

# WHAT CAN 5.5-YEAR OF PHOTO-ID DATA TELL ABOUT THE SEA TURTLE POPULATION DYNAMICS AND HABITAT USE IN A COASTAL FORAGING GROUND? A CASE STUDY FROM SOUTHERN KENYA



OLIVE RIDLEY  
PROJECT-KENYA

Registered NGO EPFPPJ6

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## Introduction

Kenya's coastline, a global biodiversity hotspot, provides critical habitat for sea turtles. To address knowledge gaps and inform effective conservation strategies within the Diani-Chale Marine National Reserve (DCMNR), a long-term photo-identification study was initiated in 2018.

### Goal:

Employ open capture-recapture models to estimate sea turtle population dynamics, including size, recruitment, and departure rates, while assessing changes in site fidelity and residency durations, using photo-ID data.

## Methodology

**Model:** Bayesian Capture-Recapture Robust Design  
**Data:** Capture-recapture photo ID data collected during diving surveys from 10 sites (Greens) and 8 sites (Hawksbills)  
**Time:** July 2018-December 2023

### ASSUMPTIONS:

- No movement between sites.
- No temporary emigration.
- Site association based on frequent detections.
- Uneven survey effort accounted for.

### STATES:

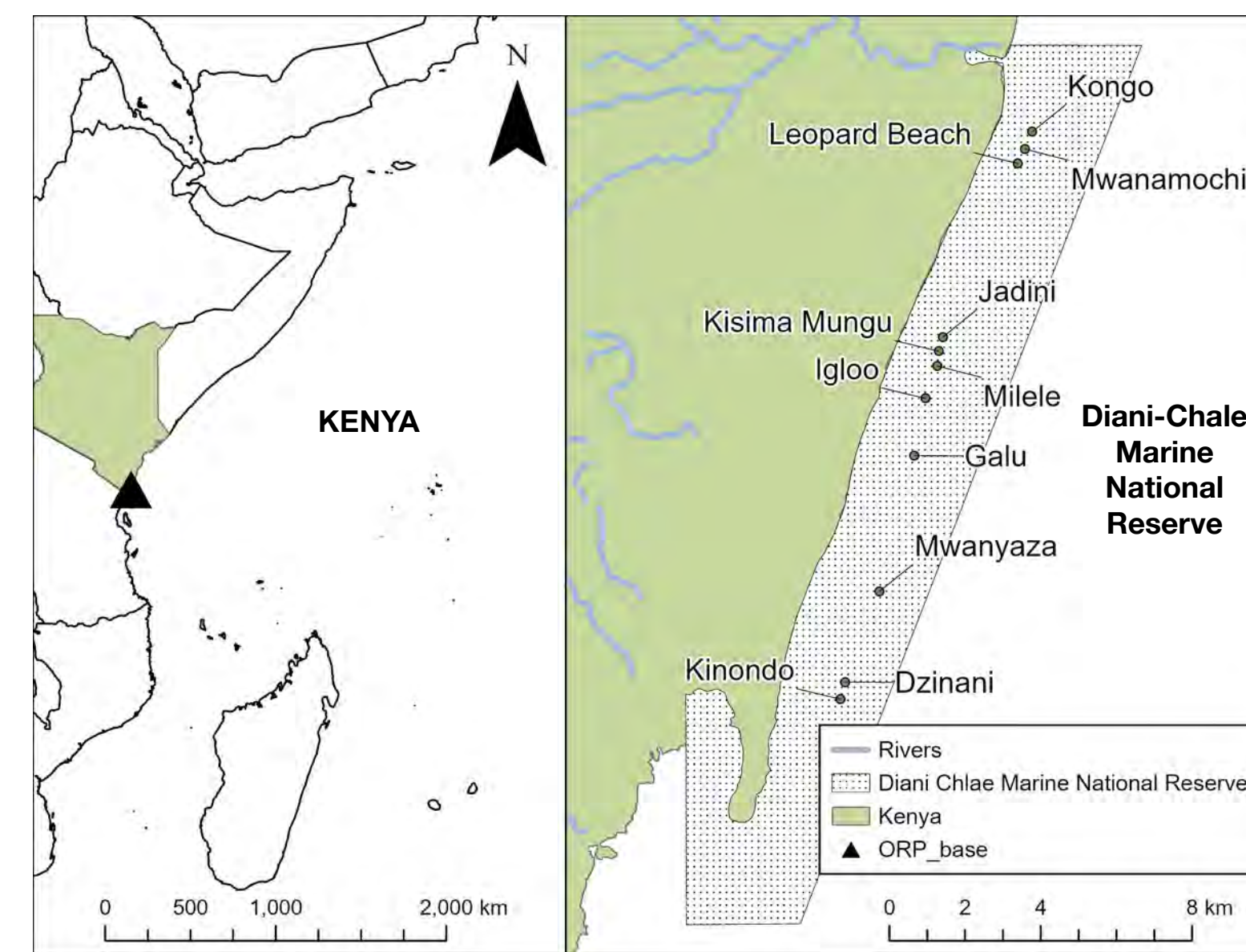
- Not recruited.
- Present.
- Departed (permanent)

### KEY PROBABILITIES:

- Recruitment ( $\psi$ ): Probability of entering the reserve.
- Persistence ( $\phi$ ): Probability of staying in the reserve.
- Detection ( $p$ ): Probability of observing a turtle when present.

$\psi$ : modelled with a random effect for year  
 $\phi$ : modelled with random effects for both site and year  
 $p$ : modelled with a site-specific random effect and a function that increases detection probability with increased survey effort

## Study Site



## Results



**GREEN SEA TURTLE**  
*Chelonia mydas*

**Total Encounters:**  
3,095

**Unique Individuals Identified (Photo-ID):**  
648

**Size Class at First Sighting:**  
Juveniles: 582  
Subadults: 38  
Adults: 16

**Re-sighted Individuals:**  
377 (61.7% of identified individuals)

### A. AVERAGE POPULATION PER SITE

SITE	MEDIAN	LOWER CI	UPPER CI
Jadini/Kisima	55.5	53	59.5
Kongo	46.5	41	53.5
Galu	42.5	40.5	46
Mwanamochi	32	29	35
Milele	29	27	32
Mwanyaza	17	14	22
Igloo	9	6	13.5
Tiwi Wall	8	4.5	12.5
Dzinani	5	3.5	8
Kinondo	3.5	1.5	6.5

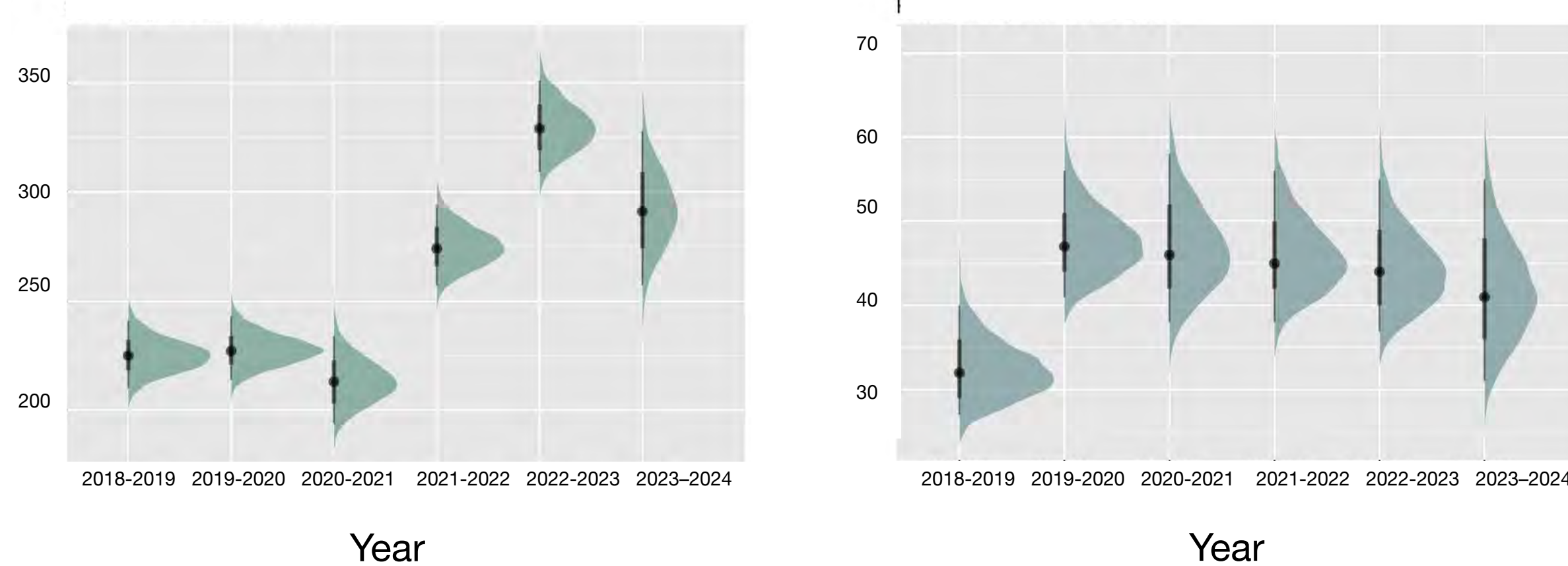
### B. AVERAGE ANNUAL GROWTH RATE



**Median**  
**+ 5.08%**  
**Credible Intervals**  
2.37 – 7.62%

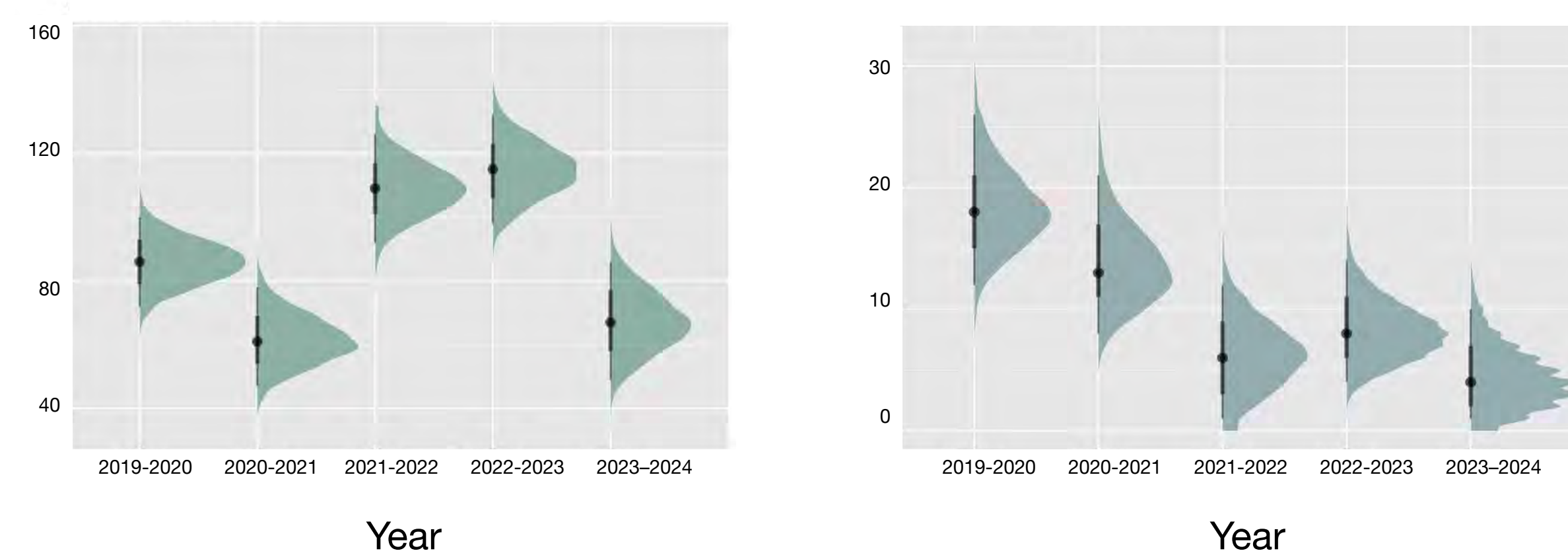
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### 1. ANNUAL ESTIMATED TOTAL POPULATION OF TURTLES\*

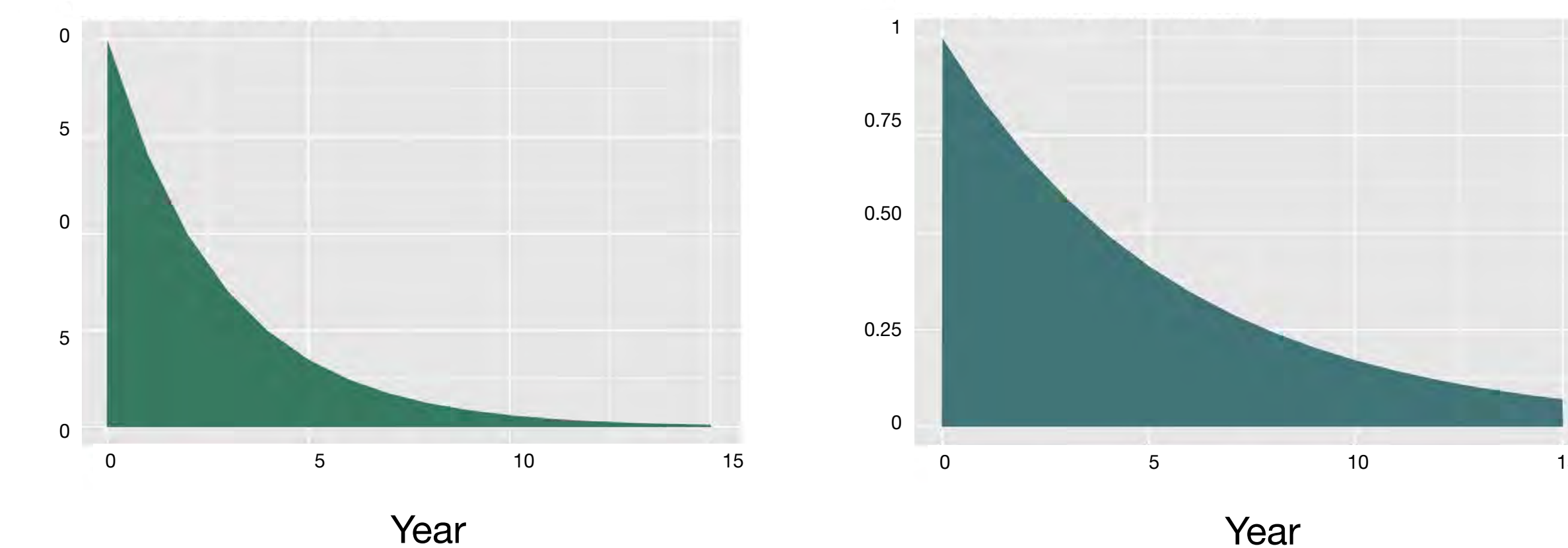


\*The first year of observation estimated a lower population size (1) due to a lack of resighting potential

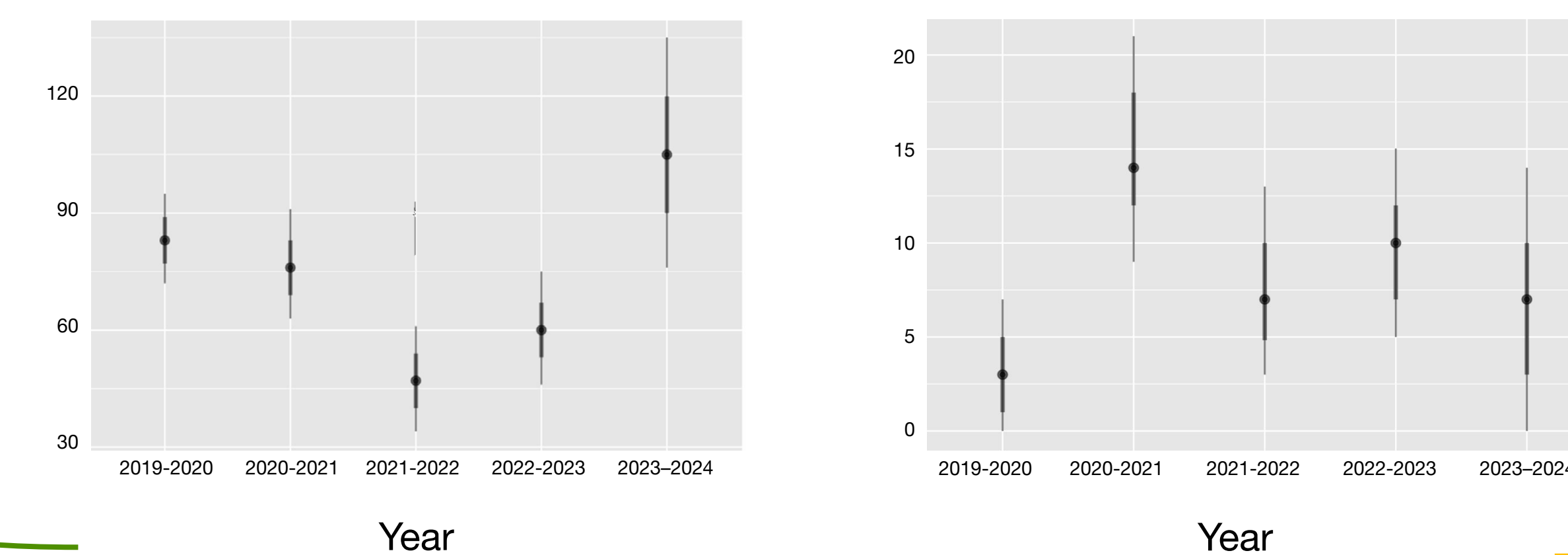
### 2. ANNUAL RECRUITMENT RATES (turtles entering reserve)



### 3. RESIDENCY DURATION (yearly survival probability)



### 4. YEARLY DEPARTURE RATES



**HAWKSBILL SEA TURTLE**  
*Eretmochelys imbricata*

**Total Encounters:**  
611

**Unique Individuals Identified (Photo-ID):**  
81

**Size Class at First Sighting:**  
Juveniles: 65  
Subadults: 19  
Adults: 1

**Re-sighted Individuals:**  
50 (61.7% of identified individuals)

### A. AVERAGE POPULATION PER SITE

SITE	MEDIAN	LOWER CI	UPPER CI
Mwanyaza	13	8.5	21.5
Jadini/Kisima	8	8	9
Galu	5.5	5	7
Milele	5	4.5	6
Mwanamochi	5	4	6
Kongo	2	1	4
Tiwi Wall	2	1	4
Igloo	1	1	2

### B. AVERAGE ANNUAL GROWTH RATE



**Median**  
**- 2.52%**  
**Credible Intervals**  
-7.97 – 2.59%

## Discussion

- The Diani-Chale Marine National Reserve (DCMNR) provides critical habitat for significant populations of green and hawksbill turtles along Kenya's southern coast. Spatial analysis identified key foraging hotspots, revealing variable species distribution (A). Jadini/Kisima and Galu are vital for both species, while Mwanyaza is primary for hawksbill turtles and Kongo for green turtles. We recommend that these sites have targeted management within the DCMNR including enhanced monitoring and protection.
- Size and species distribution confirm DCMNR as a key developmental habitat for juvenile green turtles. Temporal trends showed increasing green turtle populations and slightly decreasing hawksbill populations, reflected in annual population growth rates (B). Hawksbill decline is attributed to reduced recruitment (2) and increased emigration (4), potentially linked to a higher sub-adult percentage.
- Despite decline, modeling demonstrated higher hawksbill turtle persistence within the DCMNR (3), consistent with the reserve's extensive coral reef ecosystem, and underscoring the conservation importance of DCMNR.
- Photo-identification proved effective, offering potential for wider application in understanding sea turtle connectivity and habitat use along the Kenyan coast.

## Selected References and Acknowledgements

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