

Marine turtles in Mozambique: The development of an effective conservation and management programme

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Background

The Mozambican coast hosts five species of marine turtles: the green (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) (Figure 1). These species are listed as either endangered or critically endangered by the World Conservation Union (IUCN) (Gove *et al.* (2001) and are listed on Appendix I of the Convention on Trade in Endangered Species (CITES). Mozambique has been a signatory to CITES since 1981. In addition, all turtle species are protected under the Mozambique legislation. The killing of marine turtles and possession of their eggs is an offence under the Forest and Wildlife Regulation (Decree 12/2002 of 6 June 2002). This regulation predicts a fine for illegal hunting of marine turtles of 25, 000.00 MT (about 1,000 USD).

Despite this legislative protection, marine turtle populations in Mozambique are under increasing pressure from the human population. The close proximity of coastal towns and villages to marine turtle habitats presents threats to turtles and their habitats on shore and at sea (Gove and Magane, 1996). Anthropogenic threats include loss and degradation of nesting and foraging habitats; hunting for meat, carapaces (for the manufacture of "tortoiseshell") and collection of eggs, as well as incidental capture in various fisheries (Costa and Motta, 2006; revision by Louro *et al.*, 2006).

The first studies on marine turtles carried out in Mozambique date back to 70s (Hughes, 1971), Tinley, 1971). A huge temporal gap followed before marine turtles were the subject of studies by Gove and Magane (1996), Gove *et al.* (2001) and Magane and João (2002). Still, significant gaps in our knowledge remain. Research and conservation work, currently been undertaken on turtle populations in Maputo, Gaza, Inhambane, Nampula and Cabo Delgado. The Mozambique Marine Turtle Working Group (MMTWG) was created in April 2004 and began the first phase of a national turtle monitoring and tagging programme. Project sites include Maputo Special Reserve, Inhaca Island, Macaneta, São Sebastião Sanctuary, Bazaruto Archipelago National Park and the Primeiras and Segundas Archipelago (Figure 2), all previously identified as nationally important for marine turtle nesting (Louro *et al.*, 2006). Recent MMTWG work now supports ongoing efforts of private tourist operators, local NGOs and the Universidade Eduardo Mondlane (UEM) and their established turtle tagging programmes.

Distribution of marine turtles in Mozambique

A variety of habitat characterizes Mozambique's coastline including, delta estuaries, sandy beaches, rocky shores, mangroves, islands, and coral reefs. The coast can be divided in three sections, each with distinct basic characteristics. The Figure 2 illustrates the nesting pattern of five species that occur in Mozambique coast.

The northern section of the coast extends for 770 km from the Rovuma River in the north to Pebane in the south (17°20'S). Numerous small islands with coralline habitat extend from the Quirimbas Archipelago to the Primeiras and Segundas Islands (Massinga and Hatton, 1996, Schleyer *et al.*, 1999). The most common nesting species in this section is the green turtle, but hawksbill, loggerhead and olive ridley turtles also known to nest here. The combined nesting season runs from June to November, with peak activity between August and October in Primeiras and Segundas Islands. On the other hand, in Quirimbas archipelago particularly in Quirimbas National Park, the mating season starts in August to September and then the nesting season starts in January- February and ends in April with the peak season in March (Costa, 2007).

The central section of the coast stretches 950 km between Pebane (17°20'S) and Bazaruto Island (21°10'S) (Massinga and Hatton, 1996) and has some coral reefs (Schleyer *et al.*, 1999). However, twenty-four rivers discharge into the Indian Ocean along this section, each with an estuary supporting well-established mangrove stands. The coastal waters are shallow and the sediment loading from the rivers results in high turbidity levels (Schleyer *et al.*, 1999). Loggerhead, green, leatherback, hawksbill and olive ridley turtles known to occur along this section of coast, but nesting are mainly by loggerheads and occur between October and February (WWF, 2005; Louro *et al.*, 2006; Videira and Louro, in prep).

The southern section stretches for 850 km from Bazaruto Island southwards to Ponta do Ouro (26° 50'S). This part of the coast is characterised by high parabolic dunes backed by coastal barrier lakes (Tello, 1973), north-facing bights and extensive sandy beaches (Hatton, 1995; Massinga and Hatton, 1996). The dune systems attain heights of 120 m, considered to be the highest vegetated dunes in the world (Hatton, 1995). This section of the coast is an important nesting area for loggerhead and leatherback turtles (Tello, 1973; Gove and Magane, 1996; Magane and João, 2002; WWF, 2004; Louro *et al.*, 2006). While hawksbill nesting is limited to the northern section of the coast, studies in 2004 and 2005 revealed that this species also forages in the coastal waters off southern Mozambique (WWF, 2005).

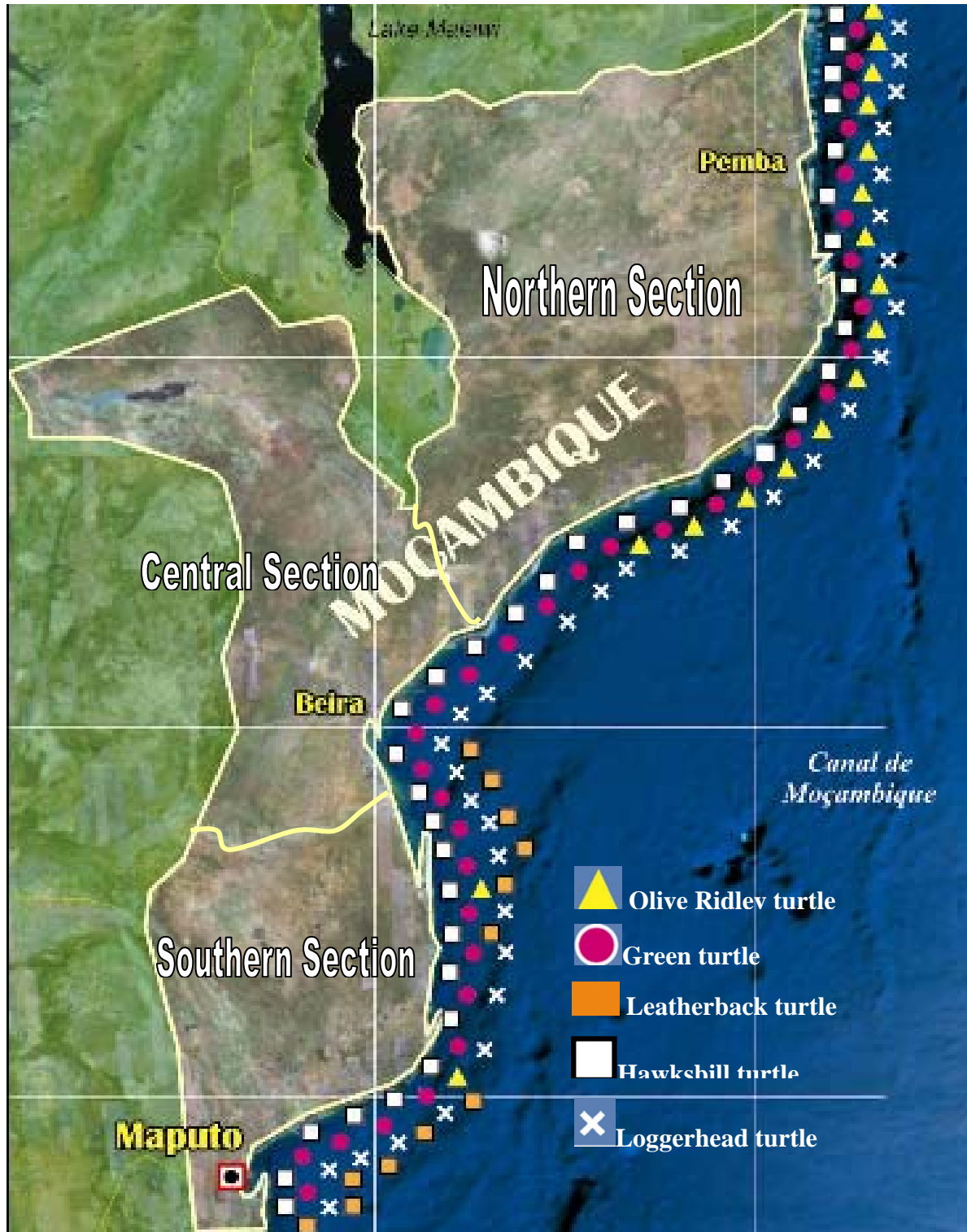


Figure 1: Mozambique map illustrating the distribution pattern of five species that occur in Mozambican waters.

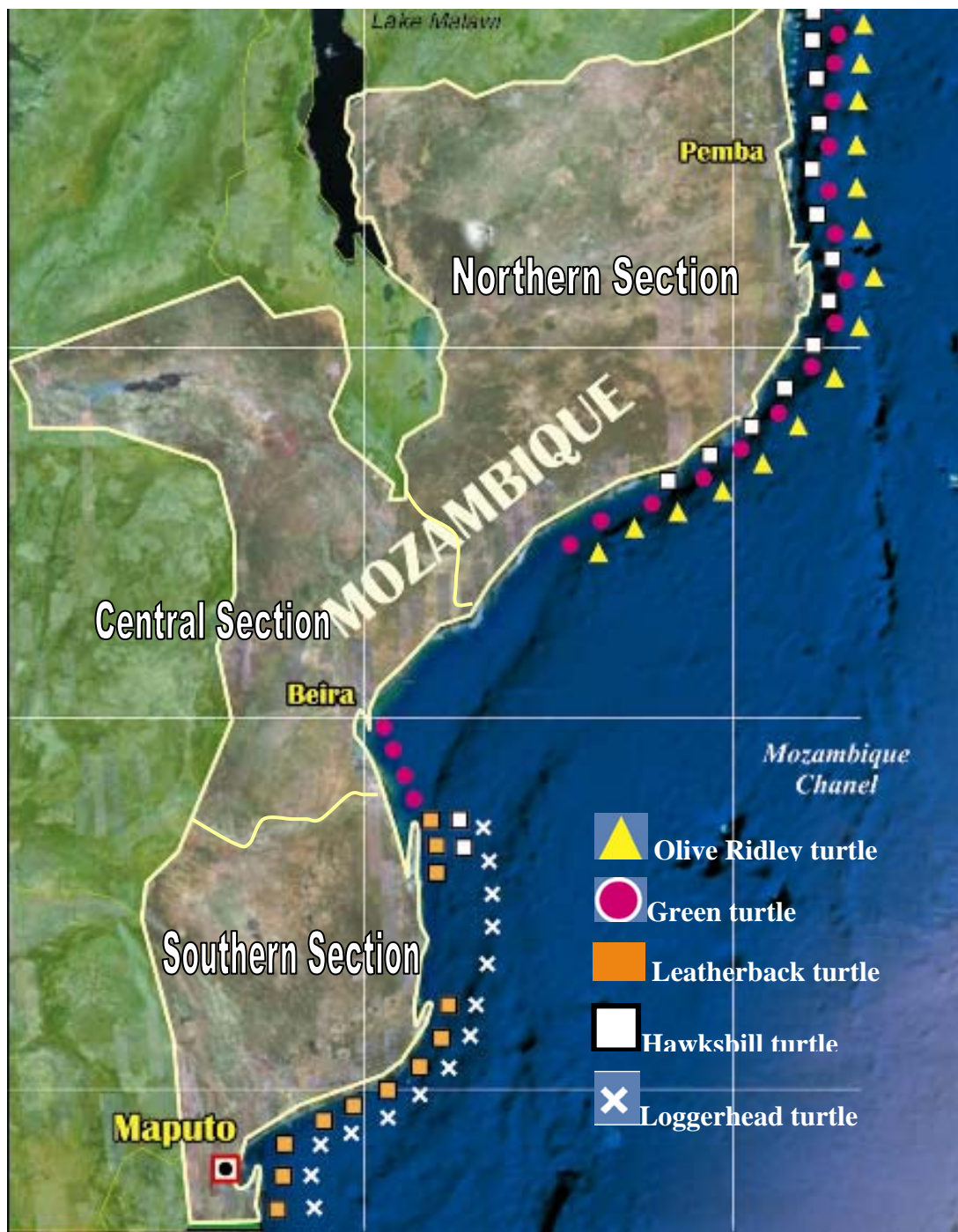


Figure 2: Mozambique Map, illustrating the nesting sites for each species of marine turtle. In **northern section** of the country only nest three species, olive ridley, green turtle and hawksbill turtle, in the **central section**, leatherback, loggerhead and green turtle and finally in the **southern section** only two species nest in this area, the loggerhead and leatherback turtle.

Marine turtle conservation, monitoring and tagging

Tagging and monitoring of nesting marine turtles and their hatchlings takes place at different months of the year along the Mozambique coast according with nesting seasonality. This programme is now coordinating six tagging and nest monitoring projects in the northern section, central section and finally in the southern section. Mozambique Marine Turtle Working Group is responsible to collect and processes the data forms. The titanium tags used in this programme carry the MO code and the return address is- Department of Biology. P.O. Box 257, Maputo Mozambique.

Northern Section: The MMTWG project in the Primeiras and Segundas Islands began in July 2005. The project aims to protect turtles and their nests, tag nesting females, demarcate turtle nesting sites, and to prevent the use of illegal fishing gear associated with high rates of turtle bycatch. Twenty-four community rangers were train to identify and tag turtles and monitor nesting activity. These rangers have also established conservation awareness and outreach programmes among the local communities in the islands, in order to reduce turtle bycatch and egg poaching. The change of attitude of local fisherman is already visible (Figure 3), were all the tagged (111) and recaptured (25) marine turtle were brought by fishermen. The recapture of green and hawksbill turtle within a year indicate that this region may be an important feeding site. One of the green turtles recaptured was caught in Puga Puga Island in August 2006 by local fisherman with Mayotte Island tag (code MAY 6091). This turtle was firstly tag in 1994 and recaptured three months later in same area in Mayotte, after that never found in anywhere Mayotte waters.

It is important to note that two turtle caught on fishing net by local fisherman in Puga-Puga Island, were recaptured one in 7 days and other in 34 days later, while nesting in same Island. The table 1, present's incidental captured of green and hawksbill turtle in Puga-Puga Island. This data provide same important results of the nesting behaviour, this is completely different from the nesting period in central section of the country, according with (Louro *et al.*, 2006) the nesting season starts in October to January with the peak in October.

Table1. Turtle incidentally captured on fishing nests around the waters of Puga-Puga Island, Mafamed Island and Ndjovo Island, subsequently tag and released and days later, three of them found nesting in the puga-puga island. **Acrescentar dados de mafamed**

Turtle No.	Tag No.	CL (cm)	CW (cm)		Place that was found	Species	Data
1	MO1227				Fishing Net	Green Turtle	19/07/2005
2	MO1229				Fishing Net	Green Turtle	19/07/2005
3	MO1228				Fishing Net	Green Turtle	19/07/2005
4				MO1226	Nesting	Green Turtle	20/07/2005
5	MO1130				Fishing Net	Green Turtle	23/07/2005
6	MO1226				Fishing Net	Green Turtle	17/07/2005
7	MO1132				Fishing Net	Hawksbill Turtle	01/08/2005
8	MO1133				Fishing Net	Green Turtle	01/08/2005
9	MO1139				Fishing Net	Hawksbill Turtle	03/08/2005
10	MO1134				Fishing Net	Green Turtle	04/08/2005
11	MO1140				Fishing Net	Green Turtle	04/08/2005
12	MO1142				Fishing Net	Green Turtle	04/08/2005
13	MO1138				Fishing Net	Green Turtle	04/08/2005
14	MO1135				Fishing Net	Green Turtle	04/08/2005
15	MO1141				Fishing Net	Green Turtle	04/08/2005
16	MO1137				Fishing Net	Green Turtle	04/08/2005

17	MO1136				Fishing Net	Green Turtle	04/08/2005
18	MO1149				Fishing Net	Green Turtle	06/08/2005
19	MO1146				Fishing Net	Green Turtle	06/08/2005
20	MO1144				Fishing Net	Green Turtle	06/08/2005
21	MO1145				Fishing Net	Green Turtle	06/08/2005
22	MO1147				Fishing Net	Green Turtle	06/08/2005
23	MO1148				Fishing Net	Green Turtle	06/08/2005
24	MO1143				Fishing Net	Green Turtle	06/08/2005
25				MO1144	Nesting	Green Turtle	18/08/2005
26	MO1101				Fishing Net	Green Turtle	19/08/2005
27	MO1102				Fishing Net	Green Turtle	19/08/2005
28	MO1103				Fishing Net	Green Turtle	19/08/2005
29	MO1104				Fishing Net	Green Turtle	19/08/2005
30	MO1111				Fishing Net	Green Turtle	21/08/2005
31	MO1112				Fishing Net	Green Turtle	21/08/2005
32	MO1110				Fishing Net	Green Turtle	21/08/2005
33	MO1105				Fishing Net	Green Turtle	21/08/2005
34	MO1108				Fishing Net	Green Turtle	21/08/2005
35	MO1109				Fishing Net	Green Turtle	21/08/2005
36	MO1120				Fishing Net	Green Turtle	24/08/2005
37	MO1152	87	79		Fishing Net	Green Turtle	12/10/2005
38	MO1123	102	97		Fishing Net	Green Turtle	12/10/2005
39	MAY6091	114	105		Fishing Net	Green Turtle	12/10/2005
40				MO1149	Nesting	Green Turtle	12/09/2005
41	MO1154	68.5	63		Fishing Net	Green Turtle	13/10/2005
42	MO1157	105	95		Fishing Net	Green Turtle	13/10/2005
43	MO1153	85	81		Fishing Net	Green Turtle	13/10/2005
44	MO1156	110	103		Fishing Net	Green Turtle	13/10/2005
45	MO1155	43	40		Fishing Net	Green Turtle	13/10/2005
46				MO1228	Fishing Net	Green Turtle	19/10/2005
47	MO1129	80	75		Fishing Net	Green Turtle	31/10/2005
48	MO1230	54	48		Fishing Net	Green Turtle	25/11/2005
49	MO1231	65	60		Fishing Net	Green Turtle	25/11/2005
50	MO1231	50	43		Fishing Net	Green Turtle	25/11/2005

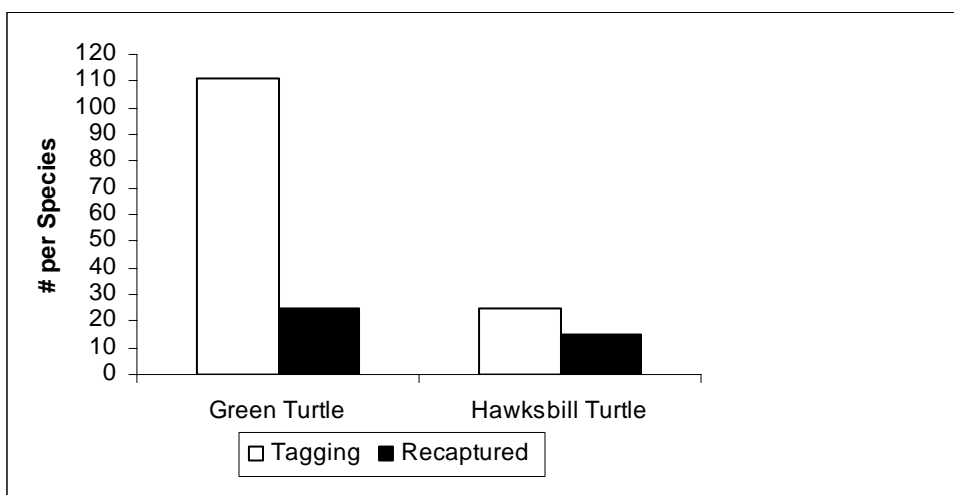


Figure 2: Number of marine turtle tagged during the 2005/2006 season in Puga Puga Island at Primeiras and Segundas archipelago in Nampula province. Number of green and hawksbill turtles tagged.

Central Section: Loggerheads are the most common species to nest in this section, although the green, hawksbill and leatherback turtles have been recorded nesting in the area. Local fishermen in Bazaruto Archipelago National Park also caught twenty-five turtles, during the 2005/2006 season, 19 of these were green turtles, 3 hawksbill and 3 loggerhead turtles. In addition 9 tagged turtles were recaptured by local fisherman (Figure 3; WWF, 2005). The lack of TIME availability of rangers and funding constraints made it difficult to conduct nesting patrols in the 2005/2006 season in the area.

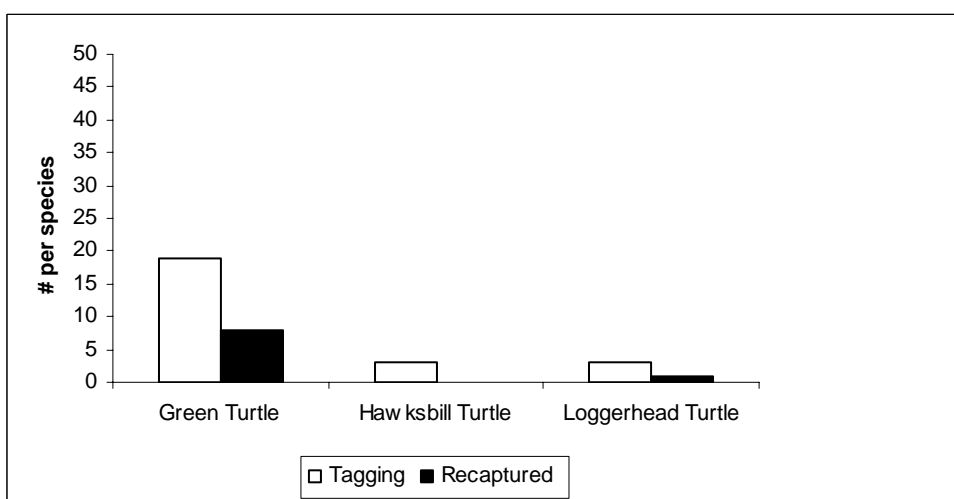


Figure 3: Number of tagged green, hawksbill and loggerhead turtles in the Bazaruto Archipelago National Park, in a period of one year 2005/2006.

Southern Section: In October 2004, the MMTWG initiated a project in collaboration with the local community at the Maputo Special Reserve (MSR), an important nesting site for loggerhead and leatherback turtles (WWF, 2004). Between October 2004 and March 2005, 34

turtles tagged along a 29km stretch of coast from the MSR to Ponta Chemucane, twenty-seven turtles (21 loggerhead, 1 hawksbill, 5 leatherback) with Mozambican address and seven nesting loggerhead females were observed South African address (Figure 4). It is important to note that the hawksbill does not nest in this region; this could be a feeding ground. The rangers captured the one hawksbill by hand while free swimming. This proves that the hawksbill occur on entire coast of Mozambique.

Rangers in the same area, among which, observed 239 nesting attempts were by 83 were false crawls (62 by loggerhead turtles and 21 by leatherbacks) and 156 attempts resulted in nesting (109 loggerhead and 47 leatherbacks). During this period, more than 90 loggerhead nests successfully hatched. It is important to note that the hawksbill turtles encountered and tagged were foraging (José João personal communication) on shallow water, this area as very close to the beach were they were caught by community rangers (WWF, 2005).

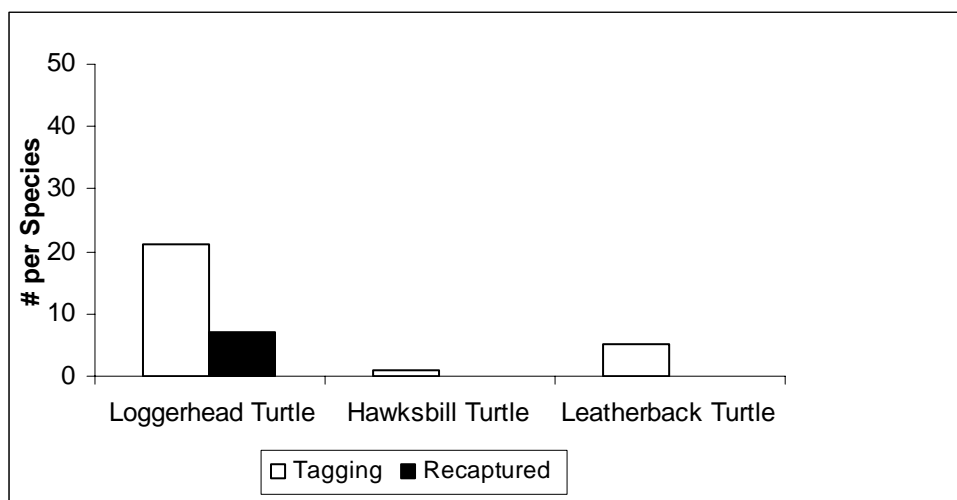


Figure 4: Tagged species occurring in the Maputo Special Reserve (2004/2005 season)

Concluding remarks

As a result of the work carried out by the rangers, fishers and local community, has been a substantial reduction of poaching of turtles and turtle eggs.

The artisanal fishers operate in coastal provinces of Mozambique are currently taking steps in conservation of marine turtle through active involvement on turtle tagging and monitoring programme. Local fisher brought 90% of turtles tagged by rangers, an indication of a change of attitude by local fisherman.

The collaboration with local community and most importantly the local fisherman effort in working with the park rangers contribute to success of the turtle tagging programme.

Northern section it is important nesting and feeding ground for green turtle and hawksbill, on the other hand the southern section it is very important for nesting site for loggerhead and leatherback turtle.

The marine turtle tagging and monitoring enables coastal communities and the conservation agencies, NGOs, private sector and government authorities to develop the capacity to influence the decision-making on conservation.

Will be important to investigate the presence of sea turtle in the northern section because the turtle in the Primeiras and Segundas Islands have different nesting behaviour as the ones occurring on the Quirimbas Archipelago.

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