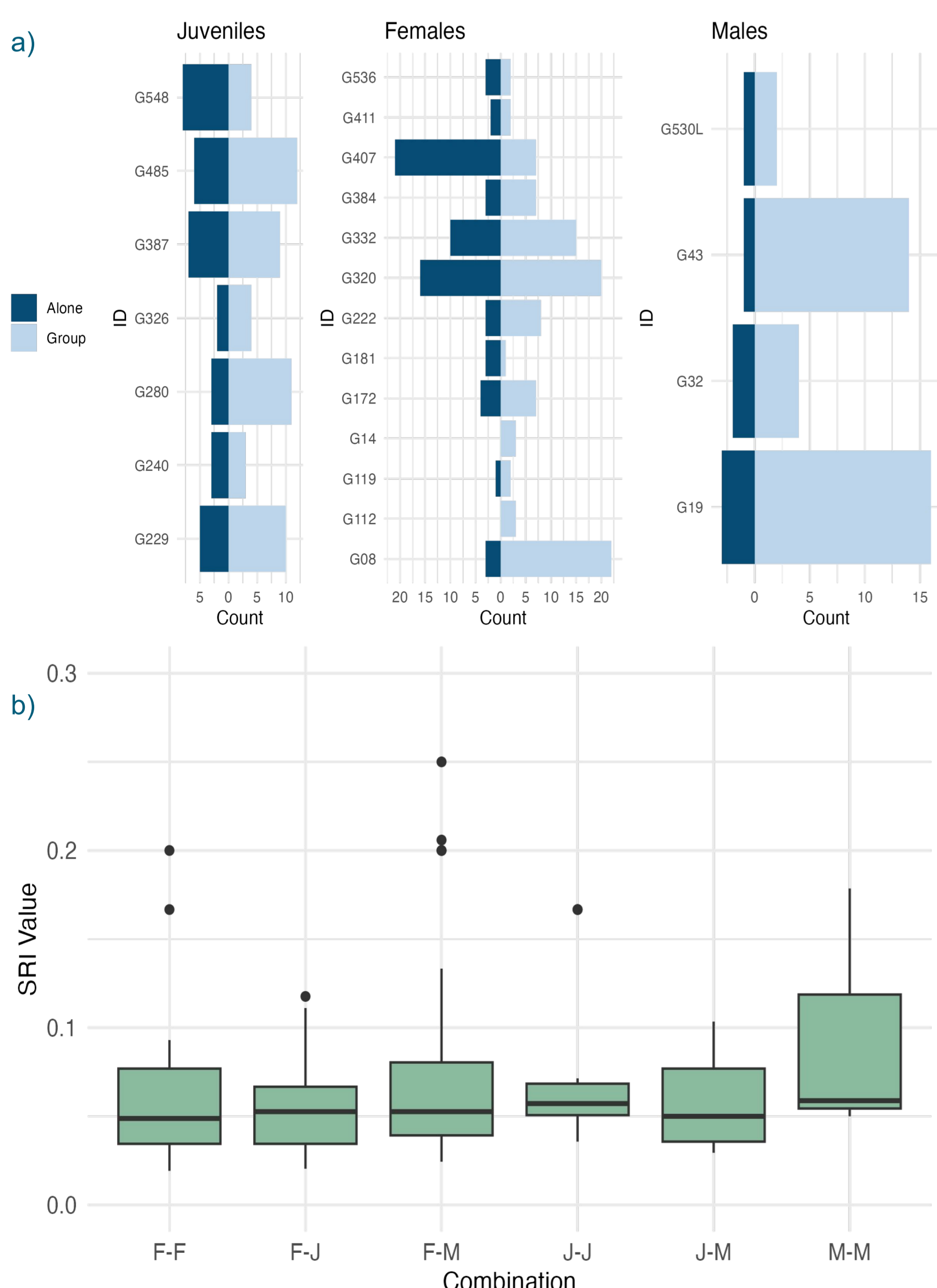
The key finding was that 62% of encounters observed turtles resting in groups, with sizes ranging from 2-6 individuals, with pairs being the most common (Fig. 3). Bayesian analysis revealed significant effects of life stage and sex on the degree of association, with adult males displaying the highest affinity to grouping (Fig 4a). Whilst juveniles had the lowest propensity to associate.

Throughout the surveys, 124 different pairs were observed, averaging 1.43 sightings per pair (range 1-8). Females and juvenile pairs were most commonly observed associating pairs (n=34), however with limited repetitions of these associations.

SRI to test for the strength of associations, indicated a moderate level of strength of associations (average 0.08). Male-male and male-female associations exhibited the highest average strength values (Fig 4b).



**Fig 3:** Frequency of different groups sizes observed across the survey period. Number of individuals encountered on a block at one time; referred to as a group, n = 85.



**Fig 4:** (a) The tendency for an individual to be found alone on a block or within a group of other individuals, split by life-stage and sex. This includes individuals encountered 3 or more times across the survey period; n = 24. (b) The SRI value for each observed pair, split by demographics F (female), M (male), J (juvenile).

## Discussion

The tendency of sea turtles to rest alongside others in this study continues to challenge the historical notion of them as non-social animals. This behavior may offer fitness benefits such as predator avoidance; grouping can provide safety through the dilution effect. Fitness benefits are also seen from resource sharing, especially considering the optimal resting conditions at the study site, characterised by suitable depths and proximity to foraging areas (Hart et al., 2016).

While all individuals showed a propensity for grouping, adults exhibited higher association rates, consistent with patterns observed in other vertebrate species, where we see adults have developed greater tolerance (Rosati and Santos, 2017). Aggressive interactions, involved individuals of different sizes, were commonly observed, suggesting juveniles may avoid group associations to minimize harassment.

Further work to understand the 'why' behind these social interactions is an important next step, and by understanding the drivers, we can use these insights to adapt conservation and protection strategies for these threatened species (Gaos et al. 2021).

## Selected references

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