

EDSON DE JESUS DELGADO MANGUEIRA

Nº 82329

**TEMPORAL VARIATIONS IN PHENOLOGICAL PATTERNS OF
OLIVE RIDLEY TURTLES (*LEPIDOCHELYS OLIVACEA*) IN
MANONO-BENTIABA, ANGOLA**



UNIVERSITY OF ALGARVE

Faculty of Science and Technology

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MANONO-BENTIABA, ANGOLA

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Declaro ser o autor deste trabalho, que é original e inédito. Autores e trabalhos consultados estão devidamente citados no texto e constam da listagem de referências incluída.

Declaration of work authorship

I declare I am the author of this work, which is original and unpublished. Authors and works consulted are properly cited in the text and included in the reference list.

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Abstract

Sea turtles are migratory reptiles with a complex life cycle. Of the seven recorded species of sea turtles, three use Angolan waters: the leatherback, the green turtle and the olive ridley, which are confirmed as species that nest in Angola. Sea turtles play an important role in maintaining the balance of marine ecosystems, as they are marine and terrestrial bioindicators, participate in food chains and energy transfer, and have sociocultural and economic value.

The decline in the sea turtle population is a cause for concern for their conservation, since all species are on the Angolan red list of species. Threats from climatic factors (temperature, precipitation, humidity, erosion, flooding, disease) and anthropogenic pressures (hunting and egg collection, coastal occupation and development, habitat degradation and high-powered vessels in sensitive areas) can influence the decline of these populations.

In this context, the present study aims to examine the phenological patterns of *Lepidochelys olivacea* in Angola, with a specific focus on the Bentiaba region from 2018 to 2022. The surveys were conducted between September and March from 2018 to 2019 and from 2021 to 2022. The results showed a total of 264 nests during this period with declines in nesting and consequently in turtle hatching from 2018 to 2022, with 133 nests in the 2018-2019 season and 131 nests in the 2021-2022 season. October and December of 2018, February and March of 2019, presented with the highest egg density, while February and March of 2022, presented with the lowest egg density. November and December of 2021, and February and March of 2022, were the months with the highest mortality rate.

This study includes monitoring nesting sites where eggs are laid and inspected, providing a baseline for conservation to identify the main stages where declines in nests, eggs and neonates occur.

Keywords: Sea turtles; phenological patterns; vulnerable species; natural and anthropogenic threats; conservation.

Resumo

As tartarugas marinhas são répteis migratórios com um ciclo de vida complexo. Das sete espécies registadas de tartarugas marinhas, três usam águas angolanas: a tartaruga-de-couro, a tartaruga-verde e a tartaruga-oliva, que são confirmadas como espécies que nidificam em Angola. As tartarugas marinhas desempenham um papel importante na manutenção do equilíbrio dos ecossistemas marinhos, pois são bioindicadores marinhos e terrestres, participam de cadeias alimentares e transferência de energia e têm valor sociocultural e económico.

O declínio da população de tartarugas marinhas é motivo de preocupação para sua conservação, uma vez que todas as espécies estão na lista vermelha de espécies angolana. Ameaças de origem climáticas (temperatura, precipitação, humidade, erosão, inundações, doenças) e pressões antropogénicas (caça e coleta de ovos, ocupação e desenvolvimento costeiro, degradação de habitat e embarcações de alta potência em áreas sensíveis) podem influenciar o declínio dessas populações.

Neste contexto, o presente estudo visa examinar os padrões fenológicos de *Lepidochelys olivacea* em Angola, com foco específico na região de Bentiaba de 2018 a 2022. As amostragens foram realizadas entre Setembro e Março de 2018 a 2019 e de 2021 a 2022. Os resultados mostraram um total de 264 ninhos durante este período com declínios na nidificação e consequentemente na eclosão de tartarugas de 2018 a 2022, com 133 ninhos na temporada 2018-2019 e 131 ninhos na temporada 2021-2022. Outubro e Dezembro de 2018, Fevereiro e Março de 2019, apresentaram a maior densidade de ovos, enquanto Fevereiro e Março de 2022, apresentaram a menor densidade de ovos. Novembro e Dezembro de 2021, e Fevereiro e Março de 2022, foram os meses com maior taxa de mortalidade. Este estudo inclui o monitoramento dos locais de nidificação onde os ovos são depositados e inspecionados, fornecendo uma linha de base para a conservação, afim de identificar os principais estágios onde ocorrem declínios populacionais de *L. olivacea*.

Palavras-chave: Tartarugas marinhas; padrões fenológicos; espécies vulneráveis; ameaças naturais e antropogénicas; conservação.

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1. Introduction

Sea turtles are reptiles that existed more than 200 million years ago with representatives of the order Chelonia. They have undergone almost no metamorphosis (which is why it is said that turtles are living dinosaurs!) (Camacho, 2023). Sea turtles are creatures that are very long-lived, grow slowly and use multiple types of habitats during their life cycle (Heppel *et al.*, 2003; Ribeiro, 2018). Throughout their evolution, several transformations have allowed these animals to adapt and survive in new habitats. In the case of sea turtles, their shells have become flatter (dented), making them lighter and more hydrodynamic, and their legs have become flippers, allowing them to move more efficiently underwater. Another important adaptation was the emergence of salt glands, located near the eyes. The tears observed in nesting females are salt secretions expelled through these glands (Lutz, 1997). Their bodies are divided into two parts, the dorsal portion (carapace) and the ventral portion (plastron) (Ernest & Barbour, 1989), which are connected by bony bridges located laterally on the body. They are marine lung-bearing creatures with a great capacity to remain underwater, whether at rest or in search of food. This capacity is the result of the efficient distribution of oxygen throughout the body. They have highly developed vision, smell and hearing, as well as an excellent ability to orient themselves (Lohmann *et al.*, 1997).

The reproductive biology of turtles has been studied based on the number of nests, clutch size, incubation time, hatching success, number of hatchlings, biometrics and marking of females (Marcovaldi *et al.*, 1999). These organisms have complex life cycles, which involve very long generation times, late sexual maturation, transoceanic migrations and alternation of habitats and food resources (Márquez, 1990; Bolten, 2003; Luschi *et al.*, 2003). Due to this complexity, there are still numerous gaps in knowledge about these animals and because they are shared biological resources, since they do not recognize political borders between countries, collective management and conservation efforts are required (Reis & Goldberg, 2017).

Turtles have a random polygyny system, with males trying to mate with as many females as possible without establishing territories (Fitzsimmons, 1996), which is why a single female can lay more than one egg in a single season. They take more than a decade to reach sexual maturity, with references to 20 to 30 years, depending on the species (Meylan & Donnelly, 1999). Each nest, depending on the species, houses an

average of 120 eggs (Santos *et al.*, 2011). In approximately 50 to 70 days, the hatchlings are born and will emerge from the sand, usually at night, when the temperature is milder, guiding themselves to the sea by the reflection of the waves' shine, and are then carried by the waves to the open sea. They remain in pelagic habitats where they are passively carried by ocean currents away from their birth beaches, only reappearing on the coast in feeding areas, as juveniles (Bowen *et al.*, 1995; Camacho, 2023).

Some authors suggest that newborns (little turtles) memorize the chemical composition of water and the earth's magnetic field (“imprinting”), presenting magnetite crystals in their brains, the most magnetic lodestone on earth. This mineral is used to make compasses and can be found in the form of igneous and metamorphic rocks as well as in meteorites (Musick & Lutz, 1997; Santos, 2017).

Some experiments suggest that sea turtles can detect the angle and intensity of the Earth's magnetic field and determine their latitude and longitude, and thus their position in the open ocean (Lohmann & Lohmann, 2006). Other theories suggest mobility through reference navigation of stars, the sun, ocean temperatures, sea currents, geological features or wave patterns (Gulko & Eckert, 2004).

During their reproductive process, turtles must seek out spawning sites that can provide both a relatively safe shelter for their eggs and the heat needed to ensure incubation and hatching of their young. For species that have sex determination dependent on environmental characteristics, factors extrinsic to biology generally affect their reproduction. For these species, the incubation period is one of the most critical moments in the lives of these animals. Understanding how the physical environment influences nest temperature is essential to understanding the factors that govern sex determination in turtles (Junior, 2009).

Sea turtles have a complex life cycle that involves occupying diverse habitats (terrestrial, oceanic and coastal) (Hays & Scott, 2013; Dellinger *et al.*, 2022), with a circumglobally distribution, swimming in tropical, subtropical and temperate waters (IUCN Marine Turtles Specialist Group - Green Turtle Task Force, 2004). Sea turtles can travel great distances, migrating between feeding and breeding areas, with everyone always returning to the beach of origin to carry out its reproductive process. This behavior is known as philopatry (Bowen, 1995; Reece *et al.*, 2005; Simões, 2022). Of the seven existing species of sea turtles, five of them are found in Angola, namely:

leatherback turtle (*Dermochelys coreacea*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*) and loggerhead turtle (*Caretta caretta*) (Morais, 2014; Camacho, 2023). Of these five documented species of sea turtles that use the territory of Angolan waters, the *D. coreacea*, *C. mydas* and *L. olivacea* are confirmed as species that nest in Angola, with *L. olivacea* being the most common and abundant (Alves Primo *et al.*, 2022). Sea turtles have survived numerous extinction events throughout their history on Earth. However, with the increase in human populations, some turtle populations have been declining and are close to extinction, with the majority in decline or already in very low numbers (Bjorndal *et al.*, 1999; Balazs & Chaloupka, 2004; Witherington *et al.*, 2009). In addition to direct capture, the main causes of mortality are accidental capture in fishing gear, ingestion of debris, disease and the widespread loss or degradation of coastal habitats (Eckert, 1995; Simões, 2022). These factors, in combination with a late age at maturity, make population recovery slow and difficult (Crouse *et al.*, 1987; Simões, 2022). Their highly migratory and oceanic lifestyle has made research on the species difficult, with research being mostly restricted to the study of nesting females and newborns, which has led to conservation programs focusing only on protecting nesting beaches (Sousa, 2021; Dellinger *et al.*, 2022). The protection of aquatic habitats, used by turtles, is of great importance for effective conservation of the species, since breeding individuals and feeding and development areas for juveniles play a fundamental role in maintaining populations (Maxwell *et al.*, 2011). However, their oceanic life stage is the least known and understood (Bolten, 2003b; Simões, 2022).

Climate change, with rising temperatures and changes in precipitation patterns, together with loss of coastal vegetation and urbanization, are direct and indirect threats to numerous species that inhabit or use coastal habitats (Pacifci *et al.*, 2015; Ariano-Sánchez *et al.*, 2023). Furthermore, climate change and coastal development have been shown to have direct (negative) effects that may compromise the resilience of some coastal-associated species (Ariano-Sánchez *et al.*, 2023).

Sea turtles are particularly vulnerable because they are affected by climate change in multiple ways, also due to their dependence on different habitat types throughout their life history (Patrício *et al.*, 2019; Patrício *et al.*, 2023). However, since sea turtles migrate and forage over large spatial distances, they are expected to be more resilient to climate change during their oceanic life stages than during their coastal life stages. On

land, climate change poses several threats to sea turtles. One of the most important is the increase in sand temperature on nesting beaches and the resulting consequences for egg incubation in nests (Patrício *et al.*, 2023). In this context, it is crucial for conservation strategies to produce information that can help assess hatching success (Mazaris *et al.*, 2017; SEMARNAT, 2018). This study provides monitoring activities at nesting sites where eggs are collected and relocated to hatcheries and serve as baseline for conservation actions aimed at identifying critical phases related to nest, egg, and hatchling losses.

1.1. Objective:

The present work aims to investigate the seasonal variations in phenological patterns of olive ridley turtles (*Lepidochelys olivacea*) in Manono-Bentiaba, Angola.

And it is divided in the following specific objectives: (i) to estimate the average egg rates per clutch (nests) per year and months; (ii) to analyse the patterns in live newborn *L. olivacea* turtles between 2018 and 2022; (iii) to examine the trends in the number of dead newborn *L. olivacea* turtles from 2018 to 2022; (iv) to evaluate the total egg of *L. olivacea* turtles between 2018 and 2022 and investigate its correlation with the number of live newborns;

2. Materials and Methods

2.1. Study area

Angola, located on the central west coast of the African continent (Morais *et al.*, 2006; Mangueira, 2017), has as its maritime borders, to the north, the Republic of Congo and the Democratic Republic of Congo and to the south the Republic of Namibia. The coastal extension is about 1650 km (between latitudes S 05° 00" and S 17° 25"). The Angolan coast is characterized by a continental shelf of up to 200 m, with around 51,000 km² and a peculiar configuration, being wide to the north and becoming more variable as it heads south (World Commission on Environment and Development, 1987; Sangolay, 2004; Morais *et al.*, 2006; Africano, 2014).

The Angolan coast is under the influence of a tropical (5° S to 13° S) and subtropical (13° S to 17° S) climate (Ehrlich *et al.*, 1977; Sangolay, 2004; Castro, 2015) and is divided into three regions, namely: northern region (5° S to 9° S), central region (9° S to 13° S) and southern region (13° S to 17° S) in which the study area is located. Off the

coast of Angola, ocean waters move under the influence of a mixture of surface and non-surface currents (Csir Environmentk, 2001; Erm, 2004; Morant, 2003; Morais *et al.*, 2006) and this division is related to the action of the currents that act on them (Anon, 1991; Castro, 2015). Two oceanographic regimes predominate in the Angolan region. The southward-flowing Angola Current is oxygen-saturated, warm, and highly saline, with nutrient-poor conditions and equatorial origin, influencing the coastal waters of northern Angola (Lass *et al.*, 2000; Baptista *et al.*, 2021). The Benguela Current is an oxygen-poor, cold, less saline, and nutrient-rich water mass flowing from the south in a north-westerly direction (Lass *et al.*, 2000; Lin & Chen 2002; Baptista *et al.*, 2021). The Benguela upwelling system, one of the largest upwelling systems in the world, extends from South Africa to Angola (Shannon & Nelson 1996; Baptista *et al.*, 2021). At about 16°S, the Angola-Benguela Front (ABF) represents a sharp but highly variable thermal front that separates the tropical and oligotrophic surface waters in the north from the cold, nutrient-enriched waters by upwelling in the south (Lass *et al.*, 2000 ; Mohrholz *et al.*, 2008; Baptista *et al.*, 2021). It is in the ABF zone where the two currents converge, the Warm Angola Current moving towards the South Pole and the Cold Benguela Current moving towards the Equator (Shannon & Nelson, 1996; Stramma & England, 1999). In this zone, coastal upwelling reaches its maximum peak between the months of August and October and its minimum from January to March (Hart & Currie 1960; Castro, 2015).

The study area covered the province of Namibia, Manono - Bentiaba between latitudes S14°06'41.24" and S14°09'33.19" (Figure 1), with 6 km of coastline, which is strongly influenced by the Benguela current. Bentiaba is a commune Angolan village located in the province of Namibia, belonging to the municipality of Moçâmedes. It is a coastal village, bathed by the Bentiaba River that forms a small oasis, where agriculture is carried out, in which fossils of marine reptiles from the Cretaceous period were discovered.

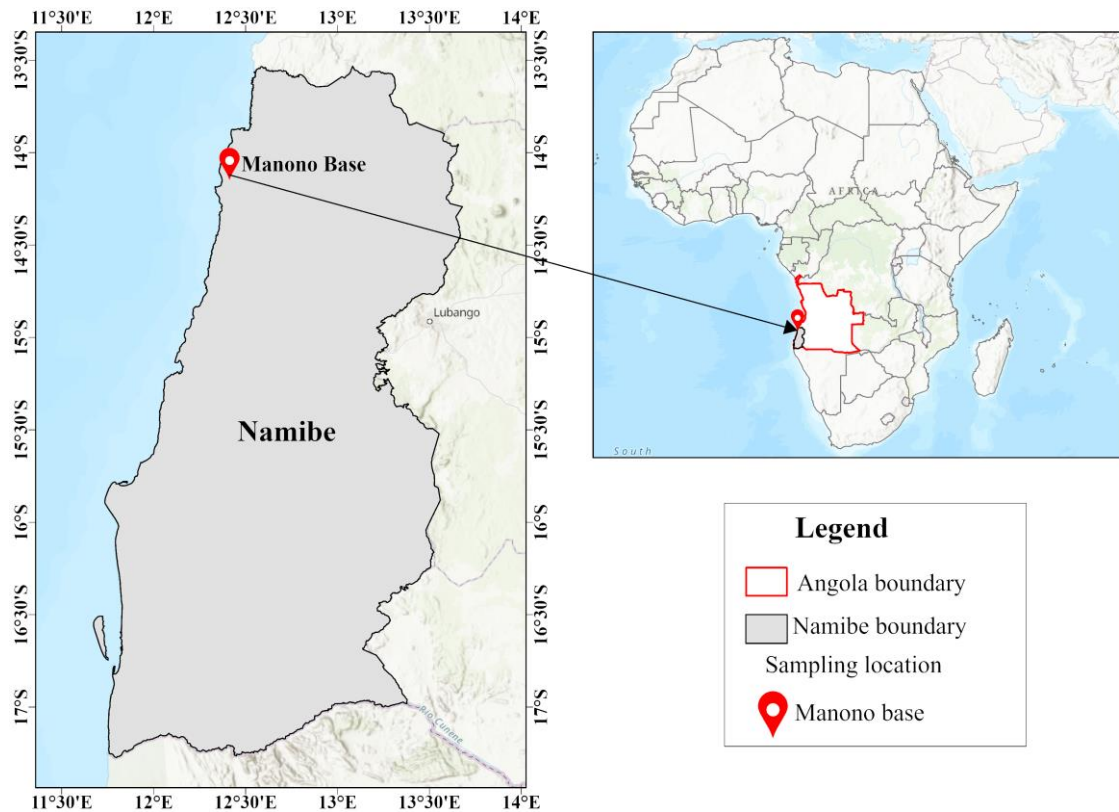


Figure 1: Sampling map of the Manono-Bentiaba monitoring line in 2018-2019 and 2021-2022.

2.2. Data collection

Data were collected during the 2018-2019 and 2021-2022 seasons, between latitudes S14°06'41.24" and S14°09'33.19". The study area was selected because it is an area monitored by the Kitabanga project, where the communities (Salinas - Manono) are involved in conservation. This aspect facilitated data collection, since it was done with the help of the members working on this project at each sampling point, thus allowing data to be obtained at several sampling points and simultaneously. Another reason is that the information coming from different latitudes of the coast can be seen as expressive and representative, allowing a comparative study and relevant information for conservation, at the level of the Angolan coast.

These surveys were carried out based on data collection and notation methodologies used by several authors (Pritchard *et al.*, 1983; Godley *et al.*, 2001; Bhupathy & Saravanan, 2002; Shanker *et al.*, 2003a; Shanker *et al.*, 2003b; Aguirre, 2004; Cruz *et al.*, 2006; Sandambongo, 2023). Nocturnal monitoring was based on direct observations and surveys (during the night), since nesting activity generally takes place during the night, also allowing records of the biometrics of nesting turtles. Daytime surveys of nesting activity were carried out through indirect observations, using fresh tracks or

traces that they leave during their activity, considering that each species has its own particularities in its tracks (Pritchard *et al.*, 1983; Sandambongo, 2023). These records were made daily in the early hours of the day, to record all the activity that occurred during the night, both in relation to the incidence of spawning and successful hatchings.

2.3. Nest marking

The nests observed during the monitoring period were marked with a properly labeled stake (laying date and target species). The identification of nests based on the tracks left was verified by pressing the stake on the nest bed and, in cases where there was actual nesting, the stake in that place sank quickly, proceeding to excavation and certification of the presence of eggs for later marking and effective monitoring. The position of each nest was recorded with a portable GPS device, Garmin brand, model Foretrex 301 and the information obtained during the daily patrol was entered into an open file, for each nest and in the general database of the Kitabanga Project.

2.4. Data Analysis

We tested the normality of variances of the residuals with Shapiro–Wilk and performed the non-parametric Kruskal–Wallis tests to analyze whether each year/month was significantly different for number of total eggs, live newborns and dead neonates. All analyses were performed in R (R Development Core Team, 2018) and RStudio v.3.6.6 (R Core Team, 2018).

3. Results

3.1. Phenological patterns of *L. olivacea*

The peak number of nests was observed in 2018, with 84 nests. This number declined to 49 in 2019. A recovery occurred in 2021, with the number of nests rising to 79, nearly reaching the 2018 level. Yet in 2022, the amount dropped to 48, marking the lowest number recorded across the studied years (Table 1).

Table 1: Number of *Lepidochelys olivacea* nests in the Manono - Bentiaba monitoring from 2018 to 2022.

Year	Number of Nests
2018	84
2019	49
2021	79
2022	52

A declining trend in the total number of eggs of *L. olivacea* turtle was observed from 2018 to 2022 (Figure 2). The highest values occurred in 2018, with a peak in October 2018 (Figure 6). Each year, however, experienced a decline, with the reduction reaching 25% by 2022 (Figure 2). This indicates a decrease in eggs over the analyzed period, particularly in January, February and March of 2022 (Figure 3), where reductions were more than 70% compared to peak in 2018.

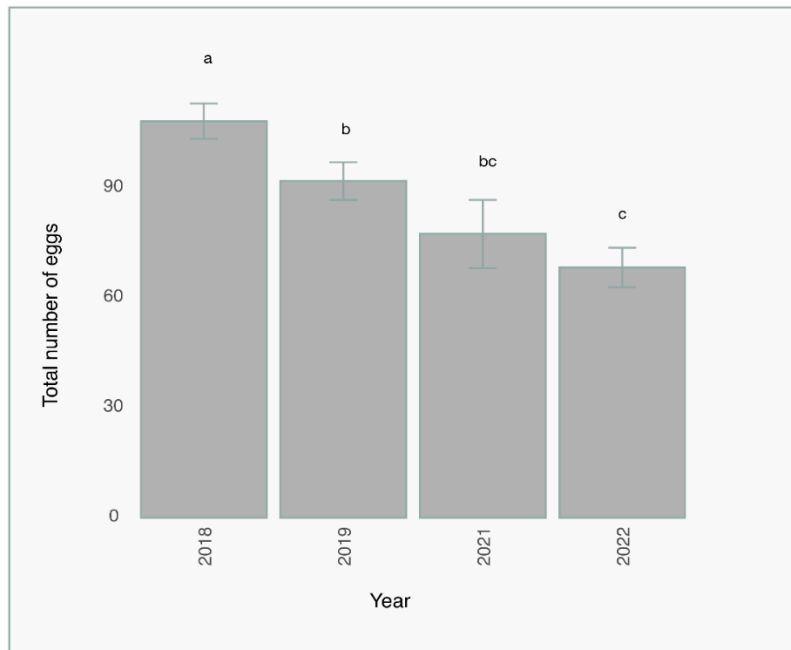


Figure 2: Total number of *Lepidochelys olivacea* eggs per year recorded on the Angola (Manono – Bentiaba) monitored during 2018, 2019, 2021 and 2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

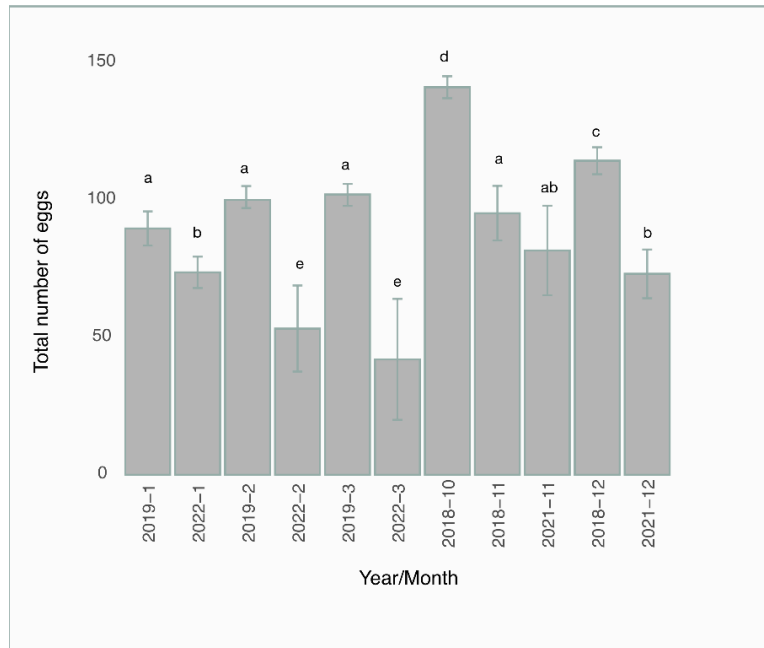


Figure 3: Total number of *Lepidochelys olivacea* eggs recorded in Angola (Manono – Bentiaba) across the years and months, monitored between September and March during the periods of 2018-2019 and 2021-2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

The scatter plot shows a positive correlation between the total number of eggs and the total number of live newborns of *L. olivacea* (Figure 4, $R = 0.88$, $p < 0.001$). This correlation shows that successful hatching is closely related to the initial number of eggs laid.

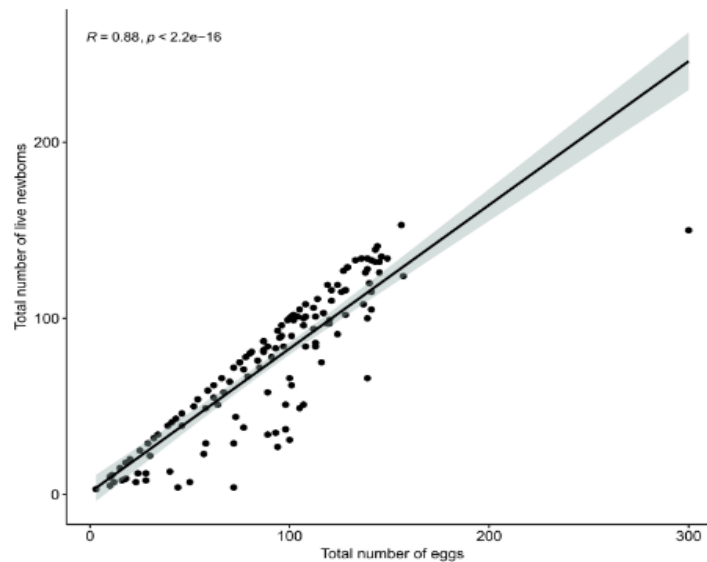


Figure 4: Scatter plot showing the relationship between the total number of eggs and the total number of live newborns of *Lepidochelys olivacea* in the Manono - Bentiaba monitoring line 2018, 2019, 2021 and 2022. The solid black line represents the linear regression fit, indicating a strong positive correlation ($R = 0.88$, $p < 0.001$) between the number of eggs and the number of live newborns. The shaded area around

the regression line represents the confidence interval, illustrating the expected variability in the relationship.

The decline was also evident in the total number of live newborn *L. olivacea* turtles recorded during field surveys (Figure 5). The highest numbers were found in 2018, with a peak occurring in October (Figure 6). However, every year thereafter showed a decline, culminating in a 25% reduction by 2022 (Figure 5). This trend suggests a decrease in live newborns across the study period, especially in February and March of 2019 and 2022 (Figure 6), with reductions surpassing 60%.

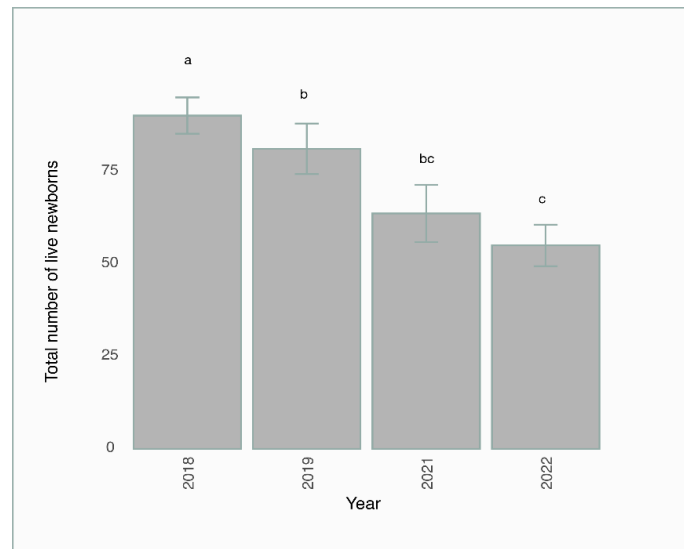


Figure 5: Total number of live newborns of *Lepidochelys olivacea* recorded in the Angola (Manono – Bentiaba) monitored during 2018-2019 and 2021-2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

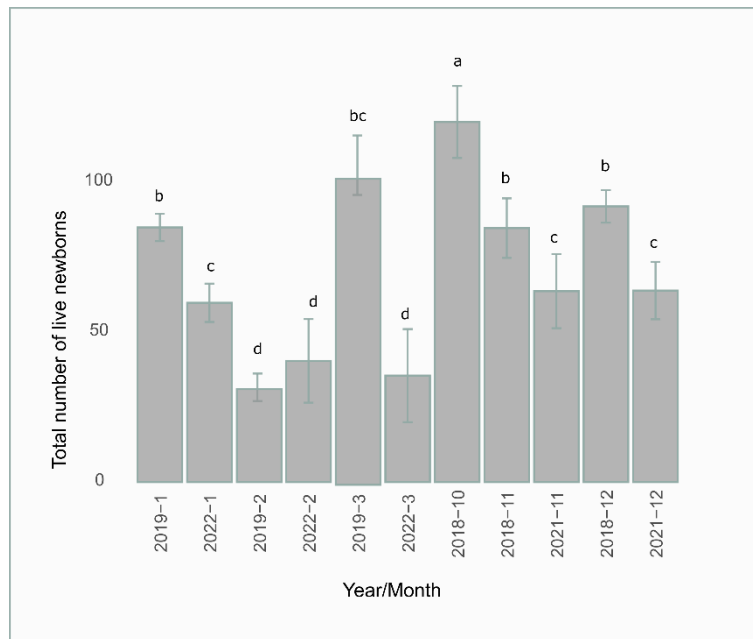


Figure 6: Total number of live newborns of *Lepidochelys olivacea* recorded in Angola (Manono – Bentiaba) across the years and months, monitored between September and March during the periods of 2018 to 2019 and 2021 to 2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

In contrast to the total number of live newborns (Figure 5), the highest numbers of dead eggs were recorded in 2021 and 2022, coinciding with a decline in successful hatchlings (Figure 5), especially during January and February of 2022. The peak in dead eggs occurred in November 2021 (Figure 7 and Figure 8).

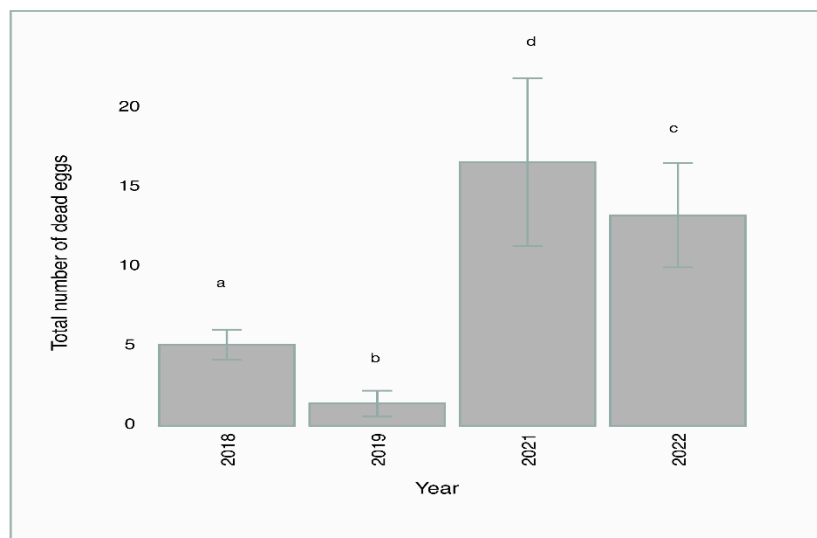


Figure 7: Total number of dead newborns of *Lepidochelys olivacea* per year recorded on the Angola (Manono – Bentiaba) monitored during 2018, 2019, 2021 and 2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

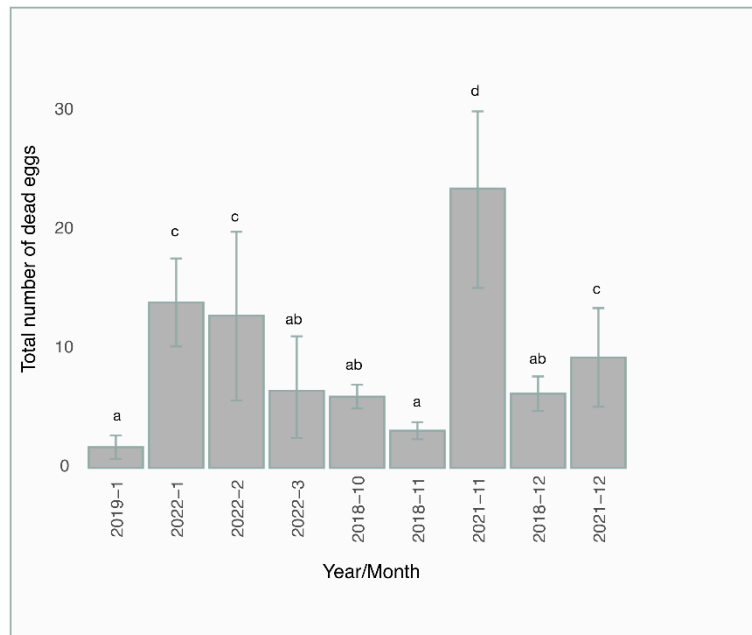


Figure 8: Total number of dead eggs of *Lepidochelys olivacea* recorded in Angola (Manono – Bentiaba) across the years and months, monitored between September and March during the periods of 2018 to 2019 and 2021 to 2022. Different lowercase letters show significant differences (kruskal-wallis test $p < 0.001$) based on Dunn’s multiple comparisons test.

4. Discussion

The present study reveals significant reductions in the number of nests, total number of eggs and live hatchlings of *L. olivacea* from 2018 to 2022, which coincide with an increase in dead nestlings observed during field surveys in Namibia Province (Manono-Bentiaba). The declines in both the number of eggs and live hatchlings, which reached 25%, were particularly pronounced during the first months of the year. The positive correlation between the total number of eggs and live hatchlings highlights the importance of protecting nesting sites to ensure the reproductive success. The increasing number of dead eggs in recent years, especially in 2021 and 2022, further indicates deteriorating nesting conditions, emphasizing the increasing challenges in protecting this vulnerable species. These results provide critical insights into the population dynamics of *L. olivacea*, underlining the need for enhanced conservation efforts to reverse the declines and protect its nesting habitats.

Despite being considered the most abundant of the seven sea turtle species, the olive ridley turtle has declined by 30-50% due to anthropogenic and climatic pressures (Cáceres-Farias *et al.*, 2022). From 2018 to 2022, there were some fluctuations in terms of the number of nests and consequently in the number of newborns (Morais *et al.*, 2018, 2020, 2022). According to Morais & Tiwari (2022), olive ridley turtle nesting

along the Angolan coast occurred during September–April, with few or no nests in May–August. Nesting onset varies with latitude, starting in September on the northern and central coast and in October in the southern region, since waters tend to become milder (warmer) towards the south in these months. Peak nesting generally occurred during November–January, identical to what occurred during the study (Figure 3). When comparing the various sampling locations for sea turtles in Angola (Cuio, Longa, Palmeirinhas, Kissebo, Soyo), Manono-Bentiaba presented lower spawning (nests) and, consequently, lower number of eggs. The low hatching rates can also be explained by the fact that the turtle makes several interruptions during the nesting process, having to return to the beach for new attempts (Miller, 1997 and Camacho, 2023).

This decline or fluctuation in the number of nests led *L. olivacea* to the status of Vulnerable species (Ministry of Environment - Red List of Species of Angola; IUCN, 2014). In Angola, from 2018 to 2023, there was a decrease in nests (Supplementary material 1), corroborating with the present study for 2023. This decrease in nests and consequently in turtle hatchlings can also be influenced by heat waves in such region (Supplementary material 2). The effects caused by heat waves alter the global average sea temperatures or even the amount of regional precipitation (Lima *et al.*, 2020), threatening sea turtles, since they are animals sensitive to temperature variations, influencing their migration, drastic sexual changes in some populations, and variation in food availability (Rodrigues, 2017; Reis & Goldberg, 2017).

Previously, the Gabon population was demonstrated to be the largest breeding population of this species in the Atlantic, with an estimated average distribution of 2.3709,814 broods with 9.485,452 females nesting annually (Metcalf *et al.*, 2015; Morais & Tiwari, 2022). This demonstrate that Angola has a larger brood than Gabon, different when compared to Brazil with 2606 nests, Suriname with 365 nests, French Guiana with 1000-3300 nests, and Republic of Congo with 300-600 nests, presenting smaller broods per year (Silva *et al.*, 2007; Plot *et al.*, 2012; Girard & Breheret, 2013; NMFS & USFWS, 2014; Morais & Tiwari, 2022).

Projecting the effort of the *L. olivacea* population is an important exercise to measure and inform conservation actions (Maurer *et al.*, 2021). In Brazil, the increase in the number of nests observed in recent years can be considered as an indicator of population recovery, resulting from conservation actions developed continuously for almost four

decades (Silva *et al.*, 2007; Castilhos *et al.*, 2022). Communities should be included in conservation strategies, integrating them into environmental education planning and programs (Frazier, 2000). Capturing this information contributes to improving knowledge of populations, and the involvement of multisectoral stakeholders is essential for the success of the program (Eckert, 1999). Similar initiatives have been carried out in Africa, with notable examples in Cape Verde, São Tomé and Príncipe, Guinea Bissau, and Angola. These countries have engaged children, young people, and fishermen in sports activities, implemented the "Cine Kandengue" program—aimed at educating community members (both children and adults) on sea turtle and biodiversity conservation—and launched the "Atelier das Kitabangas," which focuses on creating artisanal products through the recycling of waste and materials (Morais *et al.*, 2022).

5. Conclusions

This study showed that the 2028-2019 season, with two more nests compared to 2021-2022, was the most favorable for *L. olivacea*, with 133 nests, and the least productive was the 2021-2022 season, with 131 nests.

October 2018 had the highest spawning and March 2022 had the lowest spawning, with a decline from 2018 to 2022. This decline was also evident in the number of newborns, with February 2019 and March 2022, respectively, being the months with the lowest number of newborns. The highest number of dead eggs was recorded in November 2021.

Hatching success is closely linked to the initial number of eggs laid. On the one hand, temperature may have been key to successful hatching, on the other, humidity caused by rainfall or rising sea levels may have influenced the increase in eggs and consequently the number of dead newborns.

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Supplementary information

Supplementary material 1

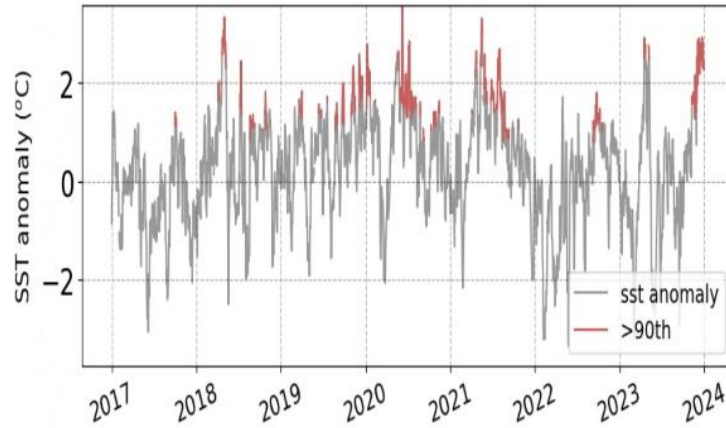


Figure 9: Sea surface temperature anomalies observed in in Angola (Manono – Bentiaba) from 2017 to 2024. Data were gathered from NOAA.

Supplementary material 2

Table 2: Raw data about the field surveys conducted in Angola (Manono – Bentiaba). Data from 2023 is provided for the Project Kitabanga - study and conservation of sea turtles (in preparation).

Temporada	Ficha	Especie	Ninho	Latitude	Longitude	Nº de ovos	Vivos	Mortos
2018-2019	1.1	L.O	1	14.94389	13.49694	0	108	7
2018-2019	1.1	L.O	2	14.28917	12.40861	0	132	5
2018-2019	1.1	L.O	3	14.27778	12.40667	0	134	7
2018-2019	1.1	L.O	4	14.20194	12.41278	-	-	-
2018-2019	1.1	L.O	5	14.20194	12.41278	0	153	1
2018-2019	1.1	L.O	6	14.24	12.39306	0	7	5
2018-2019	1.1	L.O	7	14.20111	12.48278	0	132	5
2018-2019	1.1	L.O	8	14.14306	12.45139	0	-	-
2018-2019	1.1	L.O	9	14.16944	12.4125	0	-	-
2018-2019	1.1	L.O	10	14.18694	12.475	0	116	
2018-2019	1.1	L.O	11	14.17694	12.47389	0	-	-
2018-2019	1.1	L.O	12	14.1775	12.4725	141	115	13
2018-2019	1.1	L.O	13	14.23694	12.49861	0	111	2
2018-2019	1.1	L.O	14	14.21833	12.39194	0	82	5
2018-2019	1.1	L.O	15	14.27028	12.40444	0		
2018-2019	1.1	L.O	16	14.17056	12.37778	0	126	6
2018-2019	1.1	L.O	17	14.13528	12.44694	0	134	2

2018-2019	1.1	L.O	18	14.26167	12.50861	0	4	
2018-2019	1.1	L.O	19	14.26167	12.50889	0	-	-
2018-2019	1.1	L.O	20	14.29417	12.40944	0	-	-
2018-2019	1.1	L.O	21	14.19	12.47722	0	116	1
2018-2019	1.1	L.O	22	14.17361	12.37833	0	89	4
2018-2019	1.1	L.O	23	14.14861	12.45694	0	-	-
2018-2019	1.1	L.O	24	14.14694	12.45417	0	-	-
2018-2019	1.1	L.O	25	14.20389	12.21972	0	84	1
2018-2019	1.1	L.O	26	14.15889	12.46	0	96	5
2018-2019	1.1	L.O	27	14.15167	12.4575	0	67	8
2018-2019	1.1	L.O	28	14.15167	12.45722	0	-	-
2018-2019	1.1	L.O	29	14.27278	12.51333	0	106	3
2018-2019	1.1	L.O	30	14.20306	12.48194	0	93	1
2018-2019	1.1	L.O	31	14.24583	12.39806	0	116	2
2018-2019	1.1	L.O	32	14.2075	12.48389	58	51	7
2018-2019	1.1	L.O	33	14.18972	12.47667	0	119	2
2018-2019	1.1	L.O	34	14.13417	12.44611	0	-	-
2018-2019	1.1	L.O	35	14.15833	12.4125	0	90	4
2018-2019	1.1	L.O	36	14.15389	12.45944	119	97	1
2018-2019	1.1	L.O	37	14.22056	12.41083	0	100	30
2018-2019	1.1	L.O	38	14.21528	12.41194	0	66	1
2018-2019	1.1	L.O	39	14.28417	12.4075	0	81	
2018-2019	1.1	L.O	40	14.13917	12.36778	0	38	2
2018-2019	1.1	L.O	41	14.17278	12.4675	0	-	-
2018-2019	1.1	L.O	42	14.17278	12.4675	67	58	4
2018-2019	1.1	L.O	43	14.26639	12.50722	0	-	-
2018-2019	1.1	L.O	44	14.24722	12.445	0	94	13
2018-2019	1.1	L.O	45	14.22083	12.43056	0	105	8
2018-2019	1.1	L.O	46	14.14389	12.45111	0	84	10
2018-2019	1.1	L.O	47	14.14667	12.45333	0	49	9
2018-2019	1.1	L.O	48	14.215	12.48778	0	134	
2018-2019	1.1	L.O	49	14.15083	12.36944	0	86	8
2018-2019	1.1	L.O	50	14.26278	12.50611	0	101	3
2018-2019	1.1	L.O	51	14.24278	12.50028	0	-	-
2018-2019	1.1	L.O	52	14.22333	12.50139	0	126	7
2018-2019	1.1	L.O	53	14.18611	12.41278	0	135	
2018-2019	1.1	L.O	54	14.18333	12.38278	0	139	1
2018-2019	1.1	L.O	55	14.18556	12.47389	0	-	-
2018-2019	1.1	L.O	56	14.14472	12.45111	0	-	-
2018-2019	1.1	L.O	57	14.14	12.53306	0	76	5
2018-2019	1.1	L.O	58	14.28	12.515	0	128	4
2018-2019	1.1	L.O	59	14.26667	12.50861	0	-	-
2018-2019	1.1	L.O	60	14.25417	12.43139	0	62	26
2018-2019	1.1	L.O	61	14.2225	12.415	0	84	3
2018-2019	1.1	L.O	62			0	110	3
2018-2019	1.1	L.O	63			0	-	-

2018-2019	1.1	L.O	64	14.25444	12.50611	0	66	1
2018-2019	1.1	L.O	65	14.13028	12.44389	0	124	
2018-2019	1.1	L.O	66	14.25444	12.4325	0	-	-
2018-2019	1.1	L.O	67	14.13361	12.44472	0	-	-
2018-2019	1.1	L.O	68	14.13389	12.44528	0	133	3
2018-2019	1.1	L.O	69	14.22694	12.49361	0	141	2
2018-2019	1.1	L.O	70	14.18222	12.47222	0	120	16
2018-2019	1.1	L.O	71	14.1375	12.44778	0	-	-
2018-2019	1.1	L.O	72	14.24639	12.50139	0	75	5
2018-2019	1.1	L.O	73	14.21556	12.48861	0	91	1
2018-2019	1.1	L.O	74	14.17778	12.46833	0	-	-
2018-2019	1.1	L.O	75	14.25139	12.42972	0	-	-
2018-2019	1.1	L.O	76	14.245	12.42694	0	102	4
2018-2019	1.1	L.O	77	14.2225	12.49222	0	35	41
2018-2019	1.1	L.O	78	14.13833	12.44889	0	-	-
2018-2019	1.1	L.O	79	14.17056	12.37667	0	-	-
2018-2019	1.1	L.O	80	14.15333	12.3725	0	-	-
2018-2019	1.1	L.O	81	14.18139	12.47194	0	115	5
2018-2019	1.1	L.O	82	14.16861	12.46472	0	-	-
2018-2019	1.1	L.O	83	14.14694	12.45417	0	-	-
2018-2019	1.1	L.O	84	14.11667	12.43861	0	-	-
2018-2019	1.1	L.O	85	14.26778	12.51083	0	-	-
2018-2019	1.1	L.O	86	14.20194	12.48139	0	-	-
2018-2019	1.1	L.O	87	14.17167	12.46667	0	-	-
2018-2019	1.1	L.O	88	14.17167	12.46639	0	-	-
2018-2019	1.1	L.O	89	14.24111	12.41472	0	-	-
2018-2019	1.1	L.O	90	14.22611	12.41583	0	-	-
2018-2019	1.1	L.O	91	14.21972	12.41194	0	-	-
2018-2019	1.1	L.O	92	14.13611	12.44667	0	-	-
2018-2019	1.1	L.O	93	14.13778	12.4475	0	-	-
2018-2019	1.1	L.O	94	14.19667	12.48028	0	-	-
2018-2019	1.1	L.O	95	14.24083	12.50028	0	-	-
2018-2019	1.1	L.O	96	14.25028	12.50389	0	-	-
2018-2019	1.1	L.O	97	14.25583	12.50667	0	97	7
2018-2019	1.1	L.O	98	14.17528	12.37944	0	-	-
2018-2019	1.1	L.O	99	14.29056	12.40861	0	-	-
2018-2019	1.1	L.O	100	14.14139	12.36972	0	-	-
2018-2019	1.1	L.O	101	14.13889	12.36806	0	-	-
2018-2019	1.1	L.O	102	14.23361	12.42028	0	-	-
2018-2019	1.1	L.O	103	14.24389	12.50194	0	83	5
2018-2019	1.1	L.O	104	14.19778	12.48111	0	-	-
2018-2019	1.1	L.O	105	14.19778	12.48139	0	-	-
2018-2019	1.1	L.O	106	14.16222	12.37472	0	-	-
2018-2019	1.1	L.O	107	14.24528	12.42722	0	-	-
2018-2019	1.1	L.O	108	14.22	12.40972	0	-	-
2018-2019	1.1	L.O	109	14.23861	12.42278	0	84	2

2018-2019	1.1	L.O	110	14.25056	12.42944	0	-	-
2018-2019	1.1	L.O	111	14.25083	12.42972	0	-	-
2018-2019	1.1	L.O	112	14.22778	12.41694	0	-	-
2018-2019	1.1	L.O	113	14.10944	12.44111	0	-	-
2018-2019	1.1	L.O	114	14.21194	12.41306	0	-	-
2018-2019	1.1	L.O	115	14.21639	12.48444	0	-	-
2018-2019	1.1	L.O	116	14.21167	12.48667	0	-	-
2018-2019	1.1	L.O	117	14.19833	12.48111	0		
2018-2019	1.1	L.O	118	14.19861	12.48111	0		
2018-2019	1.1	L.O	119	14.14417	12.45278	0		
2018-2019	1.1	L.O	120	14.22972	12.42	0		
2018-2019	1.1	L.O	121	14.22111	12.41333	0		
2018-2019	1.1	L.O	122	14.22056	12.41389	0		
2018-2019	1.1	L.O	123	14.21778	12.41056	0		
2018-2019	1.1	L.O	124	14.23361	12.39278	0		
2018-2019	1.1	L.O	125	14.23583	12.42222	0		
2018-2019	1.1	L.O	126	14.23361	12.42194	0		
2018-2019	1.1	L.O	127	14.22417	12.41583	0		
2018-2019	1.1	L.O	128	14.22639	12.50472	0	31	28
2018-2019	1.1	L.O	129	14.23722	12.42278	0		
2018-2019	1.1	L.O	130	14.23722	12.42222	0		
2018-2019	1.1	L.O	131	14.26472	12.43639	0		
2018-2019	1.1	L.O	132	14.24361	12.37861	0		
2018-2019	1.1	L.O	133	14.24278	12.38	0		
2021-2022	1.2	L.O	1	14.23694	12.40278		0	0
2021-2022	1.2	L.O	2	14.17722	12.41361		0	0
2021-2022	1.2	L.O	3				0	0
2021-2022	1.2	L.O	4				0	0
2021-2022	1.2	L.O	5	14.22389	12.49361	0	12	16
2021-2022	1.2	L.O	6	14.17306	12.46806	0	12	12
2021-2022	1.2	L.O	7	14.17167	12.46889	0	0	0
2021-2022	1.2	L.O	8	14.26	12.56806	0	0	0
2021-2022	1.2	L.O	9	14.26361	12.43639	0	5	5
2021-2022	1.2	L.O	10	14.14361	12.36944	127	127	0
2021-2022	1.2	L.O	11	14.2325	12.39417	0	129	0
2021-2022	1.2	L.O	12	14.1575	12.4125	0	133	0
2021-2022	1.2	L.O	13	14.24	12.39833	0	0	0
2021-2022	1.2	L.O	14	14.23833	12.39556	0	22	8
2021-2022	1.2	L.O	15	14.21528	12.405	0	8	8
2021-2022	1.2	L.O	16	14.26722	12.405	0	0	0
2021-2022	1.2	L.O	17	14.24611	12.39806	0	64	6
2021-2022	1.2	L.O	18	14.23833	12.39528	0	4	40
2021-2022	1.2	L.O	19	14.15222	12.45861	0	90	6
2021-2022	1.2	L.O	20	14.22861	12.41833	0	7	43
2021-2022	1.2	L.O	21	14.22361	12.41139	0	34	0
2021-2022	1.2	L.O	22	14.21861	12.39139	0	0	0

2021-2022	1.2	L.O	23	14.19444	12.38583	0	100	7
2021-2022	1.2	L.O	24	14.145	12.36917	0	0	0
2021-2022	1.2	L.O	25	14.14139	12.36944	0	0	14
2021-2022	1.2	L.O	26	14.13472	12.36694	0	0	0
2021-2022	1.2	L.O	27	14.26722	12.51139	0	50	2
2021-2022	1.2	L.O	28	14.19361	12.47917	0	0	0
2021-2022	1.2	L.O	29	14.14389	12.45222	0	99	21
2021-2022	1.2	L.O	30	14.24528	12.50056	99	99	99
2021-2022	1.2	L.O	31	14.23583	12.4975	0	150	150
2021-2022	1.2	L.O	32	14.21444	12.40944	0	0	0
2021-2022	1.2	L.O	33	14.25389	12.43194	0	0	0
2021-2022	1.2	L.O	34	14.22	12.41194	0	0	0
2021-2022	1.2	L.O	35	14.17528	12.47056	0	78	13
2021-2022	1.2	L.O	36	14.19861	12.41306	0	0	0
2021-2022	1.2	L.O	37	14.26361	12.43806	0	0	0
2021-2022	1.2	L.O	38	14.27806	12.40722	0	0	0
2021-2022	1.2	L.O	39	14.26417	12.40361	0	100	0
2021-2022	1.2	L.O	40	14.17806	12.41333	0	0	0
2021-2022	1.2	L.O	41	14.16306	12.41556	0	39	7
2021-2022	1.2	L.O	42	14.2775	12.51417	0	0	0
2021-2022	1.2	L.O	43	14.26861	12.51083	0	0	0
2021-2022	1.2	L.O	44	14.26028	12.43472	94	27	67
2021-2022	1.2	L.O	45	14.26444	12.43778	0	0	0
2021-2022	1.2	L.O	46	14.26306	12.43639	0	0	0
2021-2022	1.2	L.O	47	14.23917	12.395	0	99	3
2021-2022	1.2	L.O	48	14.15917	12.41333	0	0	0
2021-2022	1.2	L.O	49	14.23472	12.39361	0	0	0
2021-2022	1.2	L.O	50	14.20778	12.38806	0	0	0
2021-2022	1.2	L.O	51	14.19167	12.38528	0	0	0
2021-2022	1.2	L.O	52	14.19028	12.38389	0	0	0
2021-2022	1.2	L.O	53	14.19278	12.48028	0	72	0
2021-2022	1.2	L.O	54	14.25972	12.43528	0	0	0
2021-2022	1.2	L.O	55	14.22472	12.41417	0	0	0
2021-2022	1.2	L.O	56	14.275	12.51194	0	0	0
2021-2022	1.2	L.O	57	14.12889	12.49944	0	0	0
2021-2022	1.2	L.O	58	14.19917	12.47694	0	0	0
2021-2022	1.2	L.O	59	14.23028	12.41917	0	29	29
2021-2022	1.2	L.O	60	14.20611	12.41139	0	0	0
2021-2022	1.2	L.O	61	14.17639	12.38028	0	0	0
2021-2022	1.2	L.O	62	14.14528	12.36917	11	11	0
2021-2022	1.2	L.O	63	14.24222	12.42556	0	0	0
2021-2022	1.2	L.O	64	14.18694	12.41472	0	0	0
2021-2022	1.2	L.O	65	14.15694	12.46	65	0	65
2021-2022	1.2	L.O	66	14.15694	12.45972	0	80	0
2021-2022	1.2	L.O	67	14.26472	12.40417	0	0	0
2021-2022	1.2	L.O	68	14.16528	12.37667	0	0	0

2021-2022	1.2	L.O	69	14.14194	12.45056	0	0	0
2021-2022	1.2	L.O	70	14.26056	12.435	113	101	12
2021-2022	1.2	L.O	71	14.22111	12.41167	0	0	0
2021-2022	1.2	L.O	72	14.21417	12.41278	0	0	0
2021-2022	1.2	L.O	73	14.2	12.38583	0	87	0
2021-2022	1.2	L.O	74	14.18167	12.41194	0	0	0
2021-2022	1.2	L.O	75	14.24167	12.39583	0	41	0
2021-2022	1.2	L.O	76	14.14222	12.36944	119	119	0
2021-2022	1.2	L.O	77	14.16139	12.4625	0	55	7
2021-2022	1.2	L.O	78	14.2125	12.38944	0	0	0
2021-2022	1.2	L.O	79	14.19917	12.41278	0	129	0
2021-2022	1.2	L.O	80	14.17861	12.38	0	0	14
2021-2022	1.2	L.O	81	14.26917	12.51083	0	0	0
2021-2022	1.2	L.O	82	14.18861	12.47528	0	10	0
2021-2022	1.2	L.O	83	14.23972	12.38111	0	8	20
2021-2022	1.2	L.O	84	14.28056	12.40694	0	100	1
2021-2022	1.2	L.O	85	14.19722	12.47	0	0	0
2021-2022	1.2	L.O	86	14.12528	12.43806	0	32	0
2021-2022	1.2	L.O	87	14.22361	12.49111	0	13	27
2021-2022	1.2	L.O	88	14.21611	12.40889	0	0	0
2021-2022	1.2	L.O	89	14.25861	12.50639	0	0	0
2021-2022	1.2	L.O	90	14.16556	12.46472	0	0	0
2021-2022	1.2	L.O	91	14.27861	12.515	0	105	0
2021-2022	1.2	L.O	92	14.22778	12.49361	0	108	0
2021-2022	1.2	L.O	93	14.21222	12.48722	0	78	0
2021-2022	1.2	C.M	94	14.15778	12.46083	0	0	0
2021-2022	1.2	L.O	95	14.26333	12.435	0	0	0
2021-2022	1.2	L.O	96	14.2075	12.48639	0	0	0
2021-2022	1.2	L.O	97	14.21417	12.48833	0	46	0
2021-2022	1.2	L.O	98	14.13417	12.36694	0	72	13
2021-2022	1.2	L.O	99	14.22556	12.41278	0	37	61
2021-2022	1.2	C.M	100	14.17694	12.415	0	101	3
2021-2022	1.2	L.O	101	14.14583	12.415	0	58	31
2021-2022	1.2	L.O	102	14.19083	12.385	0	7	16
2021-2022	1.2	L.O	103	14.27028	12.5125	0	44	29
2021-2022	1.2	C.M	104	14.18417	12.47333	0	0	0
2021-2022	1.2	L.O	105	14.23972	12.49861	101	101	0
2021-2022	1.2	C.M	106	14.17444	12.46833	67	0	67
2021-2022	1.2	L.O	107	14.23611	12.40444	98	51	47
2021-2022	1.2	L.O	108	14.2025	12.38806	43	43	0
2021-2022	1.2	L.O	109	14.26083	12.51056	29	29	0
2021-2022	1.2	L.O	110	14.25472	12.50694	0	0	0
2021-2022	1.2	L.O	111	14.21167	12.41444	0	23	34
2021-2022	1.2	L.O	112	14.22611	12.495	75	75	0
2021-2022	1.2	L.O	113	14.13278	12.36611	0	0	0
2021-2022	1.2	L.O	114	14.17222	12.41556	0	103	14

2021-2022	1.2	L.O	115	14.23389	12.49722	59	59	0
2021-2022	1.2	L.O	116	14.21667	12.41139	0	71	6
2021-2022	1.2	L.O	117	14.18694	12.41444	0	49	9
2021-2022	1.2	L.O	118	14.24778	12.42611	0	29	43
2021-2022	1.2	L.O	119	14.29667	12.38222	0	0	0
2021-2022	1.2	L.O	120	14.29667	12.40944	0	0	0
2021-2022	1.2	L.O	121	14.25861	12.5075	0	0	0
2021-2022	1.2	L.O	122	14.18194	12.39611	0	34	55
2021-2022	1.2	L.O	123	14.27194	12.40528	0	87	0
2021-2022	1.2	L.O	124	14.18194	12.47361	0	54	0
2021-2022	1.2	L.O	125	14.23583	12.40389	100	0	100
2021-2022	1.2	L.O	126	14.25472	12.50472	0		6
2021-2022	1.2	L.O	127	14.19778	12.48444	0	9	9
2021-2022	1.2	L.O	128	14.18222	12.41306	0	18	
2021-2022	1.2	L.O	129	14.21306	12.48833	0		68
2021-2022	1.2	L.O	130	14.18806	12.41278	0	51	13
2021-2022	1.2	L.O	131	14.23361	12.405	0	20	0
2022-2023	1.3	L.O	1	14.17	12.37056	0	124	7
2022-2023	1.3	L.O	2	-14.2308	12.40806	0	69	29
2022-2023	1.3	L.O	3	-14.2864	12.40806	0	53	10
2022-2023	1.3	L.O	4	-14.2056	12.38722	0	76	0
2022-2023	1.3	L.O	5	-14.1419	12.36917	0	60	0
2022-2023	1.3	L.O	6	-14.2233	12.49167	0	101	7
2022-2023	1.3	L.O	7	-14.1317	12.44472	0	27	81
2022-2023	1.3	L.O	8	14.29528	12.40972	0	0	0
2022-2023	1.3	L.O	9	14.24028	12.38111	0	81	36
2022-2023	1.3	L.O	10	14.165	12.46556	0	0	0
2022-2023	1.3	L.O	11	14.225	12.41	0	125	11
2022-2023	1.3	L.O	12	14.18278	12.4725	0	63	55
2022-2023	1.3	L.O	13	14.13139	12.44528	0	0	0
2022-2023	1.3	L.O	14	14.23083	12.41222	0	72	57
2022-2023	1.3	L.O	15	14.22778	12.39278	0	0	0
2022-2023	1.3	L.O	16	14.20722	12.38722	101	101	0
2022-2023	1.3	L.O	17	14.20917	12.37306	0	0	0
2022-2023	1.3	C.M	18	14.27167	12.51139	0	0	0
2022-2023	1.3	L.O	19	14.1375	12.51139	0	116	0
2022-2023	1.3	L.O	20	14.23556	12.42167	0	0	0
2022-2023	1.3	L.O	21	14.23556	12.44944	91	91	0
2022-2023	1.3	L.O	22	14.18111	12.41333	0	0	0
2022-2023	1.3	L.O	23	14.2375	12.49667	0	0	0
2022-2023	1.3	L.O	24	14.22417	12.41583	0	87	27
2022-2023	1.3	L.O	25	14.23806	12.39556	0	0	0
2022-2023	1.3	L.O	26	14.22167	12.39139	0	0	0
2022-2023	1.3	L.O	27	14.12139	12.43917	0	0	0
2022-2023	1.3	L.O	28	14.24278	12.39278	0	136	
2022-2023	1.3	L.O	29	14.24028	12.39722	0	39	0

2022-2023	1.3	L.O	30	14.15528	12.41167	0	31	83
2022-2023	1.3	L.O	31	14.155	12.44222	0	130	2
2022-2023	1.3	L.O	32	14.17139	12.37694	0	100	17
2022-2023	1.3	L.O	33	14.21167	12.38833	0	0	0
2022-2023	1.3	L.O	34	14.26444	12.43778	0	0	0
2022-2023	1.3	L.O	35	14.25833	12.40139	0	0	0
2022-2023	1.3	L.O	36	14.23167	12.40639	90	90	0
2022-2023	1.3	L.O	37	14.27167	12.51139	0	0	0
2022-2023	1.3	L.O	38	14.29278	12.40889	0	0	0
2022-2023	1.3	L.O	39	14.15278	12.3725	0	102	0
2022-2023	1.3	L.O	40	14.19778	12.48111	0	47	52
2022-2023	1.3	L.O	41	14.24417	12.50278	0	68	37
2022-2023	1.3	L.O	42	14.22028	12.41306	0	91	33
2022-2023	1.3	L.O	43	14.23111	12.40917	0	104	0
2022-2023	1.3	L.O	44	14.14722	12.37111	0	0	0
2022-2023	1.3	L.O	45	14.27306	12.51361	0	0	0
2022-2023	1.3	L.O	46	14.25889	12.50833	0	123	0
2022-2023	1.3	L.O	47	14.16944	12.41167	0	0	0
2022-2023	1.3	L.O	48			0	0	0
2022-2023	1.3	L.O	49	14.25361	12.43111	0	95	11
2022-2023	1.3	C.M	50	14.14194	12.45167	0	0	0
2022-2023	1.3	L.O	51	14.24333	12.39722	0	100	7
2022-2023	1.3	L.O	52	14.17222	12.41306	0	106	3
2022-2023	1.3	C.M	53	14.21056	12.41278	0	0	0
2022-2023	1.3	L.O	54	14.15389	12.45861	0	77	15
2022-2023	1.3	L.O	55	14.19917	12.38667	0	89	12
2022-2023	1.3	L.O	56	14.23861	12.42306	0	33	69
2022-2023	1.3	L.O	57	14.22222	12.41417	0	77	23
2022-2023	1.3	L.O	58	14.25278	12.40028	0	0	0
2022-2023	1.3	L.O	59	14.26583	12.43806	0	0	0
2022-2023	1.3	L.O	60	14.21306	12.40667	101	89	12
2022-2023	1.3	L.O	61	14.26694	12.51139	0	44	71
2022-2023	1.3	L.O	62	14.23667	12.49722	0	96	12
2022-2023	1.3	L.O	63	14.14222	12.36806	0	0	0
2022-2023	1.3	L.O	64	14.2425	12.39528	0	0	0
2022-2023	1.3	L.O	65	14.17472	12.47056	0	0	0
2022-2023	1.3	L.O	66	14.24861	12.42917	0	87	28
2022-2023	1.3	L.O	67	14.22278	12.415	0	0	0
2022-2023	1.3	L.O	68	14.22861	12.41056	0	0	0
2022-2023	1.3	L.O	69	14.29194	12.41028	87	87	0
2022-2023	1.3	L.O	70	14.28528	12.40806	0	0	0
2022-2023	1.3	L.O	71	14.27694	12.51333	0	0	0
2022-2023	1.3	L.O	72	14.26222	12.50806	0	0	0
2022-2023	1.3	C.M	73	14.26333	12.43667	0	97	5
2022-2023	1.3	C.M	74	14.2225	12.415	0	59	32
2022-2023	1.3	L.O	75	14.25583	12.43222	0	0	0

2022-2023	1.3	L.O	76	14.22139	12.41278	0	91	18
2022-2023	1.3	L.O	77	14.21222	12.48639	0	97	24
2022-2023	1.3	L.O	78	14.17361	12.46944	0	101	0