

# MONITORING, TAGGING AND CONSERVATION OF MARINE TURTLES IN MOZAMBIQUE: ANNUAL REPORT 2018/19

Compiled and edited by:

Raquel S. Fernandes, Gélica E. Inteca, Jessica L. Williams, Alima Taju,

Lara Muaves & Marcos A. M. Pereira



Maputo, January 2020

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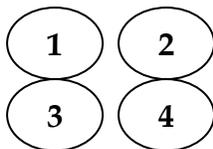
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## **Cover Photographs:**



1 - Billboard with marine turtle information at the POPMR (Photo: Vicente Matsimbe)

2 - Loggerhead (*Caretta caretta*) siamese hatchlings (Photo: Marcos Pereira)

3 - Green turtle (*Chelonia mydas*) hatchlings at Vamizi island (Photo: Gélica Inteca)

4 - Loggerhead female turtle at the POPMR (Photo: Raquel Fernandes)

*The opinions, positions and points of view expressed in this document, reflect only those of the authors and do not necessarily reflect those of governmental institutions, private sector or civil society organizations that contributed to the elaboration of this report.*

Maputo, January 2020

## SUMMARY

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The twelfth annual report on monitoring, tagging and conservation of marine turtles in Mozambique presents the results of the 2018/19 season. These results are based on the compilation of data on nesting females, tracks, nests and hatchlings, strandings and mortalities, including sporadic sightings, from different monitoring and conservation programs. The report also highlights current research and published studies, training and awareness talks, as well as priorities for monitoring and research.

The 2018/19 monitoring season took place from June 2018 to May 2019 in the northern section of the country, from Vamizi island to the Quirimbas National Park (QNP), and from September 2018 to March 2019 in the southern section, from the Bazaruto Archipelago National Park (BANP) towards the Ponta do Ouro Marine Partial Reserve (POPMPR).

Tracks and nests of loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) turtles were recorded along the stretch of coastline between Cabo de São Sebastião Total Protection Zone (CSSTPZ, also known as the Vilanculos Wildlife Sanctuary) and the POPMPR; green turtles (*Chelonia mydas*) were reported at Vamizi and BANP.

In total, 2 199 tracks and 986 nests were recorded. The most abundant species were loggerheads (1 890 tracks; 705 nests) and greens (225 tracks; 196 nests), followed by leatherback turtles (57 tracks; 42 nests) and unidentified species (27 tracks; 25 nests). No hawksbill and olive ridley turtles were reported.

The POPMPR continues to be the most important nesting area for both loggerhead (99.2% and 97.9% of all loggerhead tracks and nests reported, respectively) and leatherback turtles (93.0% and 92.9% of all leatherback tracks and nests reported, respectively). Approximately half of the tracks were recorded in December for both species. Tracks and nests were most abundant from Ponta Malongane to Ponta Dobela (51.2% of total tracks and 49.5% of total nests from the POPMPR). The latter section is also the area where most tagging occurs (80.9% of 147 tagged turtles within the POPMPR).

Currently, the POPMR and the Vamizi island programmes are the only ones where continuous tagging of marine turtles is taking place. At the POPMR, 234 individual loggerheads and 10 leatherbacks were handled. Tagged turtles (both new and recaptured) represented only 16.6% and 22.6% (loggerheads and leatherbacks, respectively) of the total tracks recorded. These results, show a decrease in tagged marine turtles when compared to 2017/18 (248 loggerheads and 13 leatherback), 2016/17 season (308 loggerheads and 19 leatherbacks) and more than what was recorded for 2015/16 season (229 loggerheads and 12 leatherbacks).

At Vamizi island, a total of 27 green turtles were tagged and three green turtles recaptured.

Aerial surveys were conducted at the Greater Bazaruto Region under the Dugong and Seagrass Project in April 2018. A total of 175 individual sightings of marine turtles were recorded during two aerial surveys (each covered 853 nm). A lower-effort aerial survey at the POPMR (covered 127 nm) recorded 30 individual sightings. Maps of sightings dispersion are relevant to better understand marine turtle habitats use (eg. foraging grounds) and describe potential impacts of marine resources exploitation (eg. fisheries; oil and gas exploration, etc.).

At the QNP, 102 sightings of live marine turtles and nine mortalities were reported in Ibo, Matemo and Quirimba islands. Although monitoring effort is not clear, the data suggests a reduction in the number of mortalities when compared to the previous season (25 mortalities and 125 marine turtle sightings).

Overall, a total of 42 marine turtle mortalities were reported along the coastline of Mozambique. In the majority of cases, the causes were not identified (71.4%), with the remaining being originated from anthropogenic causes (28.6%). As in previous years, it is important to highlight that this number does not reflect the current level of marine turtle mortality in the country. Additionally, old carapaces were reported in Inhassoro and Govuro regions and these were not properly quantified. Therefore, efforts must continue to execute strict enforcement and penalties, as well as promotion of sustainable fishing practices.

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## INTRODUCTION

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Marine turtle monitoring is the longest marine monitoring program systematically running in Mozambique (Pereira *et al.*, 2014). The programme was first established at Inhaca island in 1988, followed by the then Bazaruto National Park (now Bazaruto Archipelago National Park - BANP) and between Ponta Dobela and Ponta Malongane (now part of the Ponta do Ouro Partial Marine Reserve - POPMR) in 1994. In 2005, the Cabo de São Sebastião and Vamizi island programmes were initiated and are still running (Videira *et al.*, 2008).

Currently, there are eight marine turtle monitoring programmes in operation that contribute to the annual report (Table 1). However, monitoring effort has not been consistent and there are data gaps throughout the seasons.

In terms of species composition, as in previous nesting seasons, marine turtles nesting females show a dominance of green turtles (*Chelonia mydas*) in the northern region (i.e. Vamizi island and Quirimbas National Park - QNP). In the south, loggerheads (*Caretta caretta*) and leatherbacks (*Dermochelys coriacea*) turtles are dominant (i.e. Ponta do Ouro Partial Marine Reserve - POPMR) (Anastácio, 2014; Fernandes *et al.*, 2014; 2015a,b; 2016; 2017; 2018, Fernandes, 2015; Louro *et al.*, 2012; Louro & Fernandes, 2013; Pereira *et al.*, 2009; Trindade, 2012; Videira *et al.*, 2008; 2010; 2011). Cabo de São Sebastião Total Protection Zone (CSS ZPT) and Bazaruto Archipelago National Park (BANP) are two areas considered of high species richness, with potential nesting of the five species known to occur in Mozambique waters. However, records of hawksbill (*Eretmochelys imbricata*) and olive ridley turtles (*Lepidochelys olivacea*) are very scarce (Fernandes *et al.*, 2014; 2015; 2016; 2017; 2018, Fernandes, 2015; Louro *et al.*, 2012; Louro & Fernandes, 2013; Pereira *et al.*, 2009; Trindade, 2012; Videira *et al.*, 2008; 2010; 2011).

**Table 1.** Historical data contribution of marine turtle monitoring programmes (Green - established program with published data on the annual reports; Blue - established program with data possibly published on other sources; Yellow - occasional patrols with published data on the annual reports; White - no program). BANP-Bazaruto Archipelago National Park; NP-National Park; POPMR-Ponta do Ouro Partial Marine Reserve; TPZ-Total Protection Zone. \* = Julien *et al.* (2017); (-) represents a cluster of nesting seasons with the same monitoring programs.

Monitoring Programme	1988 - 1994	1994 /95	1995/96	1996 - 2001	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014 - 2016	2016 - 2019
Vamizi island																			
Quirimbas NP																			
Primeiras and Segundas islands																			
BANP																			
Pomene NR																			
Cabo de São Sebastião TPZ																			
Tofo																			
Závora																			
Zavala																			
Xai-Xai																			
Bilene																			
Manhiça																			
Macaneta																			
Inhaca island, POPMR																			
P. Mucombo - P. Santa Maria, POPMR																			
P. Dobela - P. Mucombo, POPMR																			
P. Malongane - P. Dobela, POPMR																			
P.Ouro - P. Malongane, POPMR																			

## OBJECTIVES

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The general objective of the *Mozambique marine turtle monitoring, tagging and conservation annual report* is to compile relevant data collected from the various marine turtle monitoring and conservation programmes in Mozambique, as well as casual occurrences reported outside these programmes, from June 2017 to May 2018. More specifically, the report's objectives are to:

- (1) Determine the nesting females' species composition;
- (2) Determine the number of tracks with and without nests per species and per area;
- (3) Determine the number of nests, eggs and hatchlings per species and per area;
- (4) Determine the number of sightings in feeding areas or/and migration corridors; and
- (5) Determine the number of mortality and stranding cases per species per area.

## METHODOLOGY

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In the present report, data from seven areas were included: (1) Vamizi island; (2) QNP; (3) BANP; (4) CSSTPZ; (5) Pomene National Reserve (PNR; (6) Inhambane Province (Massinga, Tofo - Paindane and Závora - Praia Manhame); and (7) POPMR.

During the 2018/19 season, the total length of the beaches patrolled was approximately 288 km (~10.4% of the country's coastline; Table 1 and Figure 3). The monitoring period varied between monitoring sections. At the southern section, the nesting season run from the 1 October 2018 (but the report includes one record from a loggerhead at the POPMR in July) to 31 March 2019 and in the northern section from 1 June 2018 to 31 May 2019.

The monitoring effort is summarized in Table 2, which also details the methodology used (ie. type of patrols, number of community monitors and rangers, as well as the monitoring period).

**Table 2.** Monitoring effort per monitoring area during the 2018/19 season. (PF - Patrols on foot; PB - Patrols by bicycle and PC - Patrols by car). NP=National Park; NR=National Reserve; PMR=Partial Marine Reserve; TPZ=Total Protection Zone. \* = Occasional patrols; \*\* =Total number of days with beach patrols not recorded (numbers presented are mathematically inferred through the relation of beach patrol distance and total km reported).

Monitoring Areas	Type of patrol	Nr of monitors & rangers	Distance per section (km)	Total distance patrolled (km)	Period	Nrof days patrolled
<b>1. Vamizi island</b>	PF	4	12	≈4380	01Jun18 - 31May19	365
<b>2. Quirimbas NP</b>						
Matemo island	PB	4	≈24	≈2823	01Jun18 - 31May19	**118
Ibo island	PB	14	≈17	≈5940	01Jun18 - 31May19	**349
Quirimba island	PB	4	≈16	≈3042	01Jun18 - 31May19	**190
<b>3. Bazaruto Archipelago NP</b>						
Bazaruto island	PF	37	≈40	≈1400	01Oct18 - 31Mar19	Ni
Benguêrua island	PF		≈10	≈100		Ni
Magaruque island	PF		Ni	Ni		Ni
Bangue island	PF		Ni	Ni		Ni
<b>4. Cabo São Sebastião TPZ</b>	PF	9	25	-	01Sep18 - 31Mar19	212
<b>5. Pomene NR</b>	PF	13	≈10	-	01Oct18 - 31Mar19	*
<b>6. Inhambane</b>						
Tofo -Paindane	PF	1	*	-	01Oct18 - 30 Apr 19	*
Závora (Manhame Beach)	PF	1	10*	-	01Oct18- 30 Apr 19	*
<b>7. Ponta do Ouro PMR</b>						
P. Mucombo - Santa Maria	PF	20	≈20	≈3640	01Oct18 - 31Mar19	182
P. Chemucane - Mucombo	PF	3	≈11	≈2002	01Oct18 - 31Mar19	182
P. Milibangalala - Chemucane	PF	3	≈12	≈2184	01Oct18 - 31Mar19	182
P Dobela - Milibangalala	PF	3	≈7	≈1274	01Oct18 - 31Mar19	182
Monte Mutondo - P. Dobela	PF	3	≈10	≈1820	01Oct18 - 31Mar19	182
P. Techobanine - Mutondo	PF	3	≈10	≈1820	01Oct18 - 31Mar19	182
P. Maderjanine - Techobanine	PF	3	≈6	≈1092	01Oct18 - 31Mar19	182
P. Malongane - Maderjanine	PF	3	≈6	≈1092	01Oct18 - 31Mar19	182
P. Malongane - Mutondo	PC	1	32	≈1024	01Dez18 - 01Jan19	32
P. Ouro - Malongane	PF	3	≈8	≈1456	01Oct18 - 31Mar19	182

Opportunistic sightings of marine turtles were recorded during the aerial surveys carried out under two projects managed by Association for Protection of Dugongs and other marine mammals <sup>1</sup> in April 2018 at the Greater Bazaruto region an Ponta do Ouro Partial Marine Reserve, but the results were not described in the 2017/18 annual report (Table 3). Surveys were flown as a series of East to West or West to East transects in a progressive North to South direction, between the coast and the 30 m isobaths. Line spacing between transects was about 4 to 5 km. The lengths of transects may vary according to the coastal orientation and water depth. Transects were flown at an altitude of 450 ft and a speed of approximately 80-90 knots, in a high-wing configuration aircraft (Piper Tri-Pacer).

Due the flight altitude and speed, the identification at species level was difficult, as observed in other studies (Provanca & Stolen, 2008). The smaller size of sea turtles in relation to other taxa studied also contributed as a limiting factor for identification to species level (Alves *et al.*, 2013). Previous studies based on aerial surveys suggested a minimum size of 30 (Epperly *et al.*, 1995) to 75 cm (Shoop & Kenney, 1992) carapace width for a specific diagnosis of marine turtles. The higher density of marine turtles near the shore may indicate that the area is a breeding ground, since mating occurs in large groups in shallow waters (Hirth, 1980).

It is recognized that the data compiled, is based on data extracted from information made available by the different monitoring programmes, and might contain gaps and errors beyond the authors' control. Thus, readers are advised to proceed with caution on performing further analyses based on these data. The analysis on number of tracks and nests per day are only made for POPMR and Vamizi island because the monitoring effort in these areas is consistent and the dataset is more robust.

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<sup>1</sup> Project funded by the Global Environment Facility (GEF) entitled "The distribution of dugongs in the coastal waters of Mozambique"(More info at <http://www.dugongconservation.org/>) and the project funded by WIOMSA entitled Dugongs (*Dugong dugon*) of the Western Indian Ocean Region: - Identity, Distribution, Status, Threats and Management (More info at <https://www.dugongs.org/pt/>)

# Monitoring Areas

## 1. Vamizi Island

Vamizi island is located in Cabo Delgado Province, Palma District, Olumbe Administrative Post, (10°01'48"S and 40°39'00" E) and 40 km south of the Tanzanian border (Anastácio *et al.*, 2014). Vamizi is one of the largest islands of the Quirimbas archipelago, with a surface area of 48 km<sup>2</sup> (Silva *et al.*, 2019).

Marine turtle monitoring program on Vamizi island started in 2003 prior to the sanctuary's creation. In 2006, the sanctuary which includes five monitoring beaches was created and extends up to 3 km (Figure 1) from the east coast of the island where fishing is prohibited. This sanctuary is managed by the Community Fisheries Council (CCP) (Silva *et al.*, 2019).

Vamizi island is currently performing day and night patrols (Table 2). Day patrols are conducted early in the morning to record new nesting activities, mark new nests, check the older nests and proceed to nest excavation if there is evidence that the eggs had hatched. Night patrols are conducted during six months, from January to June (higher nesting activity) to tag new turtles and record turtles with old tags, and to mark new nests and translocate nests if necessary.

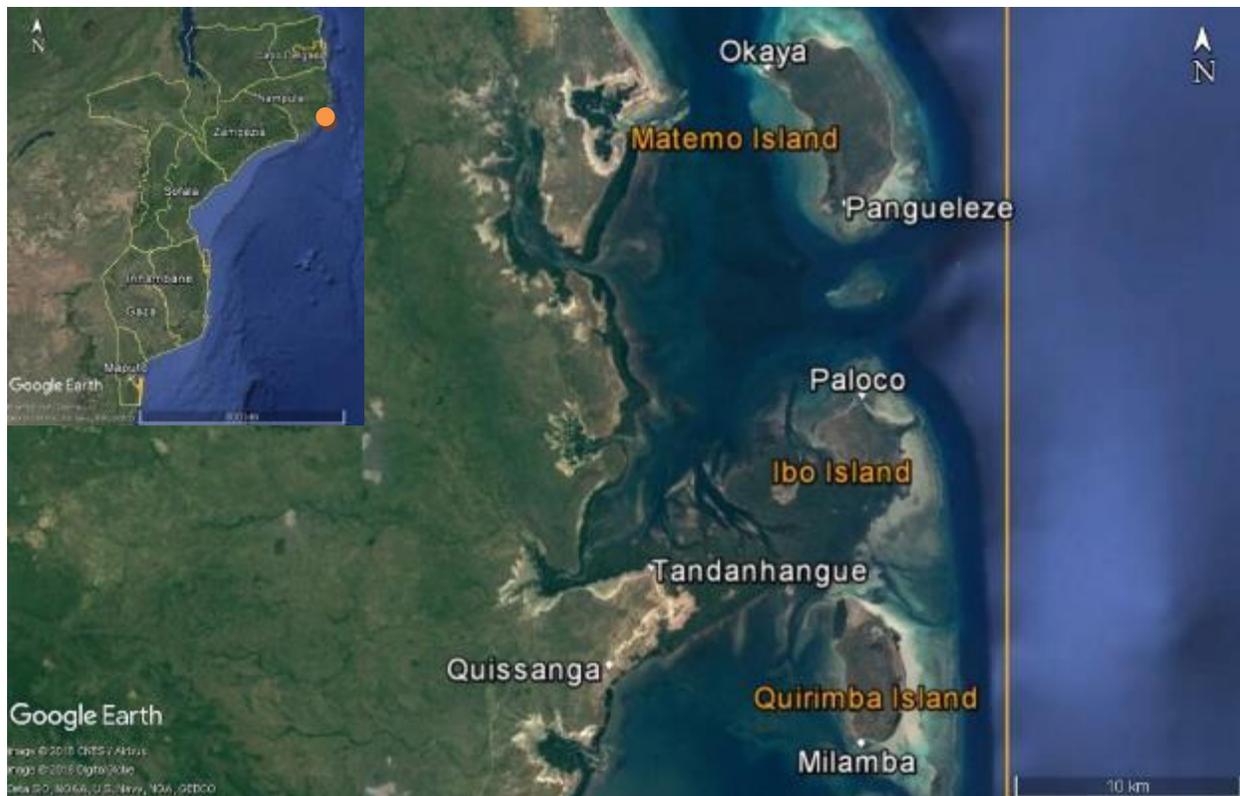


**Figure 1.** Vamizi island and main beach reference sites for marine turtle monitoring (Adapted from Google Earth).

## 2. Quirimbas National Park (QNP)

The QNP, proclaimed in June 2002 (Decree 14/2002 of 6 June), has a total area of 9 130 km<sup>2</sup>, of which 1 185 km<sup>2</sup> encompasses the marine environment (Pereira, *in press*). Monitoring patrols at the QNP are conducted daily by the 22 Management Oriented Monitoring System (MOMS) community monitors at three islands: Matemo, Ibo and Quirimba (Table 2; Figure 2). The marine turtle monitoring module is integrated within the MOMS program established by the World Wide Fund for Nature (WWF).

Unfortunately, the monitors are not implementing the protocol for data collection as applied by other programmes, and therefore neglect, for example, monitoring effort and biometric data. The data presented here only account for marine turtle sightings and mortality incidents.

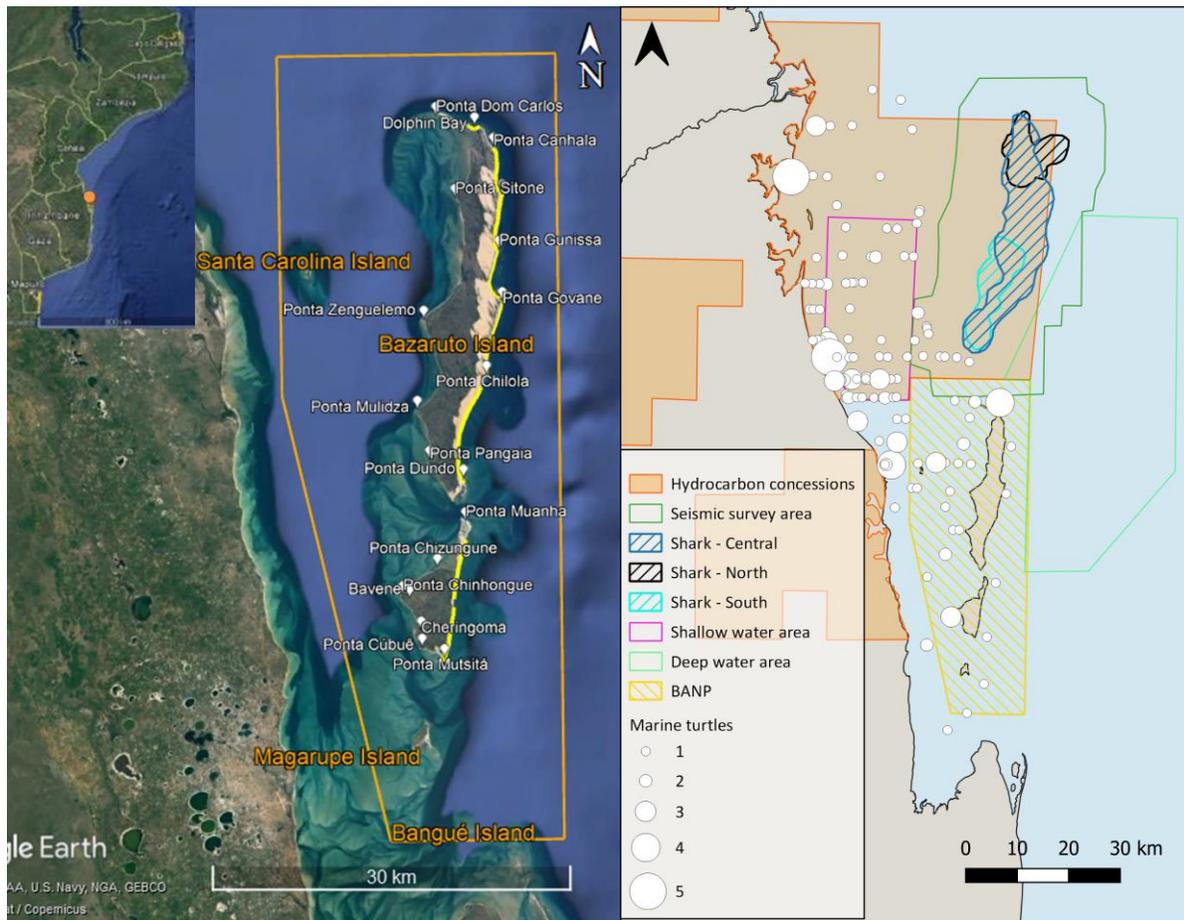


**Figure 2.** Quirimbas National Park (Matemo, Ibo and Quirimba islands) with main sites where marine turtle monitoring takes place (Adapted from Google Earth).

### 3. Bazaruto Archipelago National Park (BANP)

The BNAP was established in 1971, but the current limits were extended and approved in 2001 (Decree 39/2001, of 21 November), to an area of approximately 1 430 km<sup>2</sup>, of which 1 295 km<sup>2</sup> encompass the marine environment (Figure 3).

Two groups of rangers and community marine turtle monitors conduct daily patrols. One group patrols at night and the other group patrols in the morning. In the 2018/2019 season, the data made available was summarized by the park technicians. Additionally, opportunistic sightings of marine turtles were recorded during two aerial surveys conducted in the Greater Bazaruto Region in April 2018 (from Cabo São Sebastião to the Save River) (Figure 3).

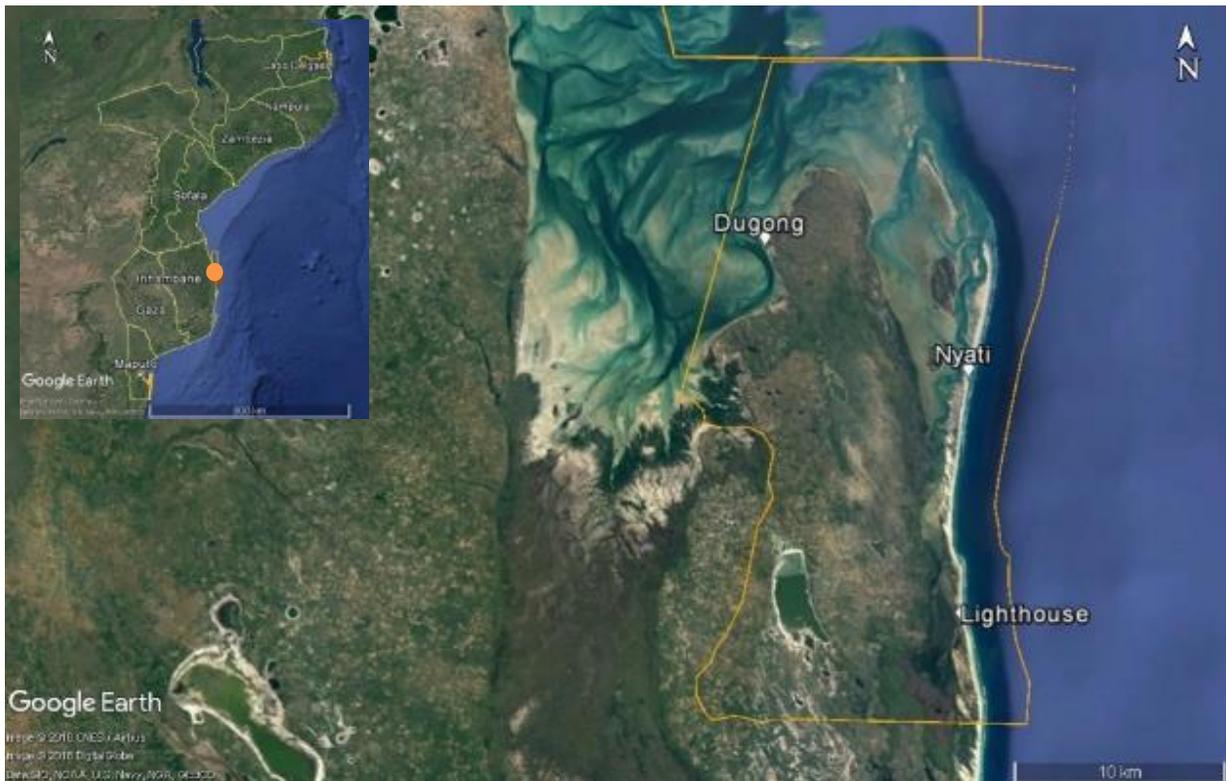


**Figure 3.** Bazaruto Archipelago National Park and reference sites for marine turtle monitoring (Adapted from Google Earth). Cumulative sightings of three aerial surveys in Bazaruto Archipelago National Park carried out in April 2018.

#### 4. Cabo de São Sebastião Total Protection Zone (CSSTPZ)

The CSSTPZ was established in 2003 (Decree 18/2003, 29 April) and a well-established marine turtle monitoring and conservation program started nine years ago. The community marine turtle monitors conduct early morning (6 to 8 am) and nightly (6 to 12 pm) monitoring patrols to identify and record all nesting females or tracks (Table 2). The Sanctuary marine turtle monitoring takes place on the beaches of the eastern shore of the peninsula northwards for about 25 kilometres past Nyati Lodge to the end of the sand spit (Figure 4).

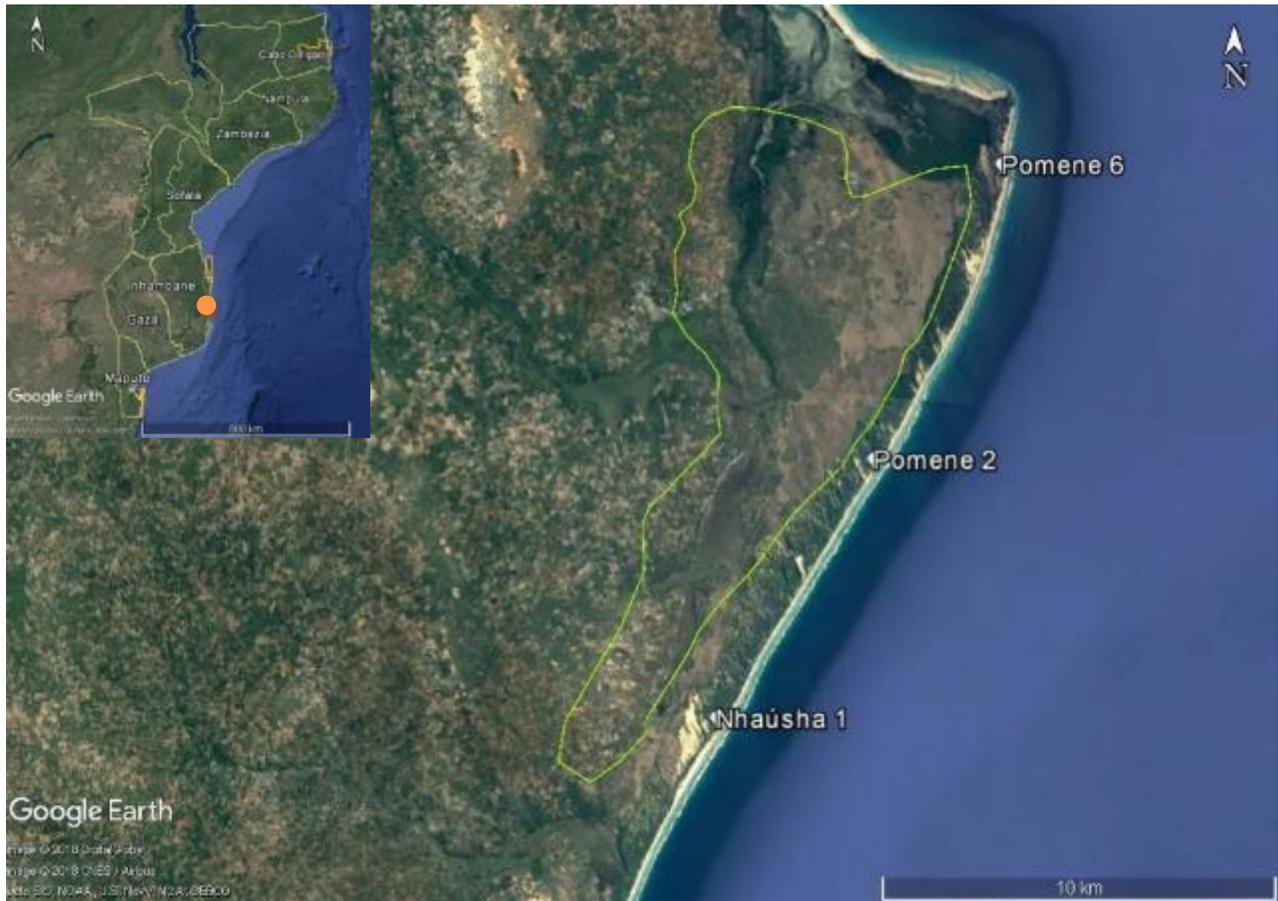
The programme is currently applying the national monitoring protocol. Additionally, small signs were used to mark nests, for easy reference, to go back to each nesting site towards the end of the season to check hatching success.



**Figure 4.** Cabo de São Sebastião Total Protection Zone and main reference sites for marine turtle monitoring (Adapted from Google Earth).

## 5. Pomene National Reserve (PNR)

The PNR was established in 1972 through Decree 109/72 of 16 November and covers an area of 50 km<sup>2</sup>. A new proposal for extending its limits to include coastal and marine ecosystems is currently being discussed. At the PNR, patrols were irregular and with an unclear monitoring effort (Table 2; Figure 5).

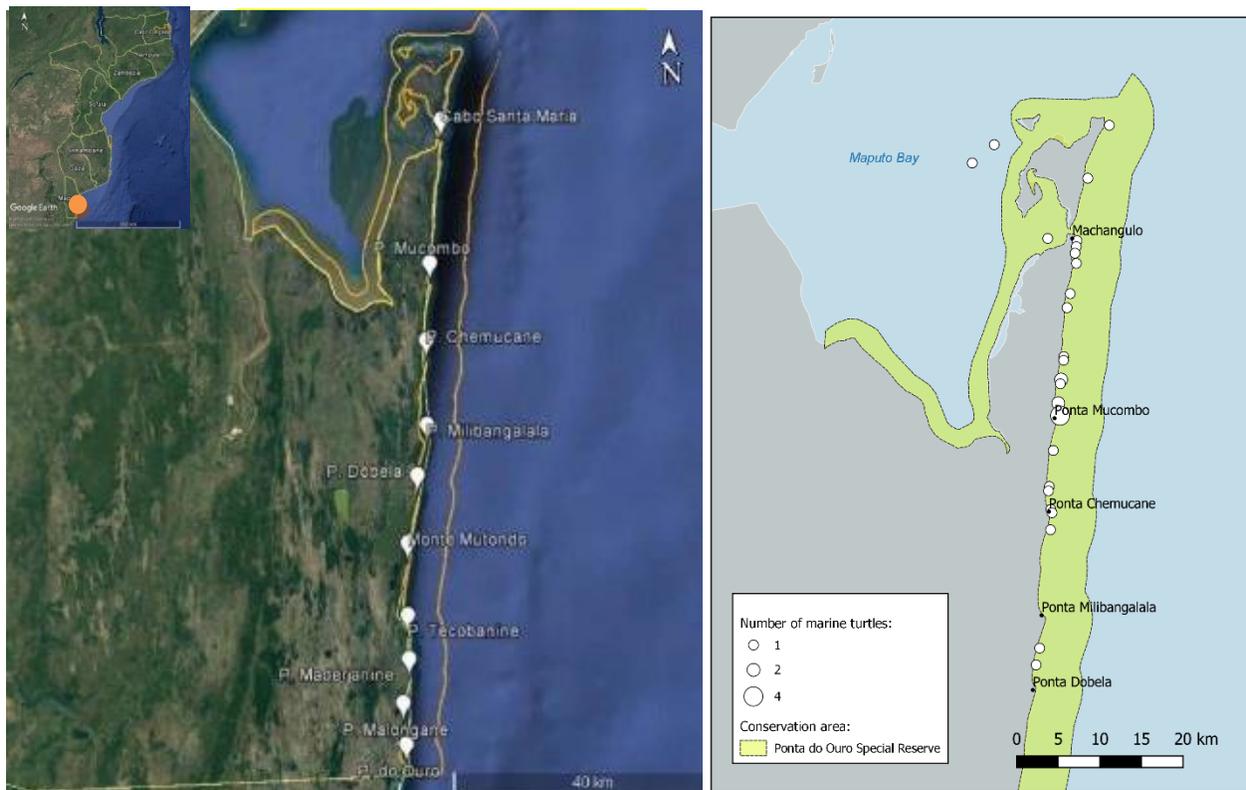


**Figure 5.** Pomene National Reserve with main reference sites for marine turtle monitoring (Adapted from Google Earth).

## 6. Ponta do Ouro Partial Marine Reserve (POPMR)

At the POPMR, as in the previous years, the 44 community marine turtle monitors were subdivided into nine sections between Ponta do Ouro and Santa Maria (Table 2; Figure 6). However, to maintain consistency within the database, data were organized according to their geographical coordinates in the following sections: 1) Ponta do Ouro to Ponta Malongane; 2) Ponta Malongane to Ponta Dobela; 3) Ponta Dobela to Ponta Mucombo and 4) Ponta Mucombo to Santa Maria. The programme is currently applying the national monitoring protocol.

Additionally, opportunistic sightings of marine turtles were recorded during one aerial survey conducted at the POPMR in April 2018 (Figure 6, right).



**Figure 6.** Ponta do Ouro Partial Marine Reserve with main reference sites for marine turtle monitoring (Adapted from Google Earth). Cumulative sightings of three aerial surveys at POPMR carried out in April 2018.

## **7. Sites with Casual Reports**

Casual marine turtle patrols occur at Inhambane Province, outside marine protected areas, more specifically at Tofo - Paindane and Závora to Manhame Beach (Dovela). These patrols are not made daily, being opportunistic field visits to validate nesting events, tracks, illegal take, stranding or entanglements.

Additional data focused on bycatch, mortality and illegal take was collected as part of a national level assessment for CITES (Pilcher & Williams, 2018). Interviews were undertaken with artisanal fishers and conservation management practitioners across three coastal provinces of Mozambique in Cabo Delgado, Inhambane and Nampula. Field surveys were conducted in southern Mozambique from 16<sup>th</sup> to 20<sup>th</sup> May 2018 and in Northern Mozambique from 30<sup>th</sup> May to 24<sup>th</sup> June 2018 in the provinces of Cabo Delgado and Nampula. During this period, a total of 77 artisanal fishers were interviewed and 11 interviews were completed with conservation management practitioners. These data were not reported in the previous annual report.

## MONITORING RESULTS

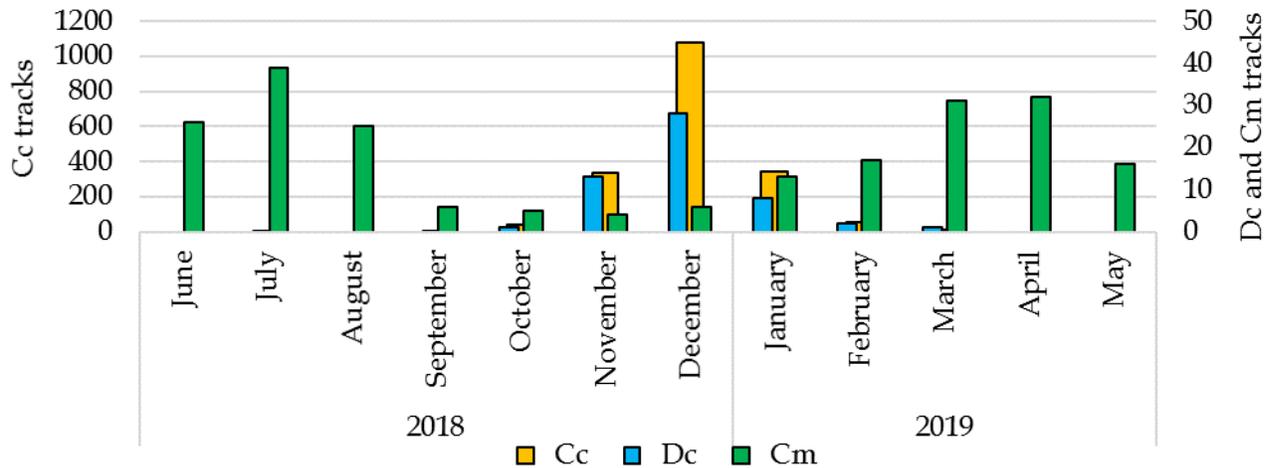
### Female tracks

During the 2018/19 nesting season, a total of 2 199 tracks were recorded (Table 3). The tracks were recorded at Vamizi island (10.0%), BANP (1.2%), CSSTPZ (0.9%), Inhambane casual sites (<0.5%) and the POPMR (87.7%). At the QNP, no tracks were reported. However, 102 sightings of live turtles were recorded in QNP, namely close to Ibo island (24 sights), Matemo island (28 sights) and Quirimba island (49 sights).

**Table 3.** Marine turtle tracks per species and per area (Cc-*Caretta caretta*; Cm-*Chelonia mydas*; Dc-*Dermochelys coriacea*; Ei-*Eretmochelys imbricata* and Lo-*Lepidochelys olivacea*, NI-Not identified; BANP-Bazaruto Archipelago National Park; TPZ- Total Protection Zone, PNR - Pomene National Reserve, POPMR-Ponta do Ouro Partial Marine Reserve), during the 2017/18 season. \* = occasional patrols.

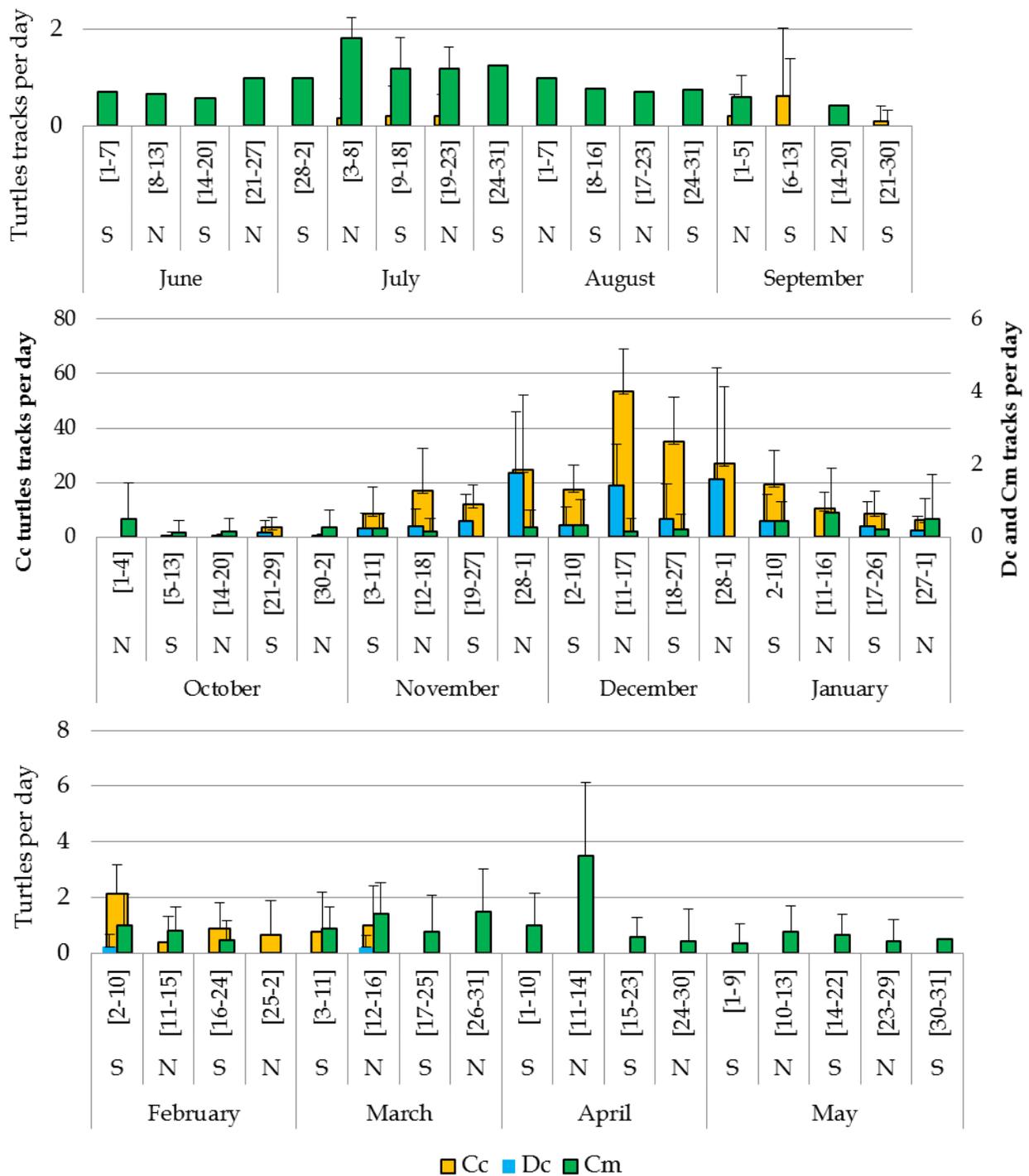
Monitoring area	Cc	Cm	Dc	Ei	Lo	NI	Total
<b>1. Vamizi island</b>		<b>220</b>					<b>220</b>
<b>2. Quirimbas National Park</b>							<b>0</b>
<b>3. BANP</b>	<b>8</b>	<b>4</b>	<b>3</b>			<b>12</b>	<b>27</b>
Bazaruto island							19
Benguérua island							5
Magaruque island							2
Bangue island							1
<b>4. Cabo de São Sebastião TPZ</b>	<b>4</b>	<b>1</b>				<b>15</b>	<b>20</b>
<b>5. PNR</b>							<b>0</b>
<b>6. Inhambane Casual Sites</b>	<b>3</b>		<b>1</b>				<b>4</b>
Tofo-Paindane*	2		1				3
Závora-Praia Manhame*	1						1
<b>7. POPMR</b>	<b>1875</b>	<b>-</b>	<b>53</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1928</b>
Ponta Mucombo - Santa Maria	201	-	17	-	-	-	218
Ponta Dobela - Ponta Mucombo	565	-	8	-	-	-	573
Ponta Malongane - Ponta Dobela	1099	-	26	-	-	-	1125
Ponta do Ouro - Ponta Malongane	10	-	2	-	-	-	12
<b>Total</b>	<b>1890</b>	<b>220</b>	<b>57</b>	<b>0</b>	<b>0</b>	<b>27</b>	<b>2199</b>

At Vamizi island, a total of 220 female green turtle tracks were reported, showing higher activity in July (39 tracks; 17.7%), followed by March and April (31 and 32 tracks; ≈14.5%) (Figures 7 and 8).



**Figure 7.** Total number of tracks per month across the 2018/19 season of loggerhead (*Caretta caretta*; Cc) and leatherback turtles (*Dermochelys coriacea*; Dc) at Ponta do Ouro Partial Marine Reserve and green turtles (*Chelonia mydas*) at Vamizi island.

A total of BNAP area 27 tracks were recorded, mostly were from loggerheads (29.6%), followed by greens (14.8%) and leatherbacks (11.1%). The number of marine turtle sightings were much higher in the second aerial survey because of the sea conditions (Table 4). However, the results show that 78% of total sightings were outside the conservation areas (Figure 3). Most concerning 68% of the total sightings were inside the oil and gas concession (Block 16/19) and 8% were within approximately one third of the area proposed for the seismic survey by Sasol that was covered by the present aerial survey. About a third of the sightings were inside the shallow water area.



**Figure 8.** Average number of tracks per day for loggerhead (*Caretta caretta*; Cc) and leatherback turtles (*Dermochelys coriacea*; Dc) at the Ponta do Ouro Partial Marine Reserve and green turtles (*Chelonia mydas*) at Vamizi island, binned into spring and neap tides groups across the 2018/19 season. Bars = SD.

At the POPMR, a total of 1 928 tracks were reported, of which 1 875 were from loggerheads (97.3%) and 53 from leatherbacks (2.7%; Table 3). Loggerhead tracks were first sighted on 6 July 2018 and the last track on 14 March 2019, with a peak nesting activity (1 078 tracks, 57.5%) in December (Figures 7 and 8). Leatherback tracks in POPMR were first sighted on 10 November 2018 and the last track on 14 March. The highest activity was observed in December (28 tracks, 52.8%) and the second peak in November (13 tracks, 24.5%; Figures 7 and 8). During an aerial survey in April 2018, 30 marine turtles were counted between Maputo Bay and Ponta Dabela (Table 4). The results seem to indicate a higher density of turtles close to Ponta Mucombo (Figure 6).

**Table 4.** Results of total counts of marine turtles in three aerial surveys carried out in April 2018. BANP = Bazaruto Archipelago National Park; POPMR = Ponta do Ouro Partial Marine Reserve.

Location	Survey #	Effort (nm)	Number of group sightings	Individual marine turtles
BANP	1	853	30	39
	2	858	94	134
POPMR	3	127	25	30

## Nests

Within the recorded tracks (Table 3), 968 tracks were associated with a confirmed nest (Table 5), 1 231 were non-nesting emergences or unconfirmed nests. Most nests were recorded at the POPMR (75.3%), followed by Vamizi island (19.7%), BANP (2.7%), CSSTPZ (1.9%) and fewer from Tofo-Paindane and Závora–Praia Manhame (<0.5%).

Loggerhead nests at the POPMR were first sighted on 12 July 2018 and the last confirmed nest on 5 March 2019 with highest nesting activity in December (433 confirmed nests, 62.8% of total nests; Table 6). At the BANP, eight loggerhead nests were exhumed, with an estimated 802 eggs laid, and a total of 319 that did not hatch (Table 7).

**Table 5.** Number of confirmed nests laid per species and per area (Cc–*Caretta caretta*, Cm–*Chelonia mydas*, Dc–*Dermochelys coriacea*, Ei–*Eretmochelys imbricata*, Lo–*Lepidochelys olivacea*; NI–not identified; BANP–Bazaruto Archipelago National Park; POPMR–Ponta do Ouro Partial Marine Reserve; TPZ–Total Protection Zone) during the 2017/18 season. \* = Occasional patrols.

Monitoring area	Cc	Cm	Dc	Ei	Lo	NI	Total
<b>1. Vamizi island</b>		<b>191</b>					<b>191</b>
<b>2. Quirimbas National Park</b>							<b>0</b>
<b>3. BANP</b>	8	4	3			12	<b>27</b>
Bazaruto island							19
Benguérua island							5
Magaruque island							2
Bangue island							1
<b>4. Cabo de São Sebastião TPZ</b>	4	1				13	<b>18</b>
<b>5. PNR</b>							<b>0</b>
<b>6. Inhambane Casual Sites</b>	<b>3</b>						<b>1</b>
Tofo–Paindane*	2		0				2
Závora–Praia Manhame*	1						1
<b>7. POPMR</b>	<b>690</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>729</b>
P. Mucombo–Santa Maria	85	-	15				100
P. Dobela–P. Mucombo	138	-	3				141
P. Malongane–P. Dobela	464	-	19				483
P. do Ouro–P. Malongane	3	-	2				5
<b>Total</b>	<b>705</b>	<b>196</b>	<b>42</b>	<b>0</b>	<b>0</b>	<b>25</b>	<b>968</b>

Green turtles nest throughout the year in northern Mozambique, with a nesting peak from March to June in Vamizi island, whereas in the southern part of the country nesting follows the seasonal trend of other species (ie. October to February). Nests from green turtles were not abundant in Inhambane, with only four nests reported at the BANP and one at the Cabo São Sebastião Total Protection Zone. All the reported green turtle nests were exhumed at Vamizi island (191 nests) and BANP (4 nests; Table 9; Figure 9).

**Table 6.** Loggerhead turtle (*Caretta caretta*): number of confirmed nests laid per area and month, during the 2018/19 season. TPZ–Total Protection Zone; POPMR – Ponta do Ouro Partial Marine Reserve. \* = Occasional patrols.

Monitoring area	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
<b>4. Cabo de São Sebastião TPZ</b>									
<b>6. Inhambane Casual Sites</b>				1	1		1		
Tofo-Paindane*				1	1				
Závora–Praia Manhame*							1		
<b>7. POPMR</b>	1		3	10	113	433	120	7	3
Ponta Mucombo – Santa Maria	1		2	1	16	43	19		3
Ponta Dobela – Ponta Mucombo			1	2	45	54	34	2	
Ponta Malongane - Ponta Dobela				7	52	334	66	5	
Ponta do Ouro – Ponta Malongane						2	1		
<b>Total</b>	1	0	3	11	114	433	121	7	3

**Table 7.** Loggerhead turtles (*Caretta caretta*): number of hatchlings and eggs per area, during the 2018/19 season. HS=estimated hatching success. Note that fully destroyed nests were not included in the table. \* = Nests with information on number of eggs laid and unhatched eggs; \*\* = Nests with information on live and dead hatchlings.

Area	Number	Nests*	Eggs Laid	Unhatched Eggs	HS (%)	Nests**	Alive Hatchlings	Dead Hatchlings
<b>3. BANP</b>		8	802	319	68.4	7	464	15

**Table 8.** Green turtle (*Chelonia mydas*): number of confirmed nests laid per area and month, during the 2018/19 season.

Monitoring	Jun	Ju	Au	Sep	Out	No	Dec	Jan	Feb	Mar	Apr	Ma
<b>1. Vamizi island</b>	20	37	23	6	5	5	4	13	12	30	26	10
<b>Total</b>	20	37	23	6	5	5	4	13	12	30	26	10

Leatherback nests in POPMR were first sighted in 19 November 2018 and the last nest on 6 February 2019. Highest activity was observed in December (23 confirmed nests, 59.0%). Three nests from leatherbacks were washed away at the BANP (Table 11).

**Table 9.** Green turtle (*Chelonia mydas*): number of hatchlings and eggs per area, during the 2018/19 season. HS=estimated hatching success. Note that fully destroyed nests were included in the table.

Number	Nests*	Eggs Laid	Unhatched Eggs	HS (%)	Nests**	Alive Hatchlings	Dead Hatchlings
1. Vamizi	191	16127	268	96.3	195	15688	171
3. BANP	4	421	51	87.8	4	365	5

\*Nests with information on number of eggs laid and unhatched eggs

\*\* Nests with information on alive and dead hatchlings

**Table 10.** Leatherback turtle (*Dermochelys coriacea*): number of confirmed nests laid per area and month, during the 2018/19 season. POPMR-Ponta do Ouro Partial Marine Reserve; TPZ-Total Protection Zone. \* = Occasional patrols.

Monitoring area	Oct	Nov	Dec	Jan	Feb	Mar
7. POPMR	0	6	23	8	2	0
Ponta Mucombo - Santa Maria		4	4	5	2	
Ponta Dobela - Ponta Mucombo		2	1			
Ponta Malongane - Ponta Dobela			18	1		
Ponta do Ouro - Ponta Malongane				2		
<b>Total</b>	0	6	23	8	2	0



**Figure 9.** Green turtle hatchling with a lighter coloration (left) than normal (right). The specimens, from the same nest, were found at lighthouse beach, Vamizi island. Photo: Gélica Inteca.

Table 11 shows the number of nests destroyed by natural and anthropogenic causes at the POPMR and Vamizi island. A total of 121 nests (species not identified) were raided by honeybadgers (*Mellivora capensis*), bush pigs (*Potamochoerus larvatus*) and probably in a minor scale by other animals, within approximately 3 to 4 km of coast between Ponta Malongane and Ponta Dobela (Annex 1). Recorded raided nests represents 25.1% of total confirmed nests laid between Ponta Malongane and Ponta Dobela, and 16.6% of total nests recorded within the reserve. While for 2017/18 season, Fernandes *et al.* (2018), reported that 21.3% of nests within this section and 16.4% of total nests were raided. Whilst this is a natural phenomenon, the long term effects are currently unknown. Attention must be given to raided nests in the reserve.

During the night patrol at Vamizi island, the monitors reported nests being washed out and were required to translocate nests to safer places (Table 12).

**Table 11.** Number of nests destroyed by natural and anthropogenic causes per area, during the 2018/19 season. Sp – Species; Cc–*Caretta caretta*, Cm–*Chelonia mydas*, Dc–*Dermochelys coriacea*, Ei–*Eretmochelys imbricata*, Lo–*Lepidochelys olivacea*; NI–not identified; POPMR–Ponta do Ouro Partial Marine Reserve.

Area	Sp	Natural causes	Anthropogenic causes	Total
1. Vamizi island	Cm	2 nests flooded at Praia de Farol (11° 0'53.53"S; 40°41'17.96"E and 11° 0'0.10"S; 40°42'26.99"E 10.5)		2
3. BANP	Dc	3 nests washed away		3
	Ni	12 nests washed away		12
6. Inhambane Casual Sites Závora - Praia Manhame	Cc	1 nest washed away		1
7. POPMR Ponta Mamoli-Ponta Dobela	Ni	Nests raided by honeybadgers, bushpigs and other animals		121

**Table 12.** Number of translocated nests per area, during the 2018/19 season. Sp – Species; Cc–*Caretta caretta*, Cm–*Chelonia mydas*, Dc–*Dermochelys coriacea*, Ei–*Eretmochelys imbricata*, Lo–*Lepidochelys olivacea*; NI–not identified; POPMR–Ponta do Ouro Partial Marine Reserve.

Area	Sp	Natural causes	Anthropogenic causes	Total
1. Vamizi island	Cm	Nests laid close to high mark tide, that would be washed in spring tide, were translocated to upper levels of the same beach.		6

### Strandings, Entanglements and Mortalities

Only one stranding case was reported pertaining to a green turtle in Vamizi island (Table 13). A total of 42 marine turtle mortalities were reported. The majority of these mortalities (71.4%) were from unidentified causes and 28.6% from anthropogenic causes (Table 14).

**Table 13.** Reported marine turtle released alive from entanglements and strandings by natural (NC), anthropogenic (AC) or not identified causes (NI) per area and species (Cc – *Caretta caretta*, Cm – *Chelonia mydas*, Dc – *Dermochelys coriacea*, Ei – *Eretmochelys imbricata* and Lo – *Lepidochelys olivacea*; CCL curved carapace length).

Monitoring Area	Description	Photo evidence	NC AC NI		
			NC	AC	NI
Vamizi island, Cabo Delgado	Cm found during the low tide at Comissete Beach (17/08/2018)	 <p>Photo: Matt Reston</p>	1		
<b>Total</b>			<b>1</b>		

**Table 14.** Reported marine turtle threats by natural (NC), anthropogenic (AC) or not identified (NI) causes that have led to the turtle mortality, per area and species (Cc–*Caretta caretta*, Cm–*Chelonia mydas*, Dc–*Dermochelys coriacea*, Ei–*Eretmochelys imbricata*, Lo–*Lepidochelys olivacea* and NI–not identified; CCL–curved carapace length).

Monitoring area	Description	Photo evidence	NC	AC	NI
Vamizi island, Cabo Delgado Province	Carapace of juvenile found on the beach, north side of the island (11°11'44.75"S; 40°39'15.59"E; August 2018)	 Photo: Gélica Inteca		1	
	Headless Ei turtle found at high tide level MutuNkulo beach (11°1'46.23"S; 40°41'22.067"E; April, 2019)	 Photo: Gélica Inteca			1
Pemba, Cabo Delgado Province	Turtle bones found at Maringanha beach in Pemba (12°57'54.48"S; 40°34'01.79"E; September, 2018)	 Photo: Gélica Inteca			1

Monitoring area	Description	Photo evidence	NC	AC	NI
Ibo, island QNP, Cabo Delgado Province	<p>Ni dried carapace found at land (November, 2018)</p> <p>Fresh Ni turtle found dead at shore</p>	No photos		1	1
Matemo island, QNP, Cabo Delgado Province	<p>Ni turtles found dead:</p> <ul style="list-style-type: none"> <li>- entire body in Missaula (June 2018)</li> <li>- carapace in the hotel (June, 2018)</li> <li>- carapace in Muanacombo (October, 2018)</li> <li>- adult turtle with wounds in the head (April, 2019)</li> </ul>	No photos			4

Monitoring area	Description	Photo evidence	NC	AC	NI
Quirimba island, QNP, Cabo Delgado Province	<ul style="list-style-type: none"> <li>- Ni entangled in fishing net in Cuminaze (April, 2018)</li> <li>- Cm found floating in the sea with a fish hook in the mouth (December, 2018)</li> <li>- Ni washed ashore in Cumilamba (December, 2018)</li> <li>- Ni found dead, without frontal flippers, in Menfuco (April, 2019)</li> </ul>	No photos		2	2
Govuro, Inhambane Province	Bones found in Madacuene mangroves (August 2017*)	No photos		?	
Red Dunes, Inhassoro, Inhambane Province	Old carapaces found (August, 2017*)	 <p style="text-align: center;">Photos: Alima Taju</p>		?	

Monitoring area	Description	Photo evidence	NC	AC	NI
Cabo São Sebastião TPZ	15 dead turtles (3 adult Cc; the others were Cm and Ei juveniles).				15
Pomene, Inhambane Province	Juvenile Cm found by the PNR rangers at the fishermen house. According to the fisher, the turtle was captured by shoreline fishery (October, 2018)	 <p>Photo: Raquel Fernandes</p>		1	
	Cc turtle stranded at Dunas do Farol beach. Turtle was consumed by the local community (November, 2018)	 <p>Photo: Marlene, Izma Lodge</p>			1
Praia Manhame, Dunes de Dovelá, Inhacongo, Inhambane Province	Cc stranded dead (9/10/2018).	 <p>Photo: Alex Polleau</p>			1

Monitoring area	Description	Photo evidence	NC	AC	NI
Praia Manhame, Dunes de Dovelá, Inhaçongo, Inhambane Province.	Juvenile Cm stranded dead (21/12/2018)	 <p data-bbox="1146 548 1367 573">Photos: Alex Polleau</p>			1
Morrumbene Travessia Beach Lodge, Inhambane Province	Remains of 3 turtles (Cm, Cc and NI) (17/10/2018)	 <p data-bbox="1129 833 1388 857">Photos: Jessica Williams</p>		3	
Praia do Tofo, Inhambane Province	Cc turtle shot by speargun at Salon divesite in Tofo Bay. Animal found by divers and re-bar spear removed from lower jaw. Animal released alive. (11/12/2018)	 <p data-bbox="1031 1206 1482 1230">Photo: Helen Armstrong- Peri Peri Divers.</p>			1

Monitoring area	Description	Photo evidence	NC	AC	NI
	<p>Juvenile Ei found entangled in gillnet (11/12/2018) on way to Salon reef, Tofo Bay. Animal released.</p>			1	
Canda island, Gaza Province	<p>Juvenile Cm (CCL ~ 35-40cm) found dead in gillnet by local fishers. (21/4/2019)</p>	 <p data-bbox="1142 914 1373 938">Photo: Daryl Balfour.</p>		1	
Bilene, Gaza Province	<p>Cc dead turtles washed ashore. One of the turtles was injured in the carapace and tissue (8.04.2019).</p>	 <p data-bbox="1136 1230 1381 1255">Photos: Eddy Comiche</p>			2

Monitoring area	Description	Photo evidence	NC	AC	NI
Macaneta "Jays Lodge" beach, Maputo Province	Several carcasses and decapitated turtles strandings, potentially related to Semi-industrial fishing vessels that were seen moored close to shore.	Strandings was reported by Gary Allport at the beginning of the nesting season (November). No photos.		?	
Penha Palhota - South Beach, Maputo Province	Adult Cc (CCL 81.5 cm; CCW 80 cm) found dead (S25°57.903; E32°36.140; 24.05.2019)	 <p>Photos: Marcos Pereira</p>			1
POP MR, Maputo Province	Adult dead Cc found entangled in an industrial trawling net (8/02/2019)	 <p>Photo: Moisés Marcelino</p>		1	
<b>Total</b>			-	<b>12</b>	<b>30</b>

\* Data not recorded in the previous reports

## Tagging and recaptures

Only three species were tagged, the loggerhead and leatherback at POPMR and green turtles at Vamizi island. Recaptures of tagged turtles were also recorded within these areas.

A total of 234 loggerhead females were handled during the nesting season, from these 147 were first tagged in the POPMR (Table 16) and 76 individuals tagged in previous nesting seasons were recaptured (Table 17), including 37 turtles with South African tags (Table 18). Tagged loggerhead turtles tracks (311 tracks) represent only 16.6% of the total recorded tracks for this species.

A total of ten leatherback females were handled, with five being tagged for the first time (Table 16) and five recaptured (Table 17). Only one leatherback recapture had a South African tag (Table 18). Tagged leatherback turtles tracks (12 tracks) represent only 22.6% of the total recorded tracks for this species.

At Vamizi island 27 turtles were double tagged, first tag in the frontal left flipper and the second tag in the right flipper (Table 16). Three green turtles tagged in previous nesting seasons were recaptured (Table 17).

A batch of tags were ordered to be used at Vamizi with the series codes: MZ 3150 - MZ3350.

**Table 16.** Number of marine turtles tagged for the first time during the 2018/2019 season at Vamizi island, Bazaruto Archipelago National Park and Ponta do Ouro Partial Marine Reserve (POPMR), per species. Note that the application of new tags to replace old tags was not counted.

Monitoring Area	<i>C. caretta</i>	<i>D. coriacea</i>	<i>C. mydas</i>
<b>1. Vamizi island</b>			27
<b>7. POPMR</b>	147	5	
P. Mucombo - Santa Maria	1	0	
P. Dobela - P. Mucombo	23	0	
P. Malongane - P. Dobela	120	3	
P. Ouro - P. Malongane	3	2	
<b>Total</b>	<b>147</b>	<b>5</b>	<b>27</b>

**Table 17.** Number of marine turtles recaptured in the 2018/2019 season at Vamizi island and Ponta do Ouro Partial Marine Reserve (POPMPR), per species. Note that this table includes only the tags that were first applied on other nesting seasons or from other areas outside the monitoring area. \* =The total of individuals recaptured at POPMPR is not the sum of the numbers reported per each section, as an individual (same tag number) can be seen in different beach sections. The POPMPR total refers to the number of individuals recaptured with tags that were applied in previous nesting seasons or different areas, for example from South Africa.

Monitoring Area	<i>C. caretta</i>	<i>D. coriacea</i>	<i>C. mydas</i>
<b>1. Vamizi island</b>			3
<b>7. POPMPR*</b>	76*	5*	
P. Mucombo – Santa Maria	5	1	
P. Dobela – P. Mucombo	16	0	
P. Malongane – P. Dobela	72	4	
P. do Ouro – P. Malongane	0	0	

**Table 18.** Series of tags applied in the 2018/2019 season and recaptured at Vamizi island and Ponta do Ouro Partial Marine Reserve (POPMPR).

Monitoring Area	Series of tags
<b>Vamizi island</b>	<b>Applied:</b> MZ3151 - MZ3219
	<b>Recaptured:</b> MZ147, MZ222 and MZ042
<b>POPMPR</b>	<b>Applied:</b> MZ2249; MZ2386-MZ2387; MZ2391-MZ2393; MZ2535; MZ2549-MZ2550; MZ2576; MZ2600- MZ2610; MZ2612-MZ2616; MZ2624- MZ2629; MZ2631- MZ2642; MZ2644-MZ2662; MZ2664-MZ2688; MZ2690-MZ2741; MZ2743-MZ2748; MZ2750-MZ2753; and MZ2755-MZ2756
	<b>Recaptured:</b> MZ210MZ277 (retagged MZ2663); MZ519; MZ571; MZ661; MZ751; ; MZ949; MZ956; MZ980; MZ1062; MZ1064; MZ1180; MZ1202; MZ1213; MZ1278; MZ1289; MZ1310; MZ1355; MZ1430; MZ1576; MZ1598; MZ164; MZ1693; MZ1699; MZ1820; MZ1890; MZ1927; MZ1943; MZ1953; MZ1955; MZ1968; MZ1972; MZ1975; MZ1976; MZ1982; MZ1999; MZ2030 MZ2086; MZ2218; MZ2240; MZ2277; MZ2334; MZ2392; MZ2395; MZ2396; MZ2397; MZ2445; MZ2447; MZ2448; MZ2449; MZ2450; MZ2548;
	<b>Foreign tags recaptured:</b> AZ-0191A, COM853, HH592, LAM1310, LL637, ZA0083C, ZA0233A, ZA0450B, ZA0525A, ZA0801E, ZA0904B, ZA0928B, ZA1018C, ZA1086E, ZA1103E/1104E, ZA1104C, ZA1302E, ZA1315/1316C, ZA1378E, ZA1453D, ZA1453D/MZ1596, ZA1484A, ZA1822E, ZA1878/ZA1808E, ZA895A, ZAAUT237/ZA0991C, ZABB418, ZABB428/MZ2742, ZACC090, ZAO377, ZARR209, ZARR222, ZAXX225, ZAXX476, ZAXX758 and ZAYT078 for loggerheads and ZA1294C for leatherbacks.

## RESEARCH UPDATE

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### Recent publications relevant to Mozambique (published from August 2018 to June 2019)

- Williams, J. L., Pierce, S. J., Hamann, M., & M. M. Fuentes (2019). Using expert opinion to identify and determine the relative impact of threats to sea turtles in Mozambique. *Aquatic Conservation: Marine and Freshwater Ecosystems*.
- Pilcher N.J. & J. Williams (2018). Assessment of the status, scope and trends of the legal and illegal international trade in marine turtles, its conservation impacts, management options and mitigation priorities in Mozambique. Report to the CITES Secretariat Project S-527. SSFA/2018/DKA. 69pp.

### Conference presentations

- Oral presentation on the update marine turtles monitoring, tagging and conservation programs on Mozambique for the Western Indian Ocean Sea Turtle Network meeting at 11<sup>o</sup> Scientific Symposium of the Western Indian Ocean Marine Science Association (WIOMSA), 01 - 06 July 2019, University of Mauritius, Mauritius. Presentation was made by Raquel Fernandes in collaboration with Cristina Louro, Gélica Inteca and Marcos Pereira.
- Poster presentation “Marine turtles mortality (1991-2018): how big is the iceberg?” at 11<sup>o</sup> Scientific Symposium of the Western Indian Ocean Marine Science Association (WIOMSA), 01 - 06 July 2019, University of Mauritius, Mauritius. Poster presentation was made by Raquel Fernandes in collaboration with Marcos Pereira.

### Priority future research and conservation management actions needed

- Analysis of female emergences, nests and tagged turtles at POPMR (from Ponta do Ouro to Santa Maria) from 1994 to the current nesting season.

- Different stakeholders (i.e. tourism operators and civil society organizations) have been occasionally reporting turtle mortalities throughout the coast. However, a specific protocol to quantify artisanal bycatch and intentional captures is still lacking. Semi-industrial and industrial fisheries bycatch data is also not being reported on a regular basis. Efforts should be made to collaborate with fisheries institutions in those matters, including the implementation of turtle excluder devices (TEDs).
- Improve the estimates of marine turtle nesting populations.
- Baseline surveys at the Greater Bazaruto area (Inhambane Province) to understand the impacts that the proposed shallow water seismic surveys and oil and gas exploration may have on turtles.

## **TRAINING RANGERS AND COMMUNITY MONITORS AND OTHER ACTIVITIES**

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Centro Terra Viva, within the terms of the Memorandum of Understanding with ANAC, Mozbio and FNDS (signed in July 2017), is developing activities related with result dissemination in marine conservation areas, namely QNP, BANP, PNR and POPMR.

The activities include talks with the park administrations to report results, improve methodologies and provide management recommendations. An experience exchange field trip between rangers of the BANP and POPMR on turtle monitoring and conservation was held in 7 to 10 January. During this field trip at Ponta do Ouro, it was clear that the monitors must go through annual refreshment on the monitoring protocol and data collection.

## ENVIRONMENTAL EDUCATION AND AWARENESS

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- Lúrio University students and researchers conducted awareness-raising activities with Vamizi Complete Primary School students and lodge staff about the importance of protecting sea turtles and marine ecosystems.
- CTV made a presentation about marine turtles at the Biofund fair “*Biodiversity of Mozambique - The Culture of Conservation and Sustainable Development: Harmonizing Economic Development and Biodiversity Conservation*” for approximately 50 children from different schools held in 9 August 2018 in Inhambane City.
- CTV made a presentation celebrating marine turtle international day, at the Maputo International School for approximately 20 pupils (9<sup>th</sup> to 11<sup>th</sup> grade).



**Figure 10.** Talk at Biofund biodiversity fair in Inhambane (Photo: Daniela Urbano). Talk at Vamizi island (Photo: Gélica Inteca)

## CHALLENGES & RECOMMENDATIONS

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Overall, and based on past and present results, the following recommendations are provided:

1. *Improvement of monitoring effort.* Monitoring programmes with no capacity to conduct daily beach patrols daily during the nesting season, should direct greater monitoring effort, towards peak nesting activity periods.

2. *Improvement of monitoring effort data recording.* Distance covered and duration of all patrols made should be recorded. The monitoring effort spreadsheets per monitoring area (digital or hardcopy) should be provided to avoid the error of considering false zero observation days.
3. *Monitoring protocol.* Programmes are encouraged to adopt the current monitoring protocol to collect all data related to female emergences (i.e. tracks, nests and biometrics) and nest data (e.g. number of eggs, and live and dead hatchlings). If possible, additional physical parameters should be record (eg. wind direction and strength, tides) to correlate with track and nest densities.
4. Make efforts to increase collaboration with different stakeholders for a holistic perception of marine turtle habitat uses and threats in Mozambique. A steep forward to improve the collaboration with local authorities (police, *Força de Protecção de Recursos Naturais e Meio Ambiente*, conservation areas administrations) to enforce the conservation law, prosecute infractions and report at national level.

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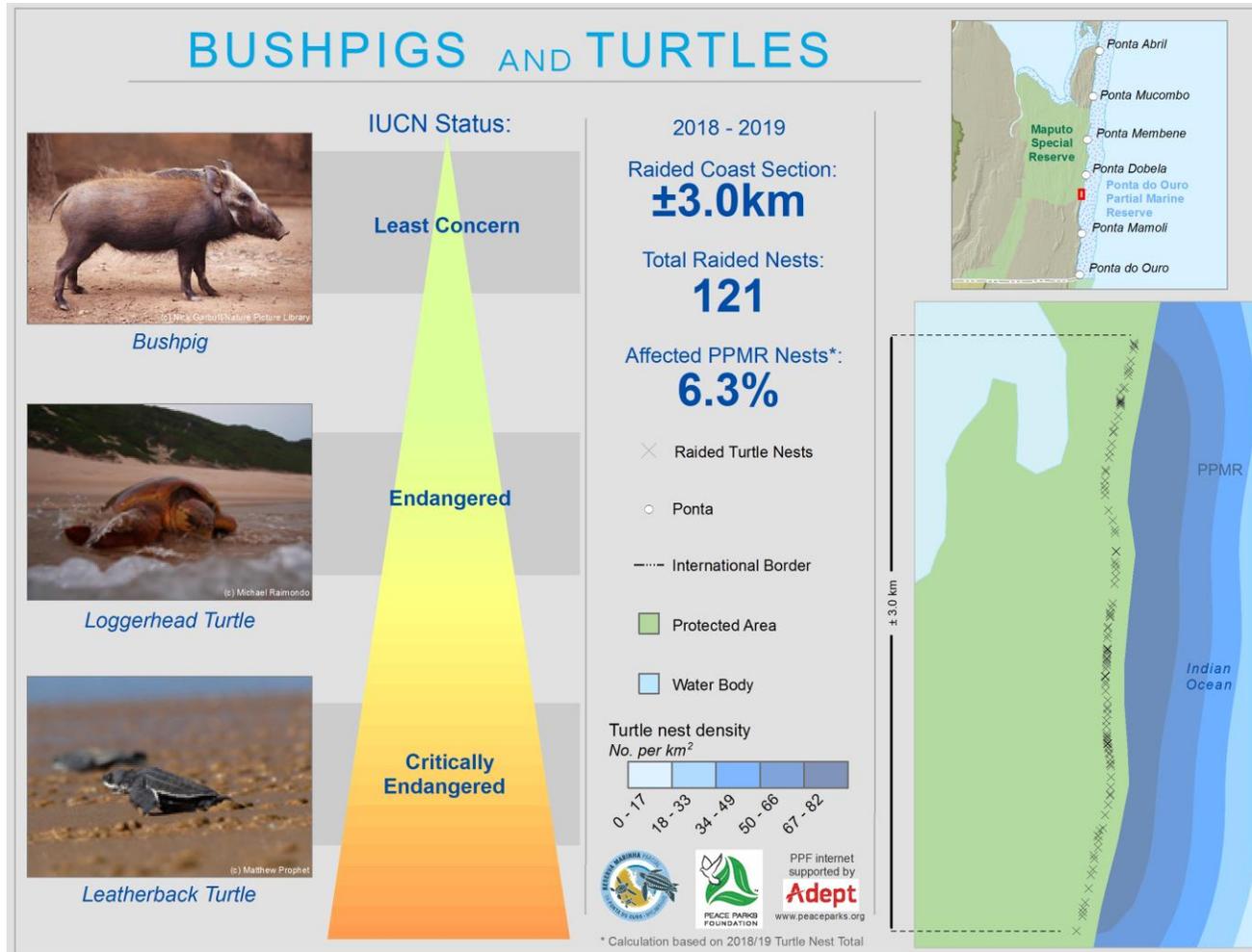
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# ANNEXS

Annex 1. Distribution of raided nests from Ponta Malongane to Ponta Dobela (Courtesy of POPMR and PPF)





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