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2020-2025 MANAGEMENT PLAN FOR THE SUSTAINABLE USE CONSERVATION AREA: SANCTUARY BRAVIO DE VILANCULOS

thesanctuary
Santuario Bravio de Vilanculos Lda

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TECHNICAL SHEET

2020-2025 MANAGEMENT PLAN FOR THE SUSTAINABLE USE CONSERVATION AREA: SANCTUARY BRAVIO DE VILANCULOS

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São Sebastião Peninsula

Vilanculos District

Inhambane Province

Mozambique

List of Abbreviations and Symbols

%	Percentage
cm	Centimeters
CARE	Humanitarian Aid Agency
Ex.	For example
ha	Hectares
ºC	Centigrade degrees
Kg	Kilograms
Km	Kilometers
nº	Number
St.	*Santa*
SOA	Associations of Sanctuary Owners
SBV	Santuário de Bravio de Vilanculos
ANAC	Administração Nacional de Áreas de Conservação
MTA	Ministério da Terra e Ambiente

List of Figures and Tables

Executive Summary of the Management Strategy

1. Introdution

This updated Management Plan is part of the legal requirements as described in Law No. 5/2017, of 11 May - Law on the Protection, Conservation and Sustainable Use of Biological Diversity, whose object is the establishment of basic principles and standards on the protection, conservation, restoration and sustainable use of biological diversity in conservation areas as well as providing for the respective integrated administration to meet the requirements of sustainable development in the country. This, allows the guarantor in the total management of the SBV conservation area located in the São Sebastião Peninsula, granted by the council of ministers per Authorisation No 4/2000, 17 October 2000 and updated Internal Resolution No 2/2003, at 29 April 2003 and as approved by Decree 18/ 2003 of 29 April.

2. Preamble

The Sanctuary's mission and vision is to support sustainable development, biodiversity conservation and low-impact tourism activities. The Sanctuary has been declared a Fully Protected Area, by the Council of Ministers, as it is characterised by internationally important marine and terrestrial biodiversity.

SBV seeks to achieve the following objectives while building a sustainable local economy and tourism development, addressing the current and anticipated threats to the area's biodiversity, uplifting communities and promoting conservation-enhancing management practices.

1. Effectively and strategically protecting threatened species and promoting the wise, appropriate and sustainable use of marine and terrestrial resources.
2. Restoring the terrestrial faunal and floral biodiversity and ecosystem processes.
3. Actively involving local communities in the management of Sanctuary.
4. Suitably and equitably sharing the benefits with local communities.
5. Developing appropriate low-impact eco-tourism facilities and activities to finance Sanctuary's activities and provide sustainable and optimal revenue streams for community development.
6. Creating a successful economic model that works towards and sustains the above while providing and growing a tourism and conservation destination, renowned at regional, national and international levels, that gives value for financial outlay to the investors.

A company named East African Wildlife Properties (EAWP), listed as the foreign investor in the Internal Resolutions, initially played a key role in the development and implementation of this project by establishing the Sanctuary. Later, EAWP transferred its interests in SBV to the Sanctuary Owner's Association (SOA), which was established by residential and commercial owners to manage Sanctuary and achieve its objectives. The SOA is the 75% shareholder in Santuàrio Bravio de Vilanculos Lda and John Kachamila, a Mozambican partner, is a 25% shareholder.

This brief Progress Report serves to highlight and describe progress to date plus the benefits the project has brought to the local community and economy. These benefits have not only improved the livelihoods of the local communities and the local and regional economies but also the environment, living resources and the biodiversity of the area. The project has taken great strides in the protection and enhancement of indigenous fauna and flora biodiversity as well as facilitated marked improvements in veld condition and ecological processes both in the terrestrial and marine domains.

Wherever possible, to facilitate comparisons and show the extent of progress, numerical values are presented. Where possible, values from the initial stages of development, or legal requirements, are presented first, then figures from the 2015 Management Plan and finally an update on the current situation.

3. Investiment

The Sanctuary has generally progressed exceptionally well, in terms of the investment requirements of the Special License, taking into account the detrimental impact that the Nyati court case had on the overall development of the project, the poor state of the southern African economy and the weak local currencies. The Nyati court case was seen by many investors as a "land claim", thus doubts arose about the "Authorisation', mentioned above. Development activities on Sanctuary were severely impacted for an extensive period but the Supreme Court of Mozambique finally ruled firmly in favour of SBV, confirming the legal status of the project. In retrospect, this had an overall positive impact on Sanctuary as it proved that the project was legally sound and had full Mozambican judicial, administrative and political support. Shortly after the Nyati case was finalised, however, the global economic climate worsened significantly. Despite this, through commitment and insight by SBV's investors, and wise management on the ground, substantial further investment has still taken place.

The total investment required by Government as per the Authorisation was R 147 million of which:

a) R 140, 200, 000 should have been direct investment,
b) R 2, 300, 000 should have been local purchases in Mozambique and
c) R 5, 000, 000 in other forms of investment.

The total project investment on Sanctuary was already approximately R360 million by 2015 (Table 1), greater than double the legally required amounts, and has subsequently grown to approximately. As principais componentes do investimento são as seguintes:

a) Direct investment including the Sanctuary, Commercial, Residential and Community infrastructure totals R250 million;

b) Indirect investment such as salaries, environmental aspects, community programs constituted R35 million;

c) Local purchases and making use of local service providers has, to date, come to a total of R75 million.

d) An added financial bonus is having game species breeding well on Sanctuary as they have a cash value and can also be seen as a further investment. Not only are game an asset for conservation, tourism development and the environment their cash value is now well into the millions of rand. The initial introductions, around 2008, cost R 3 300 000 but the current value, using 2019 auction prices, is now estimated at well over R 12 000 000 and is rising rapidly each calving season.

Table 1. Rand values required under the Special License, actual amounts given in the 2015 Management Plan, updated figures for 2019 and percentage above requirement for the Sanctuary development.

	Rand values		
Aspect	**Required**	**2015**	**2019**
Direct investment	R140,200,000.00	R250,000,000.00	R 333,125,000.00
Local purchases	R2,300,000.00	R75,000,000.00	R 80,000,000.00
Other forms	R5,000,000.00	R35,000,000.00	R 65,000,000.00
Total	R147,500,000.00	R360,000,000.00	R478,125,000.00
% above required		257	

Table 2. Numbers of introduced game, for 2015 & 2019 from a recent game count report, % increase over this period, average value at auction in SA and estimates of total current value.

Species	2015	2019	% increase	Av. val. 2019	Total Value 2019
Eland	98	194	98.0	R 28,167	R 5,464,398
Waterbuck	70	139	98.6	R 15,429	R 2,144,631
BWB	98	166	69.4	R 14,542	R 2,413,972
Kudu	62	94	51.6	R 15,389	R 1,446,566
Zebra	41	61	48.8	R 4,500	R 274,500
Nyala	29	47	62.1	R 6,091	R 286,277
Bushbuck	19	34	78.9	R 9,000	R 306,000
Sable	14	3	0.0	R 27,667	R 83,001
Giraffe	3	0	0.0		0
Total/mean	434	738			R 12,419,345.0

Infrastructure development can be split into the following categories :

i) The Sanctuary infrastructure now includes:
- A modern comprehensive administration office complex (Figure 1)
- A Marina and storage area for official and private boats
- A large comprehensive and well-resourced workshop

- 10 Managers' houses
- 45 Staff houses
- 4 Communal kitchens and bathrooms in staff village
- A comfortable and pleasant social area for Sanctuary staff in the staff village
- A strong boma for game introduction
- Two Artificial waterholes
- One Bird hide
- Horse stables and arena
- An extensive road and maintained road network of approximately 42 km.
- A comprehensive water system of boreholes, pipelines, tanks, pumps and generators for Lodges as well as the local community.
- An electrical reticulation network linking main Sanctuary infrastructure
- 28 kilometres of game fencing on the southern boundary of the core area.

Figure 1. A: The Sanctuary office **B: Game proof fence**

i. Casas Residenciais / Locais no Santuário

A total of 21 residential sites and Vila Msasa have been built to date with a total of 252 beds. According to the Authorizations, each location is owned by a Mozambican company and the total investment of the residential locations totals the largest portion of the direct investment.

Figure 2. Typical Residential Sites

iii. Commercial Lodges.

The Special License Authorisations provided for 120 commercial beds to be operated by three commercial entities. Two lodges are currently developed, Dugong Beach Lodge and Nyati Beach Lodge with a total of 60 beds.

In 2008 the SBV (including its majority quota holder the SOA) supported a commercial development by a new investor. However, after much negotiation in order to ensure that the planned development would be completed, the investors failed to fulfil their commitments and thus the process was terminated in 2013.

In early 2014 the SOA and SBV then began interacting with Singita, a world renowned tourism company with the objective of developing further commercial beds on the Sanctuary. Unfortunately, despite promising discussions and proposals, this possibility was shelved due to difficulties in finalising the conditions combined with a severe downturn in the economy.

Figure 3. A: Dugong Beach Lodge ; B: Nyati Beach Lodge

iv. Community infrastructure.

Remarkably good progress, considering the challenges and poor world economic climate, has been made with community upliftment projects, and detail will be presented separately under point 2 of present MP.

v. Research facilities

Sanctuary recently received ZAR 1 145 000 from three donors including the Oppenheimer Foundation towards the building of a facility where visiting researchers, government officials, donors, and other stakeholders may stay and work. Before this, research inputs were severely curtailed due to difficulties with access, accommodation and lack of facilities. This international recognition and strong support should begin to change this in the near future.

4. Human Resources

SBV firmly believes in training, benefitting and empowering Mozambican citizens from the communities in and around the Sanctuary. Direct employment on the Sanctuary currently stands at

a total of 136 permanent staff, of which only 4 (four) are non-Mozambican citizens. Therefore 97% of staff at all levels are Mozambican nationals. These statistics exclude staff on commercial sites and temporary employment of local people from the Queuene Community located on Sanctuary.

Figure 4. A: Sanctuary Field Rangers (Força de protecção); B: Turtle Monitors recrutados localmente.

Dugong Beach Lodge and Nyati Beach Lodge, when fully operational, have permanent employees of 40 and 60 people respectively. With the possibility of additional commercial development, a further substantial increase in contractor, casual and permanent employment opportunities is foreseen within the next five years.

With continued development of residential lodges and other projects, building contractors are currently employing approximately 100 local people, excluding casual labour that the Sanctuary employs on an ad hoc basis.

Table 3. A summary of all Sanctuary employment from the 2015 Management Plan and then a 2019 update.

Identidade	Número de trabalhadores
SBV	136
Pessoal dos Lodges Comerciais	100
Pessoal de Empreiteiros	100
Mão-de-obra ocasional	50+
Total	**399**

5. Community

In the early project stages some families of the Queuene community lived within the now fenced area and were relocated to south of the fence line. This allowed for investment and development of residential and commercial sites and the establishment of the reserve.

Some of the relocation conditions were that the Sanctuary had to build infrastructure, compensate for crops in cash and continue improving the living conditions of the relocated community. Table 4 below summarises some of the quantifiable community projects undertaken by SBV since its incorporation. During 2017 the final required projects, or suitable alternatives accepted by the communities, were completed to the satisfaction of the communities and local authorities. There was a formal “acceptance of completion” ceremony in the community attended by local and government dignitaries.

Table 4. A summary of the Community programs executed by SBV

Program	Quantity	Year
Local Community Office	1	2002
Chiefs' meeting facility	1	2002
Clinic (Centro de Saude) with a borehole and pump	1	2002 – 2003
Houses (Design and construction material agreed by the community and Government at the time)	330	2002 – 2005
Maize project - part of compensation plan to original families relocated (50kg bags)	9,000 bags	2002 – 2005
Fishing camp (huts for fishermen to overnight)	25	2003
Schools at Chingonguene and Matsopane	2	2003
Dhow for transport	1	2004
Fishermen meeting room at Matsopane	1	2004
Household items for families (part of compensation plan to original families)	16	2006 – 2007
Fishing huts – Linene zone	3	2006 – 2007
Clinic furniture and maternity room	1	2007
Annual cash compensation (R1.2million p.a.) for original families to compensate for loss of crops and fruit trees in accordance with legislation	5	2004 – 2008
Chiefs' houses (Payment in cash in lieu of building each chief a house; so requested by chiefs and agreed)	16	2009
Mosquito nets	258	2009
School benches for Chingonguene school	15	2009
Water wells with concrete rings (18 wells agreed originally, but Government then stated no wells and agreed boreholes have been sunk)	6	2010 – 2011
Waiting room tent for the clinic for pregnant women.	1	2011
Dhow sails: Supplying excellent quality replacement sails to fishing dhows identified by the local community.	13	2011 – 2013
Waiting room for patients at clinic (SBV provided financial assistance and Ministry of Health took responsibility for the construction.)	1	2008 – 2012
New block school at Chingonguene with three class rooms (seats 120 students) (Photos 8 & 9)	1	2012 – 2013
Improved Latrines (community requested cash in lieu off infrastructure – paid cash as community wanted)	178	2012 – 2013
Teachers' accommodation at new Chingonguene schools	3	2013
Toilets for new school at Chingonguene	1 block	2013
Water storage facilities 15,000liters	1	2013
Boreholes with manual pumps at Matsopane and Chibo	2	2014
Supplying reading glasses to elderly community members. (Photo 10)	250	2010 - 2014
Boreholes with manual pumps	5	2017
Payment to households in lieu of paraffin stoves	285	2017
Marape CCP Dhow paint programme	35	2018
Chingonguele Borehole and Manual Pump	1	2018
Chuinzine Water Tank	1	2019

Figure 5. School built by Sanctuary ; B: School Opening by the Vilanculos Administrator ; C: Reading glasses being given out. ; D: Borehole with manual pump

Apart from the listed contributions, Sanctuary continuously assists with resources such as building materials to upgrade schools, churches, the clinic, transportation of medical personnel to and from Vilanculos hospital, medicine and other requirements. Other programs initiated by the Sanctuary include health programs, aids awareness, conservation awareness and tourism as an industry through education. With regard to agricultural programs, an organic farming system introduced in 2004 resulted in the creation of several community vegetable gardens which today supply many lodges.

After cyclone Favio, the Sanctuary and its investors in their private capacities, assisted the community in terms of shelter, food and medicine and helped the World Food Program and CARE with accommodation and transport to reach and assist affected community members.

Regular meetings with the chiefs established and then confirmed a generally trusting and good working relationship between the resident/ neighbouring communities and Sanctuary. Constant good communication between Sanctuary management and the community has proven an essential tool in successfully managing relations between the reserve, government, investors and the community. There was a time when the relationship was under severe pressure and trust was not as strong as it could be. In recent years, however, most people now agree that there has been a marked improvement in trust that has resulted and is reflected in many aspects of current management success.

The Sanctuary has, and is, making important and substantial financial contributions towards the community, in the following ways:

a) purchasing construction materials, goods and services from the community,
b) supporting community programs initiated by the Sanctuary as listed in the table,
c) paying the salaries of local employees,
d) transporting sick community members to facilities.

It is estimated that a total of USD 4 million has been invested to date directly into the Queuene Community alone since the project started. The Sanctuary will continue to engage and assist in the socio-economic development within the community. During recent routine chiefs' meetings, it has been confirmed numerous times that the community is now generally very pleased that SBV has finally honoured all its commitments to the community. SBV has often given more than initially agreed and also listened with empathy to the further concerns and special needs of the community and offered help where possible.

6. Conservation

SBV is very environmentally aware and approaches all conservation and development matters with the greatest insight, care and sensitivity. The total terrestrial area allotted to SBV in the Authorizations is approximately 25,000 ha. A game fence erected by SBV, however, now cuts across the property from the Lighthouse in the east to Marape in the west. The Sanctuary has, for its current use for conservation and development, the terrestrial area north of this fence line comprising approximately 10,000 ha. The area south of the fence is occupied by the Queuene community who mainly practice slash and burn farming activities. This was the area to which they were relocated as part of the initial agreement.

Significant conservation actions, species enhancement, additions, monitoring and protection include:

i. Substantial suitable wildlife introductions and reintroductions (Table 5)
ii. Drawing up and implementation fisheries management and zonation
iii. Monitoring & protecting rare and endangered species. (marine turtles & dugong)
iv. Alien plant identification, mapping and control
v. Avi-fauna: significant increase in species diversity
vi. Drawing up inventories of animals and plants on Sanctuary
vii. Dealing successfully with human/animal interactions

6.1. Wildlife Introductions/reintroductions

The Sanctuary game introduction program has mostly proved to be a marked success in terms of benefiting biodiversity, tourism and community participation. It has also been a great management achievement as most species, such as blue wildebeest, have increased at very high rates and many species have more than doubled in recent years.

Sanctuary is now a substantial local source for species such as eland, blue wildebeest, waterbuck, suni, and red duiker, to potentially resupply other Mozambican conservation areas with species that have become locally depleted or even extinct.

The local communities' acceptance of wildlife and their support in keeping it safe are noteworthy and, as if to demonstrate this, no introduced animals have yet been killed by local community members inside the reserve. Snaring and hunting levels remain at exceptionally low rates, compared to other conservation areas in southern Africa, despite a long history of the use of such species by the local community. No capture or culling of game has yet been necessary but growing numbers of game will require management intervention on some species in the near future.

Considerable numbers of increasingly relaxed game animals now roam Sanctuary resulting in an ever growing number of tourism operators and Lodge Owners carrying out game drives and walks to see

the animals. A few years ago Sanctuary was only really attractive to people seeking a marine experience but now increasing numbers are also taking part in game drives and walks and bird watching.

As there are no really dangerous game species present, walking and even running have recently also increased in popularity among Sanctuary visitors. Walking trails have been mapped out and it is common to see species such as eland, wildebeest, waterbuck and even bushpigs on short walks near the lodges.

Another iconic African species, the Nile crocodile, is also present on Sanctuary and can regularly be seen basking in the sun at some of the permanent pans inside the fenced area. Work is being carried out to determine crocodile numbers and distribution in Sanctuary.

In summary, there are now estimated to be almost 1 700 individual game animals on Sanctuary compared to under 1 000 in the last reporting period. In 2015 there were 14 game species but the giraffe did not thrive and all the sable were males and many succumbed of old age leaving 12 "healthy" species and one currently dying out.

Table 5. A summary of numbers of game species on Sanctuary from 2015 and current estimates from a recent game count report.

Species	2015	2019
Eland	98	194
Waterbuck	70	139
BWB	98	166
Kudu	62	94
Zebra	41	61
Nyala	29	47
Bushbuck	19	34
Sable	14	3
Giraffe	3	0
Suni	40	250
Bushpig	200	250
Red duiker	50	200
Common duiker	150	150
Steenbok	45	100
Total	**919**	**1688**

6.2. Establishment of fish Sanctuaries

Fishing has always been of critical importance to the local community and provides not only their basic food requirements but also a way of generating revenue. Unfortunately, continued and progressive overfishing resulted in vastly reduced fish biomass and stocks as well as reduced breeding stock and recruitment. People fished everywhere and there were no “sanctuaries” in which fish could spawn and juvenile fish were free to grow to breeding size. Something had to be done if this very challenging situation was to be addressed and it could only be done with the full support of the fishing communities and local authorities.

Sanctuary management was committed to improving the situation and, having three prominent fishing communities, a balance had to be found between conservation and sustainable fishing. The challenge was discussed and negotiated between Sanctuary and the communities, with the Government present, and two areas were identified where fish could be and are now protected. These ‘fully protected’ areas, closed to all fishing, protect fish spawning and nursery areas and ultimately result in the improvement of fishing in adjacent areas. It is a joint conservation effort between the Sanctuary and fishing communities as both parties are fully convinced that sustainability is the only ultimate success for continuous cultural and livelihood benefits while conserving biodiversity and achieving improved tourism success.

The original area closed to fishing was on the west side of the San Sebastian peninsula southwards from Dugong Lodge. Apparent success and increased fish stocks created a situation where the local communities supported a new area around Mazarette being established and now discussions are currently underway to join these two areas.

Both areas have already proved to be a huge success, particularly in the eyes of the local fishermen. Generally, these closed areas are generally well respected by the local community, but marine-scouts with government support, are essential to guard against fishing by people from further afield. Artificial reefs, established by Sanctuary, increase the substrate and habitat for fish to spawn successfully and protect the early life stages of many species of fish and invertebrates. The closed areas also offer critical protection for seagrass beds, and their many and varied associated organisms, as almost all other such areas are repeatedly damaged and degraded by the pulling of seine nets.

Sanctuary intends to work towards the protection of the “estuary” area on the seaward side of the peninsula as it is still heavily utilised by fishermen focussing on prawns, juvenile fish and oysters. Discussions with communities will be held to find acceptable and sustainable solutions that will be to the demonstrable long term benefit of all.

6.3. The monitoring and protection of rare and endangered species such as marine turtles and dugong

O Santuário é parte integrante do Programa Nacional de Monitoramento de Tartarugas em Sanctuary is an integral part of the National Turtle Monitoring Programme in Mozambique and each year the results of Sanctuary monitoring and conservation are included in the Mozambican National Turtle Monitoring Report. Annual turtle monitoring on the eastern shores of Sanctuary is conducted by candidates selected from the local community who have been shown to effectively monitor and protect the turtles.

For the last few years local community members have been selected, trained and equipped to patrol, record and protect turtles breeding along over 20 km of coastline southwards from Nyati Beach

Lodge. Each year turtles are identified, measured, recorded and photographed and this is the only area of such protection for many hundreds of kilometres north or south of Sanctuary on the Mozambique coastline. Through Monitor salaries local communities directly benefit from the turtle protection and, if they find anyone killing turtles, the culprits are dealt with directly by the local authorities.

Five turtle species, leatherback, loggerhead (Photo 14), olive ridley, green and hawksbill turtles, have been observed in Sanctuary waters and all species except olive ridley are now confirmed to be nesting on the eastern seaboard of Sanctuary. All turtle species present are listed by CITES as endangered or critically endangered and protection of these animals by Sanctuary plays a key role regionally, nationally and internationally to secure the future of these species.

To date turtle breeding numbers have been low, at around 20 in the last few years, but there is an exciting overall increasing trend and no turtles have been killed on the beaches, or nests dug up, for over five years.

Dugong have frequently been spotted between Dugong Lodge and Bangue Island, and there appear to be resident Dugongs in that area. It is suspected that this might be a positive spin-off from the demarcated no-fishing areas as good quality seagrass beds, essential for healthy dugong populations, are developing and recovering here.

6.4. Alien plant identification mapping and control,

Alien plants can be an extremely difficult and important challenge to protected area management and a severe threat to natural ecosystems and biodiversity. Sanctuary has worked hard to identify, prioritise and map the most important species and implement programmes to reduce or eradicate priority species. Good progress has been made with species such as sisal and prickly pear and many other species are now being tackled as and when possible. Another species, dodder, is being treated in several ways to identify the best approach for dealing with this species that can markedly reduce the grazing capacity of an area such as Sanctuary.

6.5. Avi fauna: a significant and progressive increase in species diversity in recent months/years

Through on-going organised bird surveys and ad hoc observations, a total of 289 bird species have now been recorded, as well as an additional 22 unconfirmed species, giving a total species count of 311 species for the Sanctuary. When the project started only 240 bird species were recorded but, with a minimum bird increase of 61 species, there is firm evidence of a recovering habitat and generally sound conservation practices.

Very important and significant populations of greater flamingo, crab plover, olive bee-eater, and lemon-breasted canary occur within Sanctuary. Other noteworthy records include wattled crane, greater frigate bird, Cape teal, long-toed plover, southern banded snake eagle, sooty tern, gull-billed tern, common black-headed gull, and green-backed woodpecker, all species that are rare in southern Mozambique.

It is evident that large numbers of Palaearctic charadriiforms and other waders are present in sum¬mer. Breeding evidence is confirmed for only 22 species, with equivocal evidence for another nine species, but notably includes large breeding colonies of Olive Bee-eaters. The wetlands in the Sanctuary were inundated by Cyclone Leon-Eline in February 2000, Cyclone Japhet in March 2003 and Cyclone Favio in February 2007. A progressive drying out of the fresh¬water wetlands in the Sanctuary has been noticeable since the cyclonic inundation episodes with a resulting decline in water bird

numbers. It is possible that episodic recharging of wetlands by tropical cyclones is an important ecological factor in creating suitable habitat for breeding waterbirds in Mozambique.

6.6. Drawing up of extensive and intensive lists of animals and plants on Sanctuary

An adequate knowledge of the species present and their abundance levels is essential before truly wise conservation management is possible. Sanctuary has thus created and is constantly adding to a database of all taxa using management, visitor, community and visiting scientist inputs. Birds have already been covered but good progress has also been made with an inventory of other taxa including reptiles, amphibians, plants, marine fish and butterflies. It is already clear that Sanctuary contains populations of many rare and endemic species from a very wide variety of taxa. The discovery of a new species of purple baboon spider, currently being described, confirms that at least one and possibly several more biodiversity gems are to be found on Sanctuary.

6.7. Dealing successfully with human/animal interactions

There have been several serious incidents involving interactions between eland and members of the Chingonguene community. People have been injured, mostly after dark, when eland have entered the unfenced community area seeking food or water. Despite this, no one has died and each incident was rapidly and successfully dealt with to the satisfaction of the community. There are protocols in place to deal with incidents and they are also dealt with at routine community meetings. Sanctuary is actively investigating practical ways to reduce these incidents but both the eland and community are increasing in numbers. Occasionally eland have also escaped over the southern boundary fence, as they are very good “jumpers”, but these have been quickly reported, located and returned or other arrangements were made with the local community to satisfactorily deal with such instances.

7. Conclusion

O Exceptional scenic beauty characterises Sanctuary which now contains and protects internationally important and interesting marine and terrestrial biodiversity. It now protects and manages excellent examples of many different habitats while it is often surrounded by degraded ecosystems and resources. As a result of the prolonged war in Mozambique, local communities had become ever more dependent on the natural resources of the area as the land is not well suited for agricultural development. Alternative land uses such as nature-based tourism, which mobilise the area’s natural assets to the benefit of the community, are now fast becoming a reality in and around Sanctuary as can be seen in the progress described above. Great strides on almost all fronts have been made since the inception of the project. A steady increase in pressure on the Sanctuary’s natural resources by poachers, mostly from outside communities, has been observed but has been fairly well controlled due to the generally excellent relationships with the local communities. This threat will, however, increase progressively due to the noticeable increase in Sanctuary game numbers and natural resources as a result of its sound conservation practises.

The initial turbulent relations between Sanctuary, local people and the government have now mostly been replaced by good relations based on regular communication, interdependence and mutual benefits. This is shown by the support by these groups for the Sanctuary’s areas closed to fishing and also tolerance of game species despite some conflict and injury. The Sanctuary, meantime, remains true to its core functions of balancing the protection of the environment and developing suitable low impact tourism while uplifting the community and boosting the local economy. To succeed over time Sanctuary must further develop a viable management and economic model, uniquely suited to the area, which provides long term financial security and value for money to the investors and visitors.

2020 -2025 MANAGEMENT PLAN FOR THE SUSTAINABLE USE CONSERVATION AREA: SANCTUARY BRAVIO DE VILANCULOS

CONTENT

1. INTRODUCTION

It is essential that the development and management of the Sanctuary be carried out with a clearly stated long-term vision to ensure a sustainable, secure, economical and ecologically viable and productive future. The format set out in this document is designed to conform, in the main, to that currently used in Southern Africa for commercial and communal conservancies, private conservation areas, protected areas and National Parks.

This MP (Management Plan), focuses on the fundamental nature, as operational activities and as issues related to the management of the Sanctuary for the period 2020 - 2025 as well as the presentation of updated information on its biodiversity and ecology.

Whilst Section A set out the achievements and summarised progress of Santuário Bravio de Vilanculos Lda (SBV), Section B focuses on the fundamental nature, operational activities and issues of the Sanctuary's management for the period 2020 – 2025 as well as presenting updated information on its biodiversity and ecology.

The Sanctuary Management Plan describes the area and sets out the Vision, Objectives and Guidelines for the development and management of the Sanctuary for the period 2020 - 2025. It also acts as an archive of historical and current information on the ecology and physical environment plus the infrastructure as well as describing interactions and the relationship with the local communities. This plan represents the policies, objectives and intentions of the Sanctuary and its stakeholders and any actions and decisions should be carried out in accordance with this document.

This plan is goal orientated and should be treated as a living document, subject to regular improvement and alteration to meet the changes of a dynamic world and the needs of SBV. A comprehensive review of this plan should be conducted every five years in conjunction with suitably qualified environmental, community, social, economic, wildlife and tourism experts. The next review will be due in 2025 for implementation from 2026. Any material changes made in the interim must be approved by a SBV General meeting and formally reflected in the Minutes of that meeting. These changes must be appended to the Master Copy of the Management Plan held by the Managing Director / SBV Manager in the Sanctuary.

1.1. Planning Process Approach

The preparation process for this Management Plan 2020 - 2025 had a participatory approach, in which the interested and affected parties (PIA) are locally, in order to involve them considering them their property. Although, this Management Plan corresponds to an updated document, during the phase of updating the studies of specificity it was possible to collect sensitivities by the other PIA in order to guarantee better management of the Sanctuary. The entire process of reviewing and updating specialty studies took into account a specific methodology for collection and analysis. The various meetings with the leaders and local communities have facilitated the understanding of the ecological, environmental and social value, where the different tour operators provide elements for the development of the sector having as assumptions the need to protect the tourist attractions.

Therefore, an approach was adopted that consists of summary descriptions incorporated throughout the document and many of the details and lists were included in a set of comprehensive appendices presented at the end of the PM.

1.2. Sanctuary Development History

Santuário Bravio de Vilanculos Lda (hereinafter referred as SBV) is a Mozambican company that holds a Special License for the development of nature conservation and the development of low density tourism covering an area of approximately 25,000ha in the São Sebastião Peninsula, in the Vilanculos District in Inhambane Province in Mozambique which is generally referred to as the Sanctuary and will be referred to throughout this document. This Special License is valid for a period of 50 years and was issued on February 26, 2003 and may be renewed for another 50 years in accordance with the Land Law in force in Mozambique.

The SBV was approved by the Council of Ministers through Authorization no. 4/2000, of 17 October 2000, as amended by Internal Resolution no. 2/2003 of 29 April 2003, for the development of a tourism enterprise of nature conservation and low density.

1.3. Legal Status

The SBV was enacted by the ministerial diploma, as set out in point 1.4, and is based on Decree 18/2003 of 29 April, in which it links the need to extend the Protection System along the strip of the Mozambique channel in order to ensure the protection of natural resources in the São Sebastião peninsula, allowing for integrated management, under the provisions of paragraph b) of paragraph 3 of article 10 of Law no. 10/99, of 7 July.

1.3.1. General limits of the Total Protection area of Cabo de São Sebastião

The coordinates referred to in Article 1 of the aforementioned decree are presented in the table below:

Table 6. Limites gerais Santuário

Vertices	Latitude	Longitude
D	22º 02'55''	35º 24'01''
E	22º 02'55''	35º 32'30''
F	22º 11'34.8''	35º 24'53.6''
G	22º 20'29.5''	35º 32'38''
H	22º 20'11.5''	35º 25'26.8''
I	22º 20'26.8''	35º 33'33.6''
J	22º 10'28.6''	35º 33'31''

1.4. Bidder Identification

The proponent of this project is Santuário Bravio Vilanculos, hereinafter referred to as SBV, LDA based in Inhambane Province. The address of the Project proponent is:

SANCTUARY BRAVIO DE VILANCULOS - Av. 25 de Setembro, No 1230
São Sebastião Peninsula, Queuene, Vilanculos District
Inhambane - Mozambique
Phone: +27 (0) 11 100 4690 | +258 87 8678 186
Fax: +27 (0) 11 507 6037
Email: sanctuarymanager@mozsanctuary.com
Web: www.mozsanctuary.com
SBV, LDA is represented by:
Dave Gilroy
(General manager)
Phone: (+258) 84 301 4660

1.5. Identification of the Team Responsible for the Management Plan

Mr. Hermenegildo Américo, Independent Environmental Consultant accredited by the Ministry of Land, Environment and Rural Development (MITADER), currently Ministry of Land and Environment (MITA), was appointed for the present Management Plan for 2020 to 2025, with the Certificate Consultant No. 43/2019, of July 8, 2019. The consultant also presents the Authorization Letter competent as an Individual consultant for the elaboration of Management Plans, Invetariation of fauna and forest resources and closure plan according to Decree No. 89 / 2017 of September 29, passed by ANAC. The identified team included several specialties and was responsible for carrying out the necessary specialty studies.

The independent consultant was the main coordinator of the studies. According to their experience, specialists from the following areas were integrated into the team: Environment / Ecology; Socio-economics; and GIS. The coordinator was responsible for the following activities: i) Planning, logistics and coordination; Compilation of the Management Plan Report; ii) Preparation of the Non-Technical Summary for the purposes of Public Consultation; iii) Quality control of all documents.

The Socioeconomics specialist was responsible for the following activities: i) Elaboration of the reference situation of Community Development ii) Identification and evaluation of the potential impacts of the communities and definition of mitigation measures. The GIS Specialist was responsible for the following activities: i} Elaboration of the Reference Situation of the Climate component; ii) Contribution to the compilation of the Management Plan Report; iii) Preparation of the cartographic material necessary for inclusion in the Management Plan report.

2. BACKGROUND

2.1. Regional Background

The updated Inhambane Province Strategic Plan (PEPI) sets the objective of maintaining economic growth at an average GDP rate of at least 8% per year and reducing the incidence of poverty to 40% in 2020. For the success of the said PEPI, the Provincial Government of Inhambane relies on maintaining the performance of some success factors, such as:

- Commitment from development agents,
- Improving the business environment,
- Continuous development of human capital,
- Efficiency in the allocation and use of financial resources and the proactiveplanningand management of land use in the Province.

The Inhambane Strategic Plan is based on 4 strategic pillars - human and social development, economic development, good governance and cross-cutting issues - from which its interventions are oriented, the areas of conservation of sustainable use are framed, in the particular case the SBV sanctuary.

Tourism, combined with the scenic beauty and rich terrestrial and marine biodiversity, is a major investment in inducing sustainable economic development in the province. The five analysis variables - sector production, revenue collected, number of tourist establishments, job creation and investment made - have shown growth trends.

The sanctuary in particular, constitutes one of the most important areas of tourist development for the province of Inhambane and can become an example of good environmental practices.

2.2. Threats and challenges

Sanctuary management is faced with a wide variety of ecological realities that vary from factors that are threatening in the short term to others that may be probably advantageous in the long term. These realities may be completely “natural”, such as severe weather conditions, man enhanced, such as climate change, or man’s direct impacts, such as his bringing in invasive alien plants and animals. In this section of the Plan many of the most important ecological challenges and opportunities so far identified are discussed separately under various headings and dealt with individually.

2.2.1. Alien and problem species

Many southern African protected areas are seriously threatened by non-indigenous and some indigenous plants and animals and substantial budgets are used up, often in apparently useless endeavours, combating these species. To date, Sanctuary appears to have been fairly fortunate in that most identified threats from both plants and animals seem to be manageable or at least currently not critical. Many of the most problematic species in neighbouring areas or regions of southern Africa do not yet appear to have reached Sanctuary and a top priority of any management plan must thus be to identify and take every suitable precaution to prevent these species getting to Sanctuary.

2.2.2. Alien plants

So far Sanctuary management has identified sixteen species of alien plant on Sanctuary that are or could become problematic. While several are large scale problems, such as several of the tree species, most of these are not really invasive and thus there is less urgency in removing them. Some, such as coconut and mango, are recognized fruit trees and although in the past there was a reluctance to remove these trees, numbers are now being reduced progressively. Other plants, such as prickly pear, are aggressively invasive but only localised in occurrence. These are being tackled on an ad hoc basis as and when capacity becomes available.

Possibly the largest problem plant currently identified is that posed by dodder (Cuscuta campestris). This species is widespread and can achieve intense levels of infestation and kill indigenous host, plants. The greatest problem posed by dodder is probably the potential or real direct impact on Sanctuary grazing as numbers of antelope increase. Steps are being taken to deal with this challenge and monitor the effectiveness of the different techniques available to combat dodder and investigate and quantity the impacts of the infestation.

Até ao presente nenhuma planta invasora ou externa já foi identificada mas este aspecto precisa de um alerta e atenção constantes uma vez que, assim que o microtipo aquático aparecer numa área como o Santuário, será quase impossível erradicar.

De modo a lidar com muitas espécies diferentes de uma forma lógica e priorizada, a administrção do Santuário desenhou uma “plano estratégico para a gestão das plantas invasodas e externas”. Ao abrigo desse plano, todas as espécies são priorizadas em termos de nível de ameaça e a acção de gestão mais adequada a ser identificada tendo em conta que a taxa de implementação depende do nível de ameaça e capacidade de gestãom O plano é um “documento vivo” e é revisto regularmente e á luz de qualquer nova infromação ou circunstância que muda.

Table 7. A list of currently recognized invasive alien plants on Sanctuary, giving the common and scientific names.

No	Name	Species
1	Cashew tree	*Anacardium occidentale*
2	Coconut tree	*Cocos nucifera*
3	Casuarina tree	*Casuarina equisetifolia*
4	Sisal	*Agave sisalana*
5	Mango tree	*Mangifera indica*
6	Madagascar periwinkle	*Catharanthus roseus*
7	Jambos tree	*Syzigium jambos*
8	Prickly pear	*Opuntia aurantiaca*
9	Prickly pear	*Opuntia ficus indica*

10	(Semi prostate herb)	*Boerhavia diffusa*
11	Guava	*Psidium guajava*
12	(Rhizomatus shrub)	*Hydrocotyle onariensis*
13	Blackjack	*Bidens spp*
14	(Climbing herb)	*Cassytha filiformis*
15	Cassava	*Manihot esculentia*
16	Dodder	*Cuscuta campestris*

2.2.3. Alien animals

Sanctuary has been intensely impacted by man, and he has been present over the whole area for a long period, yet there appear to be relatively few invasive alien animals yet recorded. This is probably due to the fact that most residents were relatively poor and did not bring in large quantities of material, that could have housed alien animals, and the temperatures and other conditions are challenging for many organisms.

In terms of impact on biodiversity the most problematic alien invasive animal is probably the wild domestic cat, which is now to be found in almost all habitats in Africa. Its main impact is predation on a wide variety of indigenous animals exacerbated by its ability to breed successfully and rapidly. Feral cats are to be found on Sanctuary while nearly all local homesteads have cats probably in order to try and control rodents that may eat their stored crops.

Apart from the common European house sparrow the other known or suspected alien animals (Table 26), developed from Picker & Griffiths 2011) are insects, like cockroaches, or arachnids that will be virtually impossible to completely eradicate even if it was attempted. On the other hand many alien animals known to be “pests” or serious problems elsewhere are not currently known on Sanctuary. For these the required management is simply to be aware of and alert to the possibility of them reaching Sanctuary and dealing quickly with them should they arrive. Specifically, Sanctuary Management needs to be aware of birds like Indian crows and mynas and the Asian freshwater snail Tarebia granifera.

This snail has recently infected many waters in northern areas of South Africa, probably coming in on boats or outboard motors, and infestation levels can reach 20 000 per square meter. It is a hardy snail that few indigenous mammals, birds or fish seem to be able to eat and, if it comes to Sanctuary it will spread rapidly.

One interesting invasive alien species is the brown button (or widow) spider (Latrodectus geometricus) a native of South America. While reported to be about one quarter as toxic as the related, but indigenous, black button (or widow) spider (*Latrodectus indistinctus*) the former species is more closely associated with human habitation and thus much more obvious.

Table 8. A list of currently recognized invasive alien animals on Sanctuary, giving the common and scientific names.

	Common name	Scientific name
1	Domestic cat	*Felis catus*
2	House sparrow	*Passer domesticus*
3	Grey silverfish	*Ctenolepisma longicaudata*
4	American cockroach	*Periplaneta americana*
5	German cockroach	*Blattella germanica*
6	Ring legged earwig	*Euborellia annulipes*
7	Sand earwig	*Labidura riparia*
8	Black field earwig	*Nala lividipes*
9	Common greenbottle	*Lucilia sericata*
10	Moth/drain fly	*Clogmia albipunctata*
11	Brown button spider	*Latrodectus geometricus*
12	Smooth woodlouse	*Porcellio laevis*

Alien is the term usually used to describe species that were not historically found in an area but many species are currently and inexorably expanding their range usually as a result of anthropogenic actions. Similarly, densities of many plants and animals may be changing as a direct result of man's actions.

The extension of range of species like hadeda ibis (Maclean 1993) or the localised increase in abundance of species like the pied crow or vervet monkey can also be viewed by management with concern. These will change predation patterns, pressures and levels and could locally impact priority species. Recently concern has been expressed about the impact of hadeda ibises on localized Breviceps frogs in the Cape Province in South Africa where the ibis is a newcomer.

Management must thus not only be on the lookout for completely alien species arriving on Sanctuary but also for marked and progressive increases in indigenous species abundance that may change habitats or threaten priority species.

2.2.4. Bush encroachment

This can be seen either as one of the greatest environmental management challenges facing Sanctuary management or a natural process depending on the perspective and objectives of the commentator. Within the last few decades much of the land area of the San Sebastian peninsula has been subjected to slash and burn cultivation, often repeatedly and over many years. Since the fencing of the management area this extremely severe impact has been suddenly and completely removed and the net result is that the habitats are returning to their "natural state".

It is clear in the north west of the peninsula that much of the land used to be fairly high canopy forest, probably mostly closed canopy, but there were also more open grassy areas. There are still single tall greenthorn trees (Balanites maughami), clearly relics of this earlier forest. These areas must have been almost complete and mature forest patches but probably interspersed with grassy areas. These grassy areas were possibly also man induced from earlier slash and burn cultivation.

People have been resident in the area, and using slash and burn techniques, for hundreds of years but it was only during the latter stages of the civil war that densities of people escalated.

Almost all the land had to be cleared for crops and in the cleared areas the root stock of many trees and hardier plants did not die. As soon as the annual clearing and burning stopped, these plants sent up new shoots. The original trees, however, were probably mostly large single stem trees that formed a high, mature canopy. The new growth, particularly with common species such as Brachystigia spiciformis and Julbernardia globiflora, is a multistem form. The net result is that, instead of a recovery of the forest to what it had been, there is a transformation from open, recently cultivated land, to a low canopy extremely dense thicket that allows very little grass to grow and that blocks the movement of people or even many animals.

In the grassier areas when the annual clearing and burning is stopped there is often an apparent invasion by "bush encroaching species" such as the sickle bush (Dichrostachys cinerea). The net result is rapid growth of this species that effectively fills up the grassy areas between larger trees and results in reduced grazing. van Wyk & van Wyk report that it is often "invasive and thicket forming" and in many areas throughout southern Africa sickle bush is regarded as the main species involved in this kind of "bush encroachment".

Sickle bush is often almost the only woody plant to quickly reestablish itself and it appears to prevent or repress other woody species that may have grown to larger sizes thus resulting, at least in the medium term, with dense low canopy fairly impenetrable low grazing potential areas.

It is the vision of Sanctuary Management to create throughout the managed zone a mosaic area that resembles what the peninsula used to look like, contains many of the species that are appropriate to the region and be a conservation and tourism asset. It will carry out whatever actions are seen as appropriate and necessary to manipulate the environment towards this goal.

For this reason, management will, from time to time and guided by the normal management decision making process, carry out a series of actions to modify the "bush encroachment process."

Possibly the greatest tool in this process will be the use of fire and controlled burning. Other, more localised, management actions could be the selective pruning of some multistem trees to produce single stem, larger trees. In some areas species such as sickle bush may be selectively removed to maintain or enhance grazing while in other areas coppicing species may be cleared from near roads. This will improve their function as fire breaks but it will also create better game viewing from roads and create grazing corridors along the roads.

The end result of management will be to create a suitable diversity of natural landscapes containing a wide variety of habitats that are both necessary for the diverse biota of the area and that will enhance its tourism potential. Present management interventions will, however, markedly affect the outcomes of the recovery of the transformed areas, especially on a localised basis.

2.2.5. Concerns over water table and Climate change

Actual measurements are scarce but it is clear from the dwindling size of many freshwater pans that, despite fluctuations, the water table on the San Sebastian Peninsula has dropped overall since 2002. It is also clear that ever increasing amounts of water will be taken from the

water table by Sanctuary Management for development, core functions and the needs of introduced game. Local residents will also continue to use water and all of this will impact the water table to some degree.

it was estimated that the current impact of water abstraction by Sanctuary was extremely small, compared to the loss of water through evapotranspiration. While this is the situation every effort must still be made to keep water use to a minimum and efforts should be made to monitor what is actually going on.

To assist in monitoring actual water table height gauge plates should be erected at suitable sites on open water areas and routine recordings made of levels. Records should also be kept of estimates of the total amount of water being abstracted. Efforts should be made to make Lodge Owners aware of the value of and challenges to a good water supply and to assist them in keeping demands to a minimum. Sanctuary is prohibiting the establishment of new "lawns" and gardens that need watering to keep "landscaping" water use to a minimum.

It is now generally accepted that climate change is real and it is becoming ever more evident that changes are happening faster than most people anticipated and the impacts will be many, varied and severe. The location of Sanctuary puts it in the path of extreme weather events while its infrastructure and activities make it particularly vulnerable. Management is fully aware of the challenges and is doing what it can to establish what the impacts may be and ameliorate and minimize them.

There is now clear evidence that mean temperatures in many areas around the world have been increasing at rates much higher than in the recent geological past. There is much discussion as to the rates, what is causing it and what this means but Sanctuary management needs to be aware of the changes and their impacts and implications. It needs to build this into its decision making process and also identify and carry out some actions to mitigate impacts or even benefit from them. Management must do all it can to reduce its "carbon footprint" but it cannot affect the global outcome and so it needs to anticipate some changes and manage accordingly.

The first responsibility for management is to reduce to a minimum the carbon footprint of its actions. While, overall, this changes nothing it shows acceptance of the reality, a good example and a willingness to take action. Management must also use every means possible to find out what could be the direct and indirect implications of climate change to Sanctuary habitats, infrastructure, priority species and goals.

One immediate known impact of climate change is sea level rise and, in places like Sanctuary, this could have severe impacts within the not too distant future. While debate rages about the rate of sea level rise, Sanctuary's relatively low level, very great tidal range and infrastructure built near the shoreline combine to make this a management priority. Management needs to identify threatened infrastructure and ensure that new developments are positioned suitably far from threatened areas.

There is also mounting evidence of climate change induced localised extinction of many species, especially on places like cold mountain tops where organisms cannot move to ever cooler regions. Overall, Sanctuary is fortunate in that it is part of a land mass continuum and it is possible for mobile species to move southwards if temperatures become less suitable/.

3. GENERAL DESCRIPTION OF THE SANCTUARY BRAVIO DE VILANCULOS

3.1. Geographic location

The Sanctuary is situated in Mozambique on the Indian Ocean coast, approximately 18 km south-east of Vilanculos, Inhambane province (Figure 1) and comprises approximately 30 000 ha including land and sea. The northernmost point, known as World's View, is Latitude -22.096875 S and Longitude 35.473195 E and Sanctuary includes most of the Queuene peninsula, its adjacent dune barrier cordon (spit) and Linene and Chilonzuene Islands. The Sanctuary is part of the São Sebastião Peninsula and Bazaruto Archipelago complex.

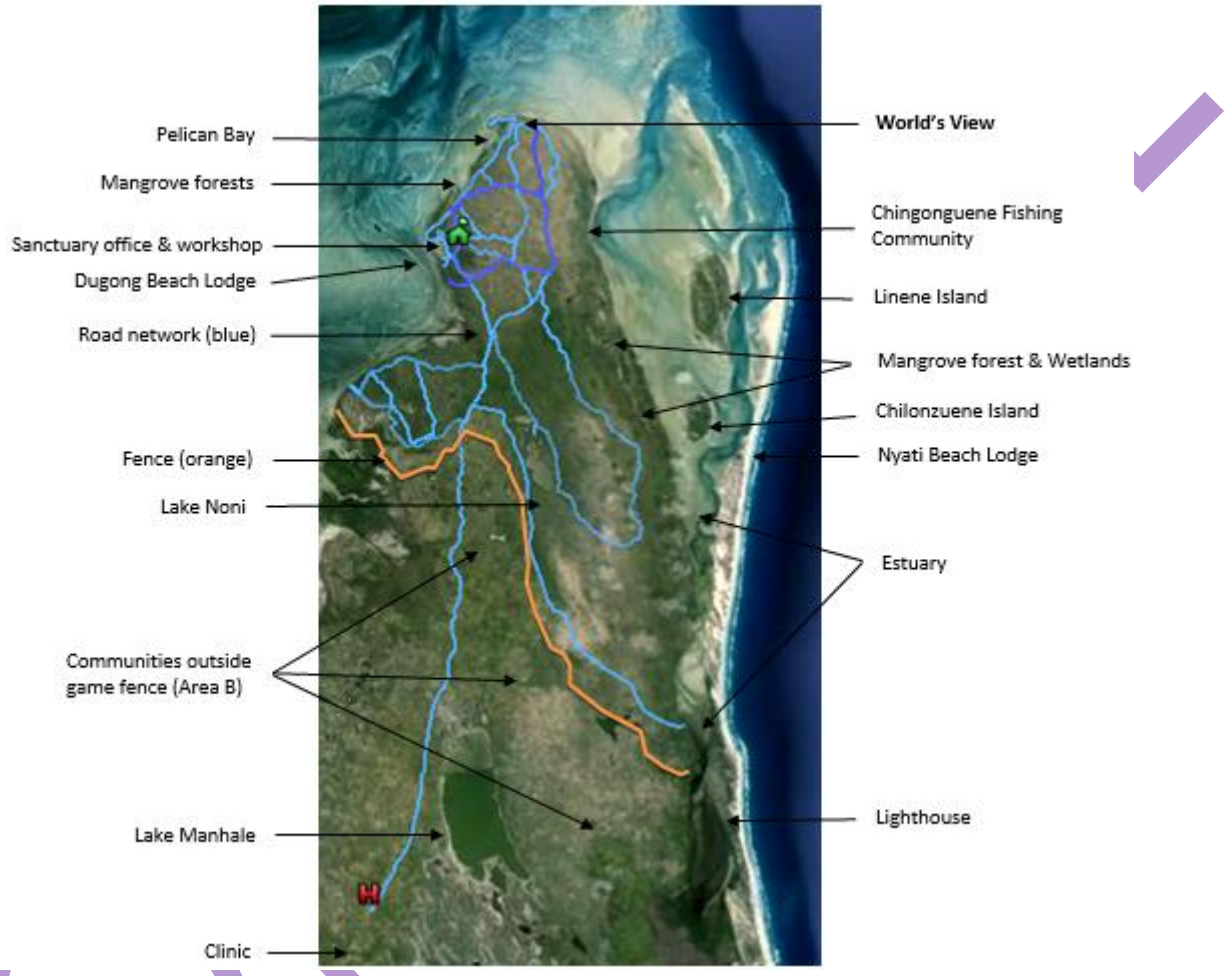

Figure 6. Geographic Location and Features

Sanctuary's administrative centre and offices are sited close to the west of the peninsula near Dugong Beach Lodge, one of the commercial Lodges. Marape Village is on the south west shore of Sanctuary and there are a series of lodges up this side to the far north where World's View is a high sand cliff overlooking the Bazaruto Archipelago. East of this is an area (507 ha.) that still contains local residents, Chingonguene Community, and further south down this coast is the "estuary" whose southern end is an extensive wetland area. The eastern side of "estuary" is an often narrow sand spit with "Lighthouse" on a high point near the south and Nyati Beach Lodge, another commercial lodge, near the north. In the north end of the "estuary" are two substantial islands, Linene, which contains two residential developments and one commercial lodge (Linene Fishing Lodge), and Chilonzuene Island. The fenced and managed land area (Figure 1) is approximately 9.5 by 20 kilometres and a comprehensive road network links the main infrastructure locations. Most people access Sanctuary by boat from Vilanculos

or by a road that leaves the main Mozambican coastal artery at Muvanza and enters Sanctuary up the peninsula.

3.2. Biophysical characteristics

3.2.1. Climate & weather

To fully understand Sanctuary and its management it is essential to understand the basics of the main features of its climate and weather. The San Sebastian Peninsula has a moderately humid, subtropical climate, with a dry season from April to September with day time temperatures of 22°C - 27°C, and a wet season from October to March (Figure 1) with day time temperatures 28°C - 33°C. Mean monthly humidity varies from 77% – 85% (Table 10). Mean annual rainfall varies from 849 mm in the northwest to 922 mm in the southeast with most precipitation falling between December and March. The month with the most rain is usually February followed by January and then December (Figure 2). Winters generally had relatively little rain but there can be significant showers at any time of the year.

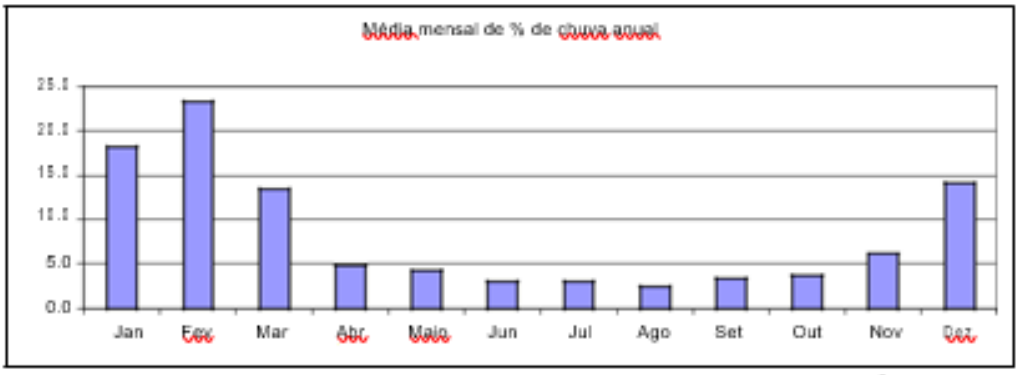

Figure 7. The mean percentage of annual rainfall that falls each calendar month

Temperatures on Sanctuary are often high (Table 9) and as the humidity (Table 10) is also high and the rainfall (Table 11) is less than the annual evaporation, conditions on Sanctuary can often be very harsh for humans as well as the animals and plants that live there. Due to the high evaporation level many water bodies and wetlands are characterised by marked fluctuations in water levels exacerbated by the very sandy soils and porous nature of the substrates.

Table 9. Mean maximum and minimum temperatures (°C) (Source: INAM, 2019)

Mês	Jan	Fev	Mar	Abr	Maio	Jun	Jul	Ago	Set	Out	Nov	Dez
Máximom	31	31	31	29	28	26	25	25	27	28	30	30
Mínimo	24	24	23	20	18	15	15	16	19	21	23	23

Table 10. Relative humidity (%) (Source: INAM, 2019)

Mês	Jan	Fev	Mar	Abr	Maio	Jun	Jul	Ago	Set	Out	Nov	Dez
Humidade	78	80	80	80	82	85	85	83	79	77	77	77

Table 11. Mean monthly rainfall (mm) (Source: INAM, 2019)

Mês	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Prec.	195	234	119	46	34	24	19	26	5	26	65	108	**901**

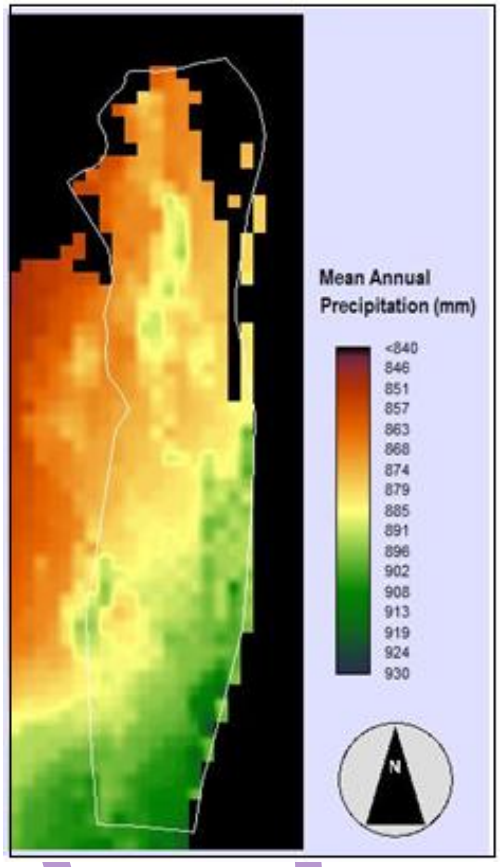

Figure 8. Gradiente de Precipitação média (SBV)

Table 12. Average evaporation (mm) (Source: INAM, 2019)

Mês	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Evaporação	100	82	94	92	80	73	71	94	89	103	102	103	**1083**

The Vilanculos area and the San Sebastian peninsula fall in a region well known for climatic extremes including tropical cyclones, torrential rains and occasional droughts. Tropical cyclones occur on average 3.1 times per annum in the Mozambique Channel. A total of 12 high intensity and 38 medium intensity cyclones were recorded during the last 50 years. In 2002 a category 2 cyclone, with excessive rainfall, passed over the Sanctuary, and then in 2007 cyclone Favio (a category 4 cyclone) had a devastating impact on the environment, infrastructure and operations. As a result of the damage caused by this cyclone, Sanctuary has developed and implemented a Strategic Plan (Appendix 4) for managing future cyclones to minimise impacts, coordinate relief work and repair the damage. Sanctuary has also built cyclone proof concrete strong rooms to protect and shelter staff and movable assets.

3.2.2. Geology

In geological terms the San Sebastian Peninsula and the islands of the Bazaruto Archipelago are of very recent origin, their first emergence as a land-form probably dating back less than a million years. The land surfaces are a consequence of a suite of geomorphological processes that persist today and which continue to reshape the features.

As The islands and the peninsula consist largely of unconsolidated sediments - mainly coarse and fine sands with a very low clay content. These materials originate from sediments carried out to sea by the up-current rivers (Save, Pungwe, Zambezi) and which have been borne southwards by the Mozambique Current. The eastern coastline of southern africa has been subject to successive risings and fallings during the last million years. The scale of the sea-level changes probably varied from 90 m higher than the present down to 30 m below the present level. In the last 6 000 years the sea-level has fluctuated around 2 - 4 m above or below the present level.

The youngest of the Sanctuary dunes, not yet vegetated and probably <1000 years old, runs up the coastline parallel to the shore and continues northwards into the sea as a long finger of sand that encloses the trough which forms the “Estuary”. To the west of this dune lie older and larger dunes that have been stabilized by vegetation. These, and the troughs between them, have been reworked by sheet erosion and wind action to the extent that ridges and troughs often merge on the peninsula and their north-south orientation is blurred in places. Given their low clay content, the peninsula’s sandy soils have low fertility and also have a low organic content, with organic-rich soils only likely to be developed in the more permanent wetlands and in the mangrove swamps. The variation in the colour of the sandy soils is a consequence of local differences in sub-surface drainage red soils developing in the best-drained sites, yellow in sites with intermediate drainage and grey soils in poorly drained sites.

3.2.3. Relief and drainage

The topography is characterised by a series of inland undulating dunes interspersed by broad, flat, low-lying areas, and an approximately 800 m wide coastal dune system that runs for approximately 30 km in a north-south direction along the eastern beach front. The inland dunes are aligned along a southeast - northwest plane due to the prevailing winds. Altitude ranges from sea level to 128 m above sea level on the highest point of the coastal dunes (Figure 9.)

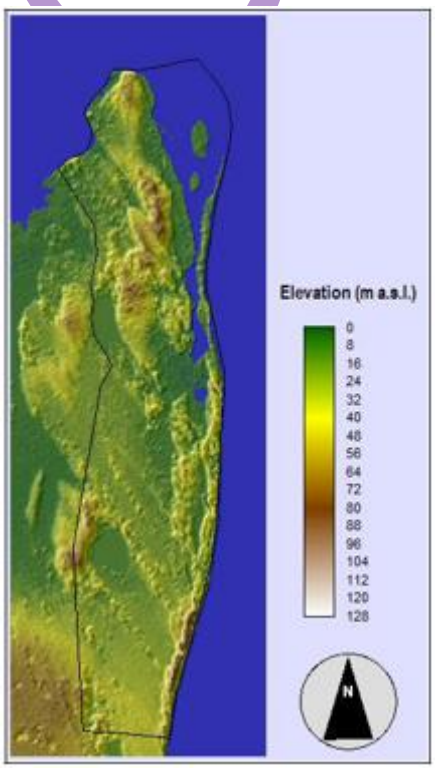

Figure 9. Relief map of the San Sebastian Peninsula showing heights in metres above mean sea level

The region is not drained by any river system but has numerous pans, marshes and lakes, formed by the inundation of low-lying areas behind the coastal dunes. The pans and lakes vary in size from a few hectares to the 1168 ha Lake Nhamanene in the south-west. Most have fresh water, being totally isolated from the ocean and fed mainly by the water table. Some appear to have surface connections to the marine environment, but without marked tidal inflows. The Inhamambane "estuary" lies along the north-eastern side of the Sanctuary, between the mainland and a sand spit.

3.2.4. Soils, substrates and coral reefs

The soils of the region are composed mainly of unconsolidated quartz sand with a minor carbonate component derived from the skeletons of marine organisms. Two deep sandy soil types, both with excellent water infiltration but poor water retention, have been identified. The topsoil has a neutral pH (between 6.1 and 7.01) and is low in basic plant nutrients. The soils at greater depths (30 – 90 cm) are more acid (pH 5.21 – 5.78), caused by water level fluctuations in the sub soil horizons. These leached deeper soils are also low in calcium, magnesium, phosphorus and potassium. Given their low clay content and nutrient deficiency, the peninsula's sandy soils have a low fertility and, for the most part, probably also have a low organic content. Organic-rich soils are only likely to be developed in the more permanent wetlands and in the vicinity of the mangrove swamps. The aeolian sand lacks cohesiveness due to the deficiency of clay, making them highly susceptible to wind and water erosion.

The rocky reefs owe their existence to the clear subtropical water of the warm current, the absence of silt-laden rivers in the coastal hinterland and suitable coral substrate formed by the submerged sandstone beachrock. The reefs are limited in extent and mostly fairly deep (10 – 40 m), with the result that no significant man-induced damage to the reefs was found inside Sanctuary waters.

3.2.5. Hydrology

The present area of the Sanctuary is relatively low lying land surrounded on three sides by the ocean with a shallow water table, fairly high annual rainfall and temperatures and soils that ensure that precipitation drains or evaporates very rapidly.
Continued access to large quantities of good quality surface and ground water is important for the indigenous and introduced animals of the area as well as to maintain ecosystems and their natural functioning. It is also very important to the increasing number of people not only dependent on it for everyday needs but for the essential development that is a requirement of management by the Mozambican government. It is thus critically important that the hydrology of the area is known, monitored and carefully managed to minimise impacts by and wastage from the activities of man. For this plan hydrology is separated into three important components, these being surface water, groundwater and marine areas.

a) Freshwater

Most of Sanctuary land is low lying and consists of undulating sandy areas with a very shallow water table. Where the land dips below groundwater level, a lake or pan results as a simple extension or reflection of the groundwater. The San Sebastian peninsula is typified by many pans and lakes some of which are extensive but the size and depth of which varies markedly

with rainfall over time. The extent of open water also varies markedly due to factors such as encroachment by marginal vegetation such as reeds, sedges and rushes.

There is currently no specific monitoring of open water but it has been noted that, over the last few years, there has been a general marked reduction in the size of many pans as well as a reduction in the amount of open water (figure 10). While rains have not been particularly good in the last few years the reduction in the size of pans does not seem to be able to be completely accounted for by reduced rainfall alone. While rains have not been particularly good in the last few years the reduction in the size of pans does not seem to be able to be completely accounted for by reduced rainfall alone.

Figure 10. progressive encroachment of aquatic macrophytes over the open water of the pan

This is a cause of concern as it is possible there are anthropogenic factors that are at least partially responsible for this of which management is currently unaware and thus unable to manage. While the average annual rainfall of the region is fairly high, at about 900mm per annum (Table 3), the evaporation rate is considerably higher and so the evaporation budget over open water is well above the annual precipitation. Open water thus acts as a pump, effectively draining the groundwater from the areas surrounding the pans.

While there are no permanent rivers or even streams on Sanctuary there are several fairly clear drainage lines and seepages on the marine fringes of Sanctuary. The largest drainage area enters the south end of the "estuary" south of Lighthouse and the area drained is fairly large. It is, however, not clear how extensive and permanent this water flow is due to the inaccessible nature of this region.

On the east side of the main peninsula there is an extensive area of freshwater wetland that appears to have a "mouth" in the north (-22.152465 S and 35.496584 E). Similarly, there is a freshwater inlet on the west side (-22.153038 S and 35.449857 E) where a small amount of freshwater seems to flow into the ocean throughout the year

b) Groundwater

A Groundwater levels are a cause of concern on Sanctuary as they clearly underpin the main source of water for human use and development on the peninsula and levels, as reflected by pan levels overall, appear to have dropped considerably over the last few years. While rainfall

has been well below average in several recent years this does not account for the pronounced and almost progressive decrease in groundwater level over this period.

There has been a concern that part of the reason for the decline in groundwater was abstraction by man but, compared to water loss by evaporation, man has only been responsible for a very small proportion of overall water loss on the peninsula.

A rough estimate of the total offtake by man of water on Sanctuary is 2 400 cubic meters per annum while a very rough first, but probably conservative, estimate of evaporation loss from only the open water within the presently fenced areas is 4 000 000 cubic meters. If the offtake by man is well under 0.1 of one percent then it is highly unlikely, especially bearing in mind the erratic and high rainfall, that man's abstraction is currently a serious threat to groundwater levels.

Sanctuary is very aware of potential water pollution, and several measures have been put in place to prevent water pollution. Nothwithstanding that pollution of groundwater would be another possible area of concern, it seems unlikely at this stage that this is a serious challenge and no problems have yet been identified. Water quality is generally fairly good with three distinct categories; water with a high iron content, high sulphur and clean water. Exploration wells indicated that in the north water tends to have a high iron content, whereas south west water is more sulphurous. Water on the eastern side is of very good quality, from the human perspective.

Many water samples have been tested and, to date, no problems have been identified in terms of being suitable for human consumption. As development advances this aspect will need to be monitored closely and disposal of solid waste, "grey" water and sewage will have to be carefully managed to minimise possible open or groundwater contamination. In some areas, such as Pelican Bay, careful attention has to be given to the correct siting of water abstraction points and septic tanks due to a very shallow water table.

c) Marine Surface water

Clearly marine water is important to Sanctuary but there is very little that Sanctuary can do that will impact quantity, quality or even flow of marine water. The spring tidal range can be over four meters and thus some currents are very strong and capable of moving vast quantities of sand and sediments rapidly. Management must be very careful not to interfere with the free flow of marine waters. Building too close to the marine shore must be avoided as, on Sanctuary, these are often either prograding (advancing) or retrograding (retreating) at noticeable rates. Few beach areas on Sanctuary are truly stable and aspects such as global climate change leading to a rise in mean sea level have serious implications to future Sanctuary development.
The great tidal range combined with the topography has resulted in the establishment of many "salinas", areas of low lying land inundated at high tides and typified by salt resistant plants able to survive both inundation and extreme dry conditions. A good example of this is the one directly east of Dugong Lodge (Latitude -22.132034 S and Longitude 35.445859 E.) where, in recent years, concern has been raised at apparent erosion and draining of the salina. Other examples can be seen around the freshwater inlet south of this and also on the east side of Sanctuary on the west side of the "estuary".

The "estuary" itself is an important, and very dynamic, feature of Sanctuary where there is a complete gradation from freshwater conditions in the far south to fully saline in the north.

Vast areas of sand are exposed at low spring tide while many hectares of mangroves and sedges are flooded at high tides.

The waters around the San Sebastian peninsula are generally clear and fairly shallow. The massive tidal range creating very strong and continuous water currents has led to the development of a marked and constantly changing series of channels. These can clearly be seen on a satellite photograph (Photo 1) and a good example of a deep-water channel near Sanctuary can be seen on the west side of the peninsula just south of Dugong Beach Lodge.

Figure 11. A satellite photo of Sanctuary showing the shallow sandbanks and deeper channels that surround the peninsula.

3.2.6. Broad vegetation types

Four basic types of vegetation are found on Sanctuary, Marine, Miombo woodland, Dune thicket and Mangroves. The most common terrestrial type is the miombo woodland with scattered bushclumps and seral thickets. Only in the northwest and along the estuary are dune forests and scrub to be found, mostly between the sea and the miombo woodland. Within the vegetation types, the following communities can be identified: Marine, Sea Grass, Salt marsh, Miombo woodland, Bushclumps and recovering cultivated and fallow land, Dune thicket, dune forest and fringe, Mangrove, typical mangrove plant and animal communities.

Approximately 40 % of land vegetation cover is Msasa savannah/weedland (Figure 6). Common woody plants include Brachystegia spiciformis, Julbernardia globiflora, Maprounea africana, Garcinia livingstonei, Hypaene coriacea, Balanites maughamii, Bridelia cathartica, Sclerocarya birrea, Ozoroa obovata, and Strychnos madagascariensis. The sparse grass layer is dominated by Digitaria eriantha, with Andropogon shirensis, Shizachryrium sanguineum, Eragrostis chapelieri, Perotis patens and Trycholaena monachne also being common. Common forbs include Crotolaria monteiroi, Chamaecrista mimosoides, and Helicrhysum kraussii. A closed canopy Msasa woodland covers a further approximately 9 % of the area.

Approximately 8 % of the vegetation cover has been modified by human settlement. Abandoned fields that were cleared for shifting agriculture are prominent in these areas, and sites of old homesteads can be identified by the presence of tree species such as the Jambolani plum (Syzygium cumini), coconut palm (Cocos nucifera), Mango (Mangifera indica) and Cashew nut (Anacardium occidentale).

Grassland covers approximately 6 % of the reserve. This vegetation type is best represented in the south of the Sanctuary where a relatively large patch occurs up against the landward side of the coastal dune system. The dominant grass species is Shizachryrium sanguineum.

The vegetation of the coastal dune system is predominantly shrubland and thicket (3 % of the total area). The herbaceous component of this vegetation type is very sparse to absent. The woody layer is of diverse composition, with common species including Eugenia capensis, Capparis sepiaria, Maerua nervosa, Vepris lanceolata, Teclea gerradii, Deinbollia oblongifolia, Xylotheca kraussiana, Mimusops caffra and Sideroxylon inerme. The cycad, Encephalartos ferox, is abundant in the dune thicket/shrubland on the exposed reddish-orange Pleistocene dunes in the extreme south of the reserve (approx. 1 % of total area). Small, but well developed, patches of dune forest occur on the leeward sides of the coastal dune system. The forest is characterised by tall trees, an open understory, and a very sparse or absent herbaceous layer. Common trees include Craibia zimmermannii, Dialium schlechteri, Drypetes arguta, Ochna natalitia, Ochna barbosae, and Diospyros inhacaensis. Where the forest abuts onto a wetland, the transition between wetland and forest is composed of a near impenetrable thicket of Phoenix reclinata palms.

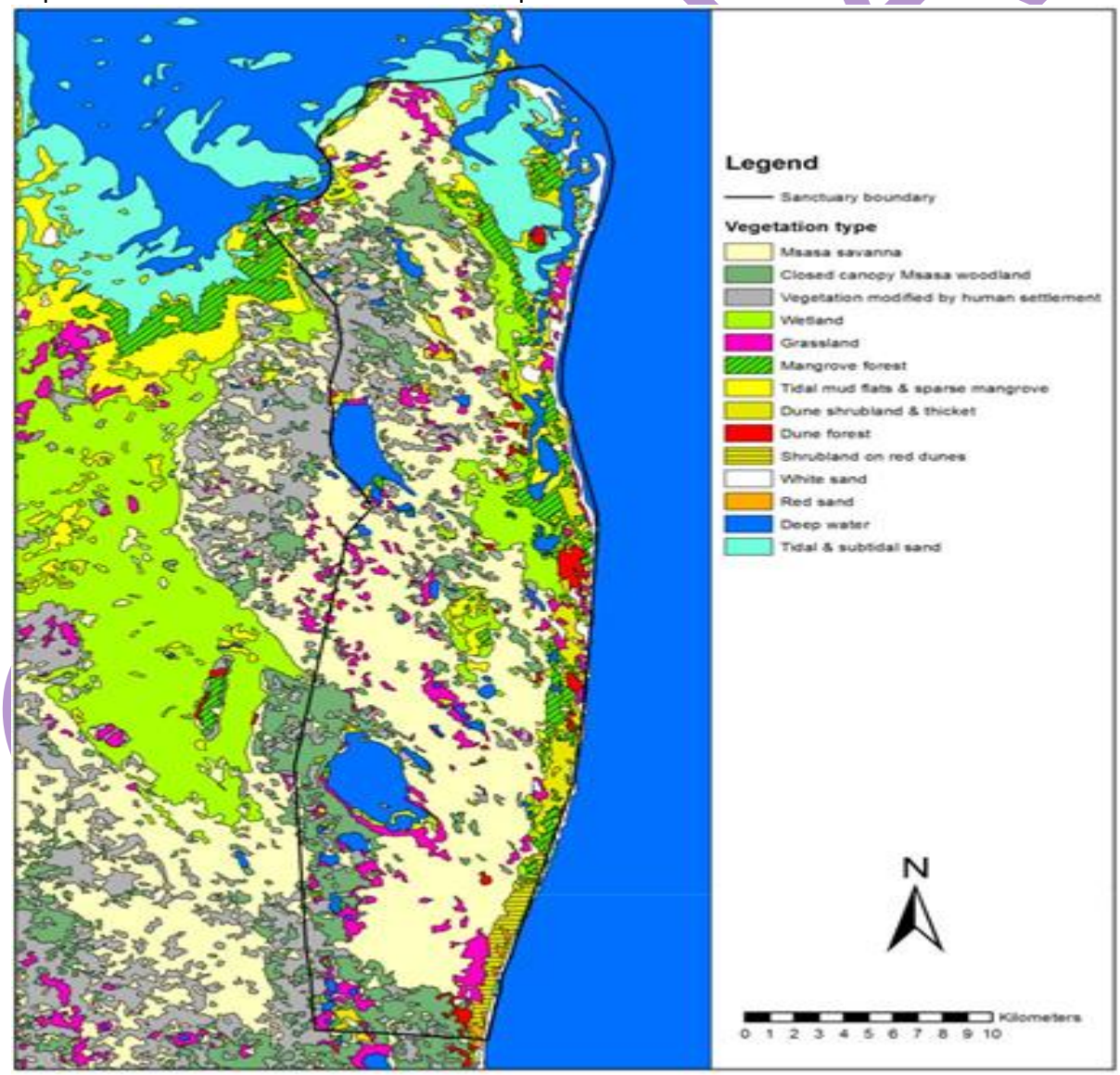

Figure 12. Vegetation map of the San Sebastian Peninsula.

Mangrove forest (approximately 4 % of the total land area) is found in the sheltered bays of the west and along the Estuary. Seven species of mangrove have been recorded; Indian mangrove (Ceriops tagal), red mangrove (Rhizophora mucronata), black mangrove (Bruguiera gymnorrhiza), white mangrove (Avicennia marina), cannon ball mangrove (Xylocarpus granatum), Tonga mangrove (Lumnitzera racemosa), and the powder puff mangrove (Sonneratia alba).

Approximately 6 % of the land can be described as wetland. A wide range of wetland types are represented, with the type being determined by the duration of flooding and whether or not a connection to the marine environment exists. Many of the smaller pans are only seasonally inundated and are therefore dominated by grasses, such as Andropogon eucomus, that cannot tolerate permanent flooding. Wetlands that are flooded for longer periods are characterised by grasses such as Imperata cylindrica, Leersia hexandra, and Phragmites australis and the sedge Cladium mariscus. Wetlands that are connected to the marine environment are vegetated by salt tolerant grasses and sedges such as Sporobolus virginicus and Juncus kraussii. Water lilies (Nymphaea spp.) and Lugwigia stolonifera are common floating aquatic plants of the fresh water lakes.

From a floristic conservation perspective, the San Sebastian peninsula is very important and interesting, having affinities with the Maputaland Centre of endemism to the south, the Southern African Miombo zone to the north west, and the flora of Madagascar to the east. The list of the flora is extensive and contains many endemic, rare and conservation worthy species (Jacobson, NCH, unpublished).

A total of 505 species of plants were recorded with several species that are rare or endangered and ten Red Data Book species (Jacobsen, N. 2002).

3.2.7. Biodiversity

Existem There are many aspects and dimensions to the variety of animals and plants that have been or are being recorded on Sanctuary. The tropical ocean adjacent to Sanctuary teems with a wide diversity of many life forms with probably well over one thousand species of fish alone plus much greater numbers of invertebrate species. Sanctuary sits on a transition zone between more and less tropical areas, and thus contains representatives of many species from each, while it also temporarily contains many migratory species of bird, fish and also some marine mammals.

To contextualize the level of biodiversity on Sanctuary, and appreciate its real extent, the United Kingdom only has seven reptiles and six amphibians compared to Sanctuary's already confirmed 49 and 19. Insect diversity is probably an order of magnitude greater than that of all Europe while its bird life probably well exceeds that of the entire United States of America.

Not only is the biodiversity of Sanctuary extremely high and varied but many species are present in abundance and enjoy heightened protection within its boundaries. Although many species are still present in surrounding areas, others have become locally extinct outside while some are under extreme pressure. Sanctuary already plays and can play an even greater role regionally in providing refugia for many species and also exporting recruits of species that are being heavily utilized elsewhere.

Many taxa, such as larger land mammals, birds and even reptiles, were severely depleted during the war years with many species becoming locally extinct. While bringing these species

back to Sanctuary will be a time consuming and expensive task, the "natural" recovery of many species of birds, for example, is well under way.

Very little detailed taxonomic or even natural history work was carried out on Sanctuary prior to 2002. It is possible, however, to extrapolate from work carried out in other nearby regions to gain an insight into the species that were present on Sanctuary and that could or should be there in future (Table 13). This information suggests that, of the more obvious taxa, there could be at least 2 027 species expected to be present on Sanctuary while, to date, only 764 have recently been positively recorded (this could increase with the steady improvement of the environment). New species are being recorded routinely and the number of species recorded will advance towards the higher number in Table 13.

Table 13. The larger and more obvious taxa on Sanctuary, listing the number of species thought to have been present and recently confirmed to be present.

Taxon	Within historical range & habitat	Recently recorded
Mammals	69	23
Birds	340	114
Reptiles	84	49
Amphibians	34	19
Fish	1000	315
Plants	500	240
Total	**2 027**	**936**

The species discussed here relate only to those reasonably thought to have occurred or are known to be present on Sanctuary. The marine mammals listed, for example, only consist of those species regularly seen in Sanctuary waters and not those that may potentially stray through them. When listing biodiversity, it is tempting to add as many species as possible, especially when attempting to show biodiversity importance, but this can be misleading and disingenuous. While it is possible that jackass penguins may stray onto Sanctuary they cannot be seen as part of Sanctuary biodiversity.

Biodiversity covers the complete spectrum of living creatures from the simplest single cell organisms to baleen whales but currently it is only possible to discuss the more obvious taxa such as mammals, birds, reptiles, amphibians, fish, some obvious and charismatic invertebrate species plus the more obvious plants.

Each of these taxa will be described and discussed and, where possible, historical and updated information will be presented. Full information or current species lists are given in this report or the appropriate appendices.

a) Mammals

Many of these species, such as the red duiker, are among the most obvious and easily seen while others, such as nocturnal bats, are not at all easily seen or recognized. The result is that our knowledge is skewed towards the more charismatic and obvious species. Nevertheless, as time goes on this situation is improving and the lists are becoming progressively more representative of the species present on Sanctuary.
In terms of primates, Sanctuary currently contains four species; vervet and samango monkeys, the thick tailed galago and chacma baboons. The vervet monkey and thick tailed galago are

widespread and common in some areas while the samango monkey and chacma baboon are more restricted in distribution and number with most baboon records being in the south eastern areas of Sanctuary and the samango in quieter areas near the centre.
Four species of rodent have recently been recorded and they include the scrub hare and cane rat, that are widespread and locally common, plus the porcupine and spring hare that are neither common nor widespread.
Among the carnivore's present are the water mongoose, banded mongoose and large spotted genet. The genet is probably the most common and widespread of these species while water mongoose tracks can be seen most mornings along almost any water body. Banded mongooses are not common but groups of them have regularly been seen.
At least twelve species of antelope, or even toed ungulates, are currently present on Sanctuary. The most commonly seen are the red duiker, suni, grey duiker and steenbok. Herds of wildebeest, eland (Figure 14) and waterbuck are routinely seen while nyala, sable, bushbuck, zebra and kudu can also be seen. Throughout the Sanctuary bushpigs are present and are occasionally seen, even during the day.

Figure 13. A: A herd of eland on Sanctuary.- B; Whale

Other mammal species, particularly smaller ones, may be present on Sanctuary but species like aardvark have been exterminated and will need to be actively reintroduced. One pangolin, recovered from the mainland, was released on Sanctuary. Hippopotamus tracks were seen near the southern boundary fence of Sanctuary in 2018 but no sign of the species has subsequently been noted.

No meio ambiente marinho, a lista para o Santuário contém quatro espécies, o golfinho roaz-
While populations of many offshore and open ocean marine mammals, such as many baleen whales, are currently increasing fairly rapidly some inshore species are not. Locally the dugong population is generally seen as under severe stress, both from direct mortality as well as degradation of essential seagrass beds. The area's population it is now seen as the only east African population with a chance of long term survival. Sanctuary fish protected areas should protect any dugong in these areas and allow recovery of seagrass beds within their boundaries. Although Sanctuary waters are not essential to the dugong population they offer a small amount of relatively safe and suitable habitat. Sheltered areas near Sanctuary may be, or become, important "nursery" areas for this endangered species.

Humpback dolphins are generally restricted to shallower sheltered bays and estuaries and several pods of these animals make heavy use of Sanctuary waters, both on the east and west sides of the peninsula. Numbers are not great and mortalities have been reported from fishing activities and they may be killed, damaged or driven away by intense boating activity.

At least six marine mammals are present in Sanctuary on a permanent or annual migration basis (Table 14).

Table 14. Marine mammals confirmed present in Sanctuary waters as of July 2019.

Species	Scientific name
Bottlenose dolphins	*Turisops truncatus*
Common dolphins	*Delphinus delphis*
Spinner dolphins	*Stenella longirostris*
Humpback dolphins	*Sousa chinensis*
Humpback whales	*Eubalaena australis*
Dugong	*Dugong dugon*

Sanctuary waters are relatively safe, contain fairly undisturbed areas and there is a good chance that any killing of these animals in Sanctuary waters will be reported and acted upon.

3.2.8. Historical Information

Ao While there is little information on the presence of most of the larger mammals in the Sanctuary area prior to 2002 useful extrapolations may be made from known distributions and habitat requirements.
During the recent war many people gravitated towards the ocean shore to access marine resources. The San Sebastian Peninsula received a massive influx of people and there was no work or other opportunities for the people to make money and so they relied heavily on the living resources of the area for the daily food and other requirements. Firearms were readily available and there was no control over the 'poaching" of mammals.
The result, all along the Mozambique shoreline and in many interior areas as well, was the extirpation of many larger species and the reduction to extremely low levels of the remaining ones. Bushpigs alone seemed to escape decimation due to this species being extremely difficult to hunt and to them having high reproductive rates. The local people have a long history of hunting and probably used many methods such as snaring, trapping and the use of dogs, to catch any other mammals that could be eaten.
Now that the war is over and authority has been re-established it is possible to assess the situation and work out what species should or could be brought back to Sanctuary in order for it to become a regional, national and even international conservation asset and tourism attraction.

3.2.9. Introductions of fauna species

In order to fulfil the legal requirements of the original investment authorisations of Sanctuary it was essential to bring to Sanctuary a suite of suitable African game to fill the niches in the various ecosystems present on Sanctuary. Sanctuary management had to decide what species of animal would be appropriate to fill the ecological niches as well as to add to the tourism attraction of the area.

The aim was not to try and recreate the peninsula as it had been hundreds of years ago but to develop a natural area populated by suitable flora and fauna that conserved natural processes and habitats, was attractive to visitors and was also economically viable in terms of management costs and tourism attractions. An approach is being implemented to work towards restoring the natural ecosystems of Sanctuary to as close as possible to their "natural" states while fully addressing the other aims and objectives.
The species of larger mammals to be on Sanctuary would be those species already there, including bushpigs, steenbok, red and grey duiker, reed buck and suni plus appropriate numbers of suitable species as decided by Sanctuary management. The criteria used by management to decide which species and in what numbers varied from the purely practical to the economic.

Currently many local residents and workers walk through much of Sanctuary and so dangerous animals such as lions, elephant, buffalo and leopard had to be rejected. Similarly, hippopotamus, although they could be an important part of several Sanctuary ecosystems, had to be avoided as they are dangerous and it would be very difficult to retain them within the fenced area at the present moment.

While "first prize" would be to bring in only the species known to have occurred on Sanctuary in the not too distant past this had to be tempered with economic realities and relative economic values. There is also a limited amount of browse and grazing on Sanctuary and thus a restricted amount of game that can be sustained.
Economic viability was also seen as very important and a decision was made to endeavour to optimize the value of game on Sanctuary by selecting the more valuable type of animal where two were seen as appropriate. There are, for example, two sub species of eland whose natural distribution is close to or included Sanctuary. While one was fairly common and widespread in conservation areas in southern Africa the other was not. Consequently, in terms of game value at auction, the rarer type was much more valuable and so Sanctuary management identified this rarer type as the one to be brought to and be bred on Sanctuary.

Similarly while there is a limited amount of grazing on Sanctuary this could be taken up by species like blue wildebeest alone but these have a relatively low economic value while sable have a much greater value as well as tourist appeal. Following an initial introduction of blue wildebeest the decision was thus made to locate and bring in sable and not let blue wildebeest completely fill this niche.

Species such as oribi are uncommon with declining populations in much of their range and Sanctuary appears to have suitable habitats. It and other species locally extinct or uncommon, such as pangolins and aardvarks, were also added to the list of potential species for reintroduction to try and make the ecosystems as representative and complete as possible.

A list of suitable larger mammal species for introduction to Sanctuary was thus drawn up by management, after consultation with many people and agencies including Mozambican reserve managers, provincial officials, and regional wildlife experts. This list (Table 14) attempted to optimize all criteria for selection in that it would be as "natural" as possible, a real tourist attraction and contain a good number of relatively high value species.

Table 14. A list of larger mammal species already introduced or identified for future introduction to Sanctuary

Species	Scientific name	Introduced	Identified
Bushbuck	*Tragelaphus scriptus*	✓	✓
Wildebeest	*Connochaetes taurinus*	✓	✓
Eland (Livingstone's)	*Taurotragus oryx*	✓	✓
Giraffe	*Giraffa camelopardalis*	✓	✓
Nyala	*Tragelaphus angasii*	✓	✓
Sable	*Hippotragus niger*	✓	✓
Roan	*Hippotragus equinus*		✓
Kudu	*Tragelaphus strepsiceros*	✓	✓
Hartebeest (Lichtenstein's)	*Alcelaphus lichtensteinii*		✓
Oribi	*Ourebia oureba*		✓
Waterbuck	*Kobus ellipsiprymnus*	✓	✓
Blue duiker	*Cephalophus monticola*		✓
Sharp's grysbok	*Raphicerus sharpei*		✓
Aardvark	*Orycteros afer*		✓
Pangolin	*Manis temminckii*	✓	✓
Zebra	*Equus burchelli*	✓	✓
Total		**10**	**16**

Many individuals of several species have already been introduced (Tables 14 & 15) and, despite some mortalities, they have generally fared well and sometimes bred exceptionally well.

3.2.10. Current mammal species and estimates in terms of numbers

a) Larger mammal

The nature of the terrain, type of animal and capacity of Sanctuary management make accurate and complete game animal counts very difficult. A first estimate of game numbers on Sanctuary was worked out in July 2015 and this was followed by a more formal game count and estimate in 2019 using BIOFUND funding. This report used all available data including several thousand sightings by Field Rangers on patrol. A full report on this game estimate is included in Appendix 8 while the totals are included in Table 15.

Table 15. The larger terrestrial mammals confirmed to be present on Sanctuary, number estimates in 2016 (A) and estimates from the game monitoring in 2019 (B).

English name	Scientific name	A	B
Red duiker	*Cephalophus natalensis*	60	200
Suni	*Neotragus moschatus*	50	250
Bushpig	*Potamochoerus porcus*	100	250
Common duiker	*Sylvicapra grimmia*	120	120
Bushbuck	*Tragelaphus scriptus*	20	34
Steenbok	*Raphicerus campestris*	75	100
Wildebeest	*Connochaetes taurinus*	122	166

Eland (Livingston's)	*Taurotragus oryx*	122	194
Giraffe	*Giraffa camelopardalis*	3	0
Nyala	*Tragelaphus angasii*	35	47
Sable	*Hippotragus niger*	12	3
Kudu	*Tragelaphus strepsiceros*	92	94
Waterbuck	*Kobus ellipsiprymnus*	77	139
Zebra	*Equus burchelli*	45	61
Total		933	1658

From the information available, it is clear that, in general, the number of animals is currently lower than the estimates previously made regarding capacity. Only wild pigs are seen to be at an optimum number and the wildebeest is approaching the number where action by the administration will be needed within a short time. From Tables 16 it is also clear that in recent years, great efforts have been made to populate the Sanctuary with good numbers of suitable species.

b) Smaller mammals

Most of the smaller mammals were also targeted as food during the war and populations of many species were severely reduced or even became extinct. A survey of the literature shows what species were likely to be present on Sanctuary and to this can be added the species recently confirmed as currently present (Table 16).

Table 16. Smaller terrestrial mammals likely to be present and confirmed present as of July 2019.

It is highly likely that many of the species not yet confirmed as present will be confirmed in the near future as observations intensify and monitoring methods improve. Several species that were reduced to small relic populations, such as porcupine, should increase fairly rapidly but locally extinct species, such as aardvark and probably honey badgers, will need to be reintroduced.

Taxon	English name	Scientific name	Confirmed
LORISIDAE	Thick tailed bushbaby	*Otolemur crassicaudatus*	1
(BUSHBABIES)			
CERTHOPITHECIDAE	Vervet monkey	*Certhopithecus aethiopius*	1
(MONKEYS)	Samango monkey	*Certhopithecus mitis*	1
	Yellow baboon	*Papio cynocephalus*	1
INSECTIVORA	Hottentot golden mole	*Amblysomus hottentotus*	
(INSECTIVORES)	Black musk shrew	*Cocidura marquensis*	
	Lesser red musk shrew	*Cocidura hirta*	
	Grey musk shrew	*Cocidura silacea*	
	Four toed elephant shrew	*Petrodromus tetradactylus*	

CHIROPTERA	Wahlberg's epaulleted bat	*Epomophorus wahlbergi*	
(BATS**)**	Damara woolly bat	*Kervoula argentata*	
	Hairy slit-faced bat	*Nycteris hispida*	
	Banana bat	*Pipistrellus nanus*	
	Angola free-tailed bat	*Tadardia condylura*	
	Little free-tailed bat	*Tadardia pumila*	
LAGOMORPHA	Scrub hare	*Lepus saxatilis*	1
(HARES)			
RODENTIA	Namaqualand rock rat	*Aethomys namaquensis*	
(RODENTS)	Bush rat	*Aethomys chrysophilus*	
	Common molerat	*Cryptomus hottentotus*	
	Grass climbing mouse	*Dendromus melanotis*	
	Forest dormouse	*Graphiurus murinus*	
	Cape porcupine	*Hystrix africae - australis*	1
	Dwarf mouse	*Leggada minutoides*	
	Red squirrel	*Paraxerus palliatus*	
	Multimammate mouse	*Praomys natalensis*	
	Pouched mouse	*Saccostomus campestris*	
	Kreb's flat mouse	*Steatomys krebsi*	
	Bushveld gerbil	*Tatera leucogaster*	
	Highveld gerbil	*Tatera brantsii*	
	Thicket rat	*Thamnomys dolichurus*	
	Cane rat	*Thryonomys swinderianus*	1
	Spring hare	*Pedetes capensis*	1
CARNIVORA	Water mongoose	*Atilax paludinosus*	1
(CARNIVORES)	Cape clawless otter	*Aonyx capensis*	1
	Large spotted genet	*Genetta tigrina*	1
	Slender mongoose	*Herpestes sanguineus*	
	Striped polecat	*Ictonyx striatus*	
	White tailed mongoose	*Ichneumia albicaudia*	
	Banded mongoose	*Mungos mungo*	1
TUBULIDENDTATA	Aardvark	*Orycteros afer*	
PHOLIDOTA	Pangolin	*Manis temminckii*	1

c) Mamíferos marinhos

Enquanto que as populações de muitos mamíferos marinhos e os que habitam na margem, tais como muitas baleias, estão a aumentar muito rapidamente, outras espécies que vivem ao longo da costa não estão. A nível local, a população de dugongos geralmente é vista sob fortes condições de pressão, tanto do ponto de vista de mortalidade como também em termos de degradação da vegetação marinha, apesar de agora ser vista como a única população na África oriental com uma possibilidade de sobrevivência a longo prazo. As zonas de protecção do peixe no Santuário não devem apenas proteger quaisquer dugongos nestas zonas mas também devem permitir a recuperação da vegetação marinha dentro dos seus limites. As águas do Santuário oferecem um habitat relativamente seguro e adequado. As zonas cobertas perto do Santuário podem ser ou podem tornar-se em importantes zonas de reprodução para estas espécies em perigo.

Geralmente, os golfinhos-corcova restringem-se às baías com águas não profundas e estuários e vários grupos destes animais fazem um grande uso das águas do Santuário, tanto do lado este como do lado oeste da Península.

Provavelmente existem pelo menos seis mamíferos marinhos presentes no Santuário de forma permanente ou anual (Table 17).

Table 17. Marine mammals confirmed present in Sanctuary waters as of July 2019.

Species	Scientific name	Confirmed
Bottlenose dolphins	*Turisops truncatus*	
Common dolphins	*Delphinus delphis*	
Spinner dolphins	*Stenella longirostris*	
Humpback dolphins	*Sousa chinensis*	√
Humpback whales	*Eubalaena australis*	√
Dugong	*Dugong dugon*	√

Sanctuary waters are relatively safe, contain fairly undisturbed areas and there is a good chance that any killing of these animals in Sanctuary waters will be reported and acted upon.

3.2.11. Birds

Existe uma grande variedade de espécies de aves no Santuário. Estas espécies são bastante A large number of a wide variety of bird species are to be found on Sanctuary. They are important to Sanctuary in terms of biodiversity, ecological processes and attracting visitors while Sanctuary is important to many of them in terms of habitat, feeding, roosting, breeding or as a relatively safe stopover on migrations. The current Sanctuary bird list is included as Appendix 1 A 1 but a large amount of work has been carried out on birds over the years and this has been written up in several reports and publications. Warwick Tarboton completed a comprehensive report in 2002 (included here as Appendix 1 A 2) while in 2013 Read et al published a thorough and very useful annotated list of species that have recently been recorded on Sanctuary.

While birds are of great importance it is not appropriate to exhaustively list and describe all species in this plan. From a birds' perspective, the types of swamp spaces presented at the Sanctuary provide a very important feature for the area. The variety of seabird species recorded here in winter is related to the quality of these marshes and, based on what was

seen by Tarboton, an area could undoubtedly qualify for Ramsar status, just for its seabird communities.

It is perhaps an anachronism that the devastated and burned areas currently contribute to the increase of all the diversity of birds in the region - they provide an open space with many plants like weeds that attract a variety of seed-eating birds and others - and the complete disappearance of these areas of the Sanctuary would have a negative impact on the entire biodiversity of the peninsula.

3.2.15. Herpetofauna

a) Reptiles

Despite widespread hunting and killing of reptiles the area of Sanctuary still shows a great diversity of reptiles including some rare and localised species, although current knowledge levels are poor. Sanctuary probably contains several species of rare and very localised burrowing reptiles but, to date, little work has been carried out to confirm their presence.

Table 15. The number of reptile species, per major taxon within whose range Sanctuary sits and whose habitat Sanctuary contains (A) indicating (B) those species confirmed present and those recorded recently from the Bazaruto Archipelago (C).

Espécies	A	B	C
Land tortoises	1	1	0
Marine turtles	5	3	1
Terrapins	5	0	4
Snakes	48	17	19
Lizards	26	16	15
Crocodiles	1	1	1
TOTAL	**86**	**38**	**40**

The protection and monitoring of four species of turtle nesting on Sanctuary showing reduced poaching and good hatching success. While mammals and fish undoubtedly bore the main brunt of the desperate search for food during the war years, many reptile species suffered the same fate. The high densities of people and greatly transformed landscape also resulted in habitat destruction and many more interactions between man and reptiles that resulted in the former killing the latter. Marine turtles were targeted for food, both in the open ocean and also if they came ashore to nest. Almost every homestead on the peninsula had the remains of turtle carapaces nearby and there were also carapaces of dead turtles along the shoreline. Tortoises were also eaten but they were smaller and at fairly low densities rendering specific hunting unrewarding.

The most threatened reptile group in Mozambique are probably the marine turtles. Along ninety percent of the Mozambique coastline there is little or no protection for these animals and widespread and routine killing and nest robbing. What protection is afforded is focused in the far south of the country while in the middle regions there are affectively no protected beaches other than those of Sanctuary.

The eastern shores of Sanctuary probably provide the only protected nesting beaches within a 2 000 kilometer stretch of coastline extending from Inhaca Island northwards and every effort must thus be made to continue, enhance and catalogue this protection.

Despite challenges, marine turtles are still fairly abundant in the waters around Sanctuary and loggerhead, leatherback, green and hawksbill turtles have been recorded nesting on the sandy beaches on the east of the sand spit on the eastern shore of Sanctuary. Sanctuary management, supported by BIOFUND, spends a lot of time and effort monitoring and protecting the turtle breeding beaches each summer and has a Strategic Plan outlining how this is done and produces annual reports on each season's work. It also works closely with other Mozambican turtle monitoring projects as well as those of the south east Indian Ocean.

A total of five species of freshwater terrapin may be present on Sanctuary but little is known about the presence, identification or abundance of this taxon on Sanctuary. Sanctuary falls within the known range of only one species of land tortoise and it still occurs on Sanctuary but at low densities.

Table 16. A checklist of the chelonian species within whose range Sanctuary sits, those confirmed present and those recorded breeding on Sanctuary.

Taxon	Common name	Scientific name	In range	Confirmed	Breeding
Turtles	Leatherback turtle	*Dermochelys coriacea*	1	1	1
	Loggerhead turtle	*Caretta caretta*	1	1	1
	Green turtle	*Chelonia mydas*	1	1	1
	Hawksbill turtle	*Eretmochelys imbricata*	1	1	1
	Olive ridley turtle	*Lepidochelys olivacea*	1		
Terrapins	Pan hinged terrapin.	*Pelomedusa subniger*	1		
	Serrated terrapin.	*Pelusios siunatus*	1		
	Mashona hinged terrapin	*Pelusios rhodesianus*	1		
	Yellow bellied hinged terrapin	*Pelusios castanoides*	1		
	Zambezi soft shelled terrapin	*Cycloderma frenatum*	1		
Tortoise	Bell's hinged tortoise.	*Kinixys belliana*	1	1	1
Total			11	5	5

Several very large pythons have been seen and photographed by the Field Rangers showing that this species is still thriving on Sanctuary. Good records have been made of some uncommon burrowing snakes and a Cape wolf snake was recently photographed at a lodge and yet Sanctuary is well outside its known range.

Many of the larger snakes, such as pythons and cobras, would be attracted to homesteads by higher densities of rodents and toads and also if there were chickens being kept for food. These homesteads would thus act as "large snake aggregating devices" where the snakes would mostly be killed thus reducing the density of affected species.

The tropical nature and many and varied habitats and ecosystems lead to a high diversity of snake species being possibly present on Sanctuary. Most snakes are, however, cryptically coloured, secretive, difficult to identify, fast moving and many are also nocturnal and all of this combines to make drawing up a comprehensive species list very challenging. Despite this already 17 of the apparently possible 48 species have been recently confirmed present on Sanctuary and this number will increase progressively as time passes and more observes visit Sanctuary with digital cameras.

Table 17. A checklist of the snake species within whose range Sanctuary sits, species confirmed present (A) and those recorded recently from the Bazaruto Archipelago (B).

Nome comum	Especie	A	B
Cobra cega de Fornasini	Afrotyphlops fornasini	√	√
Cobra cega de Schlegel	Megatyphlops schlegeli	√	
Cobra-cega-anã	Leptotyphlops conjunctus		
Cobra-cega de Peter	Leptoytphlops scutifrons		
Cobra-cega-anã	Leptotyphlops incognitus		√
Giboia	Python natalensis		√
Cobra de olhos pequenos	Amblyodipsas microphthalma		√
Cobra vermelha	Amblyodipsas polylepis		
Cobra comedora de centípedes do Cabo	Aparallactus capensis	√	√
Cobra comedora de centípedes malhada	Aparallactus lunulatus		
Cobra-estílete	Atractaspis bibronii	√	√
Cobra de lábios vermelhos	Crotaphopeltis hotamboeia		√
Cobra-comedora-de-lesmas	Dasypeltis medici		√
Come ovos	Dasypeltis scabra		
Cobra de mármore	Dipsadoboa aulica	√	
Cobra das arvores	Dispholidus typus		√
Cobra de Mopane	Hemirhagerrhis nototaenia		
Cobra das casas castanha	Lamprophis capensis	√	
Cobra da água	Lycodonomorphus obscuriventris		
Cobre de lobo de Leste	Lycophidion semiannule		√
Cobra dos pântanos olivácea	Nariciteres olivacea		
Cobra verde	Philothamnus hoplogaster	√	
Cobra verde do Natal	Philothamnus natalensis	√	√
Cobra do mato veriegada	Philothamnus semivariegatus	√	√
Cobra-de-focinho-vermelho	Rhamphiophis rostratus		
Cobra focinho de pá de África Oriental	Prosymna stuhlmanni		√
Cobra focinho de pá moçambicana	Prosymna janni	√	√
Cobra-sarapintada-come-lesmas	Duberria variegata	√	
Cobra de erva azeitona	Psammophis mossambicus		
Cobra de ventre listrado	Psammophis subtaeniatus		
Cobra de barriga listrada	Psammophis orientalis		√
Cobra semiornamentada	Meizodon semiornatus	√	
Cobra tigre	Telescopus semiannulatus		
Cobra-trepadeira de Moçambique	Thelotornis mossambicus	√	√
Cobra fina de duas cores	Xenocalamus lineatus		√
Cobra fina do Transval	Xenocalamus transvaalensis		√
Cobra-com-liga de Sundervall	Elapsoidea sunderwallii		
Cobra-com-liga de Boulenger	Elapsoidea boulengeri		
Cobra de escudo	Aspidelaps scutatus	√	
Cobra de focinho	Naja annulifera	√	
Cobra da floresta	Naja melanoleuca	√	√
Cobra cuspideira	Naja mossambica	√	
Mamba negra	Dendroaspis polylepis		

Mamba verde	Dendroaspis angusticeps		
Cobra-do-mar	Pelamis platura		
Víbora da noite	Causus rhombeatus		
Víbora de focinho	Causus defilippii		
Víbora comum			
Víbora assopradora	Bitis arietans		
Total		17	19

Several new records have been made, including extensions of known ranges.

This group also exhibits high diversity on Sanctuary though not as great as that of snakes. Many of the species are also difficult to spot or identify and several are very similar to each other and only museum specimens will finally settle some identification problems. The sandy nature of nearly all the soils and dry weather most of the time combine to make conditions often unsuitable for the free movement of lizards and so many species are only active, and thus able to be seen, for limited periods each year.

Of the 26 lizard species expected to be present on Sanctuary a total of 16 have so far been confirmed while a slightly different 15 have been recorded on the Bazaruto Archipelago (Table 19).

Table 18. A checklist of the lizard species within whose range Sanctuary sits indicating (A) those confirmed present and those recorded recently from the Bazaruto Archipelago (B).

Nome comum	Especie	A	B
Anfisbenio de focinho redondo Van Dam	Zygaspis vandami		
Anfisbenio de focinho redondo violeta	Zygaspis violacea		√
Slender spade snouted worm lizard	Monopeltis sphenorhynchus		√
Lagartixa dourada cega	Typhlosaurus aurantiacus		√
Lagartixa de Bazaruto	Scelotes insularis		√
Lagartixa-com-marcas de Moçambique	Mochlus afrum	√	
Lagartixa-com-marcas de Bazaruto	Mochlus lanceolatum		√
Lagartixa de Sundevall	Mochlus sundevalii		
Lagartixa-das-costas-vermelhas	Trachylepis depressa	√	√
Lagartixa-com-listas	Trachylepis striata	√	
Lagartixa-variada	Trachylepis varia	√	√
Lagartixa-de-olhos-cobra	Afroblepharus wahlbergii	√	
Lagarto-mulato-com-placas	Gerrhosaurus major		√
Lagarto amarelo com placas	Gerrhosaurus flavigularis	√	√
Lagarto-de-cinta de Jones	Cordylus jonesii	√	
Verano das rochas	Varanus albigularis	√	√
Varano do Nilo	Varanus niloticus	√	
Camaleão de pescoço achatado	Chameleo dilepis	√	√
Osga das casa tropical	Hemidactylus mabouia	√	√
Osga de cabeça chata	Hemidactylus platycephalus	√	√
Osga-anã-de- Cabo	Lygodactylus capesis	√	√
Osga de veludo	Homopholis wahlbergii		√
Lagarto-de-escamas-rugosas do Cabo	Ichnptrophis capensis	√	

	Ichnotrophis squamulosa	√	
Lagarto de cauda azul	Nucras caesicaudata		
Agama-com-espinhos-trópical	Agama armata	√	
Total		16	15

Crocodiles (Crocodylus niloticus) had been present throughout the region in most of the larger waterbodies and undoubtedly, and understandably, many of these would be killed to prevent danger when collecting water while others would become entangled in fishing nets and die or be killed. They are still present in several water bodies in and around Sanctuary and the presence of small individuals shows that this species was breeding at least until a few years ago. The reduction in fishing and other activities in places like Lake Noni may allow previously depressed crocodile populations to build up again but numbers in all areas are probably very low. There are still crocodiles in water bodies outside the fenced area of Sanctuary and, where appropriate and possible, it has been decided that they may be captured and brought within the fence line to reduce human/crocodile conflict.

b) Amphibians

Several new records have been noted including a very interesting Breviceps (Rain frog). It was reported to various amphibian specialists and it may well be a new species but more work will have to be done to confirm its status.

Although the sandy nature of Sanctuary soil is generally not suitable for amphibians, the high rainfall and widespread and extensive waterbodies provide large amounts of suitable habitat for many species. A total of 34 species were found to be likely to be present on Sanctuary while 19 have so far been confirmed to be there (Table 20). The nearby Bazaruto Archipelago checklist only contains eight species probably due to the extremely harsh nature of much of the island terrain.

Table 19. A checklist of the amphibian species within whose range Sanctuary sits indicating those confirmed present (A) and those recorded recently from the Bazaruto Archipelago (B).

Nome comum	Especie	A	B
Rã-de-unhas-africana	Xenopus laevis		
Rã-de-unhas-tropical	Xenopus muelleri		
Sapo-gutural	Amietophrynus gutturalis	√	
Sapo-azeitona	Amietophrynus garmani	√	
Sapo-vermelho	Schismaderma carens	√	
Sapo-da-chuva	Breviceps adspersus		
Sapo de Moçambique	Breviceps mossambicus		
Sapo-de-duas-listas	Phrynomerus bifasciatus	√	√
Rã-boi	Pyxicephalus adspersus		
Rã-do-rio	Amieta angolensis		
Rã-listrata	Amieta fasciata		
Rã-de-focinho-estreito	Ptychadena oxyrhynchus	√	
Rã-da-erva de Mascarene	P. mascareniensis		
Rã-da-erva	P. porosissima		
Rã-de-listas-largas	P. mossambica	√	√
Rã-dos-charcos	Phyrnobatrachus natalensis		

Rã-dos-charcos de África Oriental	P. acridoides	√	
Rã-dos-charcos-anã de Mababe	P. mababiensis	√	√
Rã-barulhenta	Cacosternum boettgeri		
Sapo-de-ninho-de-espuma	Chiromantis xerampelina		
Sapo-de-patas-de-pá do Norte	Arthroleptis stenodactylus		
Sapo-das-árvores	Leptopelis natalensis	√	
Sapo-de-costas-castanhas	Leptopelis mossambicus	√	√
Sapo-de-patas-vermelhas	Kassina maculata	√	
Sapo de Senegal	Kassina senegalensis	√	√
Sapo-dourado	Afrixalus brachynemis		
Sapo-das-folhas-gigante	Afrixalus fornasinii	√	
Rela de Argus	Hyperolius argus	√	
Rela-vermelho	Hyperolius tuberilinguis	√	√
Rela-dos-lírios	Hyperolius pusillus	√	√
Rela-comprida	Hyperolius nasutus		
Rela-sarapintada	Hyperolius marmoratus	√	
Rã-da-areia	Tomoptera krugerensis	√	√
Rã-morena	Tomoptera marmorata	√	
Total		19	8

Amphibians can be particularly difficult to find except during, often short, periods of suitable weather conditions. Many, particularly in sandy soil, spend many months deep under the sand only to surface and breed rapidly and then burrow again till the following season. Each wet season more species are being confirmed for Sanctuary and this is likely to continue for some years to come.

3.2.16. Fish

Sanctuary is surrounded by water on three sides and also contains substantial amounts of fresh water although there are no true rivers. While the marine environment shows extreme diversity and also localised abundance of fish, and other marine life, the freshwater areas exhibit low diversity and also fairly low abundance of fish. Only about half of the expected species of fish have so far been confirmed present in Sanctuary waters and, in the freshwater this figure drops to eight percent.

Table 20. A list of the groups of fish species within whose range Sanctuary sits indicating the number of species currently confirmed present under several headings.

Group	Number	Confirmed
Freshwater fish	12	2
Inshore marine fish Site 7		108
Inshore marine fish Linene		172
Inshore marine fish combined		280
Marine fish probable total	1000	
	1012	562

a) Freshwater fish

Although there are extensive wetlands within Sanctuary and there used to be quite a large amount of fishing in the pans it is not easy to catch fish for identification purposes. Most pans are surrounded by dense vegetation that often extends deep into the water and wading into the water often scares the fish into deeper areas. There are very few free swimming and obvious fish, such as topminnows, that can easily be caught in hand nets and many species that favour running water are absent.

Species such as eels (Table 17) are probably present in very small numbers but it is extremely difficult to catch them by hand net and they are very rarely caught in gill nets. There is an urgent need to sample freshwater fish on Sanctuary and improve the level of knowledge of this taxon.

Table 21. A checklist of the freshwater fish species within whose range Sanctuary sits indicating those species already confirmed present.

Species	Scientific name	Confirmed
Bulldog	*Marcusenius macrolepidotus*	
Longfin eel	*Anguilla mossambica*	
Giant mottled eel	*Anguilla marmorata*	
African mottled eel	*Anguilla bengalensis*	
Shortfin eel	*Anguilla bicolor*	
Broadstripe barb	*Barbus annectens*	
Bowstripe barb	*Barbus viviparus*	
Straightfin barb	*Barbus paludinosus*	
Plump barb	*Barbus afrohamiltoni*	
Sharptooth catfish	*Clarias gariepinus*	
Mozambique tilapia	*Oreochromis mossambicus*	1
Checked goby	*Redigobius dewaali*	1
Total		2

b) Inshore marine fish

Sanctuary waters contain a vast array of marine fish species but they are very unevenly distributed. Most are associated with marine coral reefs but the extent of this habitat in Sanctuary is limited to relatively small areas offshore from the sand spit north of Lighthouse. There are, however, smaller reefs in inshore waters, particularly off Linene Island, and also structures such as jetties that aggregate reef and other fish that are often visited by people who can identify marine fish.

The combined total of marine fish in Sanctuary waters is probably over 1 000 but, to date, 108 have been recorded at artificial reefs within the western bay area and 172 from the natural reef off Linene Island. The aggregate total of marine fish identified from these inshore areas is currently 280 (Table 16) but this is probably a little over one quarter of the overall real total for Sanctuary waters.

Sanctuary is not currently known to contain any marine fish species that are particularly threatened or that do not occur elsewhere but the variety of marine fish that are now protected is important to regional conservation efforts. The main significance of Sanctuary in terms of marine fish is not the biodiversity but Sanctuary's capacity to protect them and allow them to breed and emigrate from Sanctuary waters.

Many of the shallow and relatively sheltered waters around the peninsula are suitable for marine fish to spawn and also for small juvenile fish to avoid high predation levels. Constant

small mesh seine netting along much of the Mozambican shore has resulted in severely depressed fish populations and reduced mean fish length. By providing, increasing and protecting suitable areas for fish breeding Sanctuary is probably having a marked beneficial impact on many fish species in the region. The positive spin off to fishing communities outside Sanctuary waters is noteworthy.

c) Offshore marine fish

The offshore areas of Sanctuary are used by many partially or fully migrant pelagic fish species for at least part of the year. Generally, they are not heavily dependent on Sanctuary management and, in turn, Sanctuary and its visitors currently have a very limited impact on them.

For visitors to Sanctuary the commonest fish caught are the bonito, kingfishes and king and queen mackerel but the region is also well known for its black, blue and striped marlin and excellent sailfish. The open ocean is, however, mostly characterized by low diversity as well as biomass of fish.

3.2.17. Invertebrates

Many very large invertebrate groups are even now only poorly known or understood and yet they account for or control much of the nutrient transfer, ecosystem processes and biomass of living organisms on Sanctuary. The vast majority of multicelled organisms belong to the invertebrates and yet most attention is usually paid to the vertebrates that only account for a very small proportion of overall biodiversity. There are many reasons for the focus being on vertebrates, among those being that they are usually more easily seen, are often closer to humans in appearance and size and are often much more easy to find, identify and manage.

The knowledge of invertebrate taxa on Sanctuary is limited to those groups for which people with specific knowledge of them have visited Sanctuary and assisted management with information on them. Knowledge of other invertebrate taxa is rudimentary but efforts will be made to progressively add to the knowledge base and build up a database of an annotated inventory of invertebrate groups.

a) Butterflies

This is generally the largest and most obvious group of insects and is well represented by a large number of species in the sanctuary. Although in-depth studies have not yet been done at the Sanctuary, a study of the literature plus some casual notes and visualizations by some butterfly enthusiasts will soon result in a definitive list of likely species.

b) Scorpions

Scorpions occur in the Sanctuary and this is a group that contains species that can potentially cause serious poisoning situations and it is also an animal seen with great concern by many people. A survey of the literature suggests that only four species may be present, and of these, only one has been properly identified in the Sanctuary.

The species, *Parabuthus mossambicus*, is however one of the most potent in terms of strength and quantity, and should be avoided and handled with care. It is a little big, nocturnal, with thin tentacles and a stiff tail and has a color close to the yellow of the sand. When the lights are turned on, this species can be attracted by insects that approach the light. *Lychas burdoi* is a species that is usually found under tree bark or under leaf litter. It is a little small and has a yellowish appearance and with a poison that generally does not constitute a danger to

human life. *Olivaceous uroplectes* are medium in size, usually dark green with small tentacles and a stiff tail. This one is also nocturnal, secret but with a very potent poison.

Opisthacanthus asper is a species generally found in trees but under the bark of the trees or in holes in the trees. It is nocturnal, a little big, dark green with large tentacles and a relatively thin tail. Your poison is weak. All known or suspected scorpions are nocturnal and must avoid very dry conditions. The most likely time to find them is on hot nights near lights or on the bark of trees.

Table 22. A list of the scorpion species within whose range Sanctuary sits, roughly indicating the potency, or "danger level" of the species' venom where 5 is strongest and 1 is least effect.

Nome cientifico	Confirmed	Danger level
Parabuthus mossambicus	1	5
Lychas burdoi	1	3
Uroplectes olivaceus		2
Opistacanthus asper	1	1

c) Marine invertebrates

In terms of utilisation this group is of very great importance to the local community, in terms of food and finance, and also the Sanctuary marine ecosystems in terms of their functioning. Unfortunately, very little is known of more than half the Phyla present in Sanctuary waters and, of the better known ones, less than one tenth of the probable species have been confirmed to date (Table 19). This will continue under research and monitoring activities going forward.

Although no specific work has yet been carried out on these taxa in Sanctuary some work has been carried out and published on these organisms in the Bazaruto National Park. Information from surveys there was published in the 1990 Bazaruto National Park Management Plan (Dutton 1990) and also in more detail in the Oceanographic Research Institute Special report Number 8 (Everett et all 2008). Gleaning information from these documents combined with distribution information from Two Oceans" (Branch et al 2010) gives some indication of the range and scope of marine invertebrate biodiversity likely to be found on Sanctuary (Table 19 & 20).

Table 23. A checklist of the various invertebrate Phyla that have marine species within whose range Sanctuary sits contains indicating the number of species confirmed.

Phylum	Possible	Confirmed
ARTHOPODA	69	19
ECINODERMATA	25	8
MOLLUSCA	178	5
CNIDARIA	96	?
CTENOPHORA	?	
ANNELIDA	?	
PLATYHELMINTHES	?	
NEMATODA	?	
NEMERTEA	?	
SIPHUNCULITA	?	
ECHIURA	?	
BRYOZOA	368	32

Table 24. A checklist of the invertebrate Phyla and sub groups that have marine species within whose range Sanctuary sits indicating the number of species confirmed present.

Phylum	Classe ou sub phylum	Descrição	Possível	Confimed
ARTHOPODA	*Crustacea*	Cracas	5	5
		Lagosta	4	
		Camarão	7	3
		Zagaias	2	
		Caranguejo	51	11
ECINODERMATA	*Asteroidea*	Estrela-do-mar	5	4
	Crinoidea	Lírios-do-mar	3	
	Ophiuroidea	serpentes-do-mar	2	
	Echinoidea	Ouriço-do-mar	7	2
	Holothuroidea	Pepinos-do-mar	8	2
MOLLUSCA	*Bivalvia*	Animais com duas conchas	25	2
	Polyplacophora	Chitons	2	
	Gastropoda	Lapas, caracóis etc	147	
	Cephalopoda	Polvo etc	4	3
CNIDARIA	*Anthozoa*	Anémonas do mar	?	
	Alcyonacea	Corais macios e leques	29	
	Scleractinia	Corais rijos	67	
Total			**368**	**32**

The Phylum Arthropoda contains three subphyla, Hexapoda (insects), Chelicerate (includes spiders) and Crustacea (barnacles, crabs, shrimps and lobsters) but very little information is known of the presence of the first two in Sanctuary and also of Crustacea groups like the isopods and amphipods.

The limited information that is available on the Crustacea suggest that all five species of the Cirripedia (barnacles) that may be on Sanctuary are present (Table 20). These species include goose barnacles and rock barnacles but none of them is of known great direct economic, social or conservation importance.

Four species of lobster are probably present in Sanctuary waters and although there is a lobster fishery in the region that is annually estimated to have exported over 400 tons, none of the species is currently thought to be of great economic importance on Sanctuary. Lobsters are caught by beach seine, in the seagrass beds or by people swimming and spearing in the rocky areas.

In Sanctuary waters there are probably seven species of Peneid prawns including the “tiger” and “white” prawns that support economically important fisheries on the east coast of Africa. In Sanctuary waters, however, most use is made of juvenile prawns in the very shallow waters of the southern end of the “estuary” and other very shallow water areas. This kind of fishing is carried out along most of the Mozambican shoreline but it is usually seen as an inappropriate/unwise fishery as it targets juveniles of prawns that could be caught later in life when they are of much greater value. It is generally thought that most peneid prawns spawn in the open ocean, in relatively sheltered shallower areas, but somehow very small larvae manage to reach very shallow, sheltered areas.

Mantis shrimps are to be found mostly individually in the few rocky areas and sometimes in seagrass beds.

At least 51 species of crab are probably found in Sanctuary waters and some are very abundant while a few are of commercial value. The mangrove areas are particularly rich both in species and biomass of crabs. The mud crab, Scylla serrata, is often abundant and is the focus of attention wherever it is found as it is very large and contains much food. Also in the mangrove areas are vast numbers of “fiddler” crabs and also small mangrove crabs such as Metasesarma meinerti. Little use seems to be made of these species even though in other similar areas the latter species is the focus of fisheries in other nearby areas.

On the sandy areas fishers often target any mud crabs, as their holes can be seen, but one of the more used species is the blue swimming crab Portunus pelagicus. This crab is caught by people walking or swimming in the shallows using a short stick with a metal spike on the end. The most abundant crab species on upper shores is often the army crab, Dotilla fenestrata that is often seen in vast numbers digging sand when the tide is out. It is probably too small to be of any economic interest or value.

Most of the other crabs are widely dispersed hermit crabs or crabs associated with coral reefs.

Some echinoderms are abundant in Sanctuary waters and these include star fishes, feather stars, brittle stars, sea urchins and sea cucumbers. Star fishes can be very colourful, large and easily seen. These include the spine tipped star, Protoreaster lincki, (photo 4) that can be seen either washed up on the shore or in seagrass beds. Another well-known starfish is the “crown of thorns” starfish that was recently thought to be a serious threat to coral reefs but it now generally regarded as an important part of a properly functioning ecosystem.

Figure 14. Spine tipped starfish, Protoreaster lincki, showing some of their colour variation.

The most important echinoderm group in Sanctuary waters is undoubtedly the sea cucumbers, represented by about seven species. The snake sea cucumber, Synapta maculate, is one of the easier species to identify as it can be over one meter long and appears to be a thin walled bag of sea water. Several of the other species may be found in considerable numbers in the seagrass beds where they can easily be collected. These species, particularly the “sandfish”, Holothuria scabra, used to be very abundant but a well-known “boom and bust” fishery operated around the 1990’s to supply Far East markets. These animals were collected in vast numbers, boiled and dried and then sold to or collected by Chinese businessmen. Harvesting was so intense that all suitable species were rapidly reduced in

density to the extent that the fishery quickly became uneconomic. Recent apparent improvement in stocks may well result in a temporary revival of the fishery.

The phylum Mollusca contains many well-known and important animals such as mussels, ornamental shells and octopi. A bivalve, and probably the single most important species to the local community, is the sand oyster, Pinctada imbricata, called locally mapalo. These can be extremely abundant in seagrass beds and formed the main protein source of many people during the war years. Extensive and intensive use continues where there are seagrass beds. No other bivalves are harvested to any great extent in Sanctuary waters.

Chitons are found in seagrass beds and on rocky shores and although at least two species of chiton probably occur on Sanctuary neither is of any known particular importance.

The gastropod molluscs cover a wide variety of organisms including most of the ornamental shells that are collected for sale in much of the Vilanculos area. Use, or collection, in Sanctuary waters is probably very limited due to the scarcity of rocky substrate and distance from markets but 147 species of these animals have been listed from the Bazaruto Archipelago (Everett et al 2008) and it has been estimated that there could easily be well over 500 species present in the region.

The cephalopod molluscs include octopus, squid, cuttlefish and free swimming members. None of these are particularly abundant or important to man but octopuses are taken when seen, dried and eaten. Squid is also the target of a smallish seasonal fishery where people on boats target them with handlines and the squid can be dried or sold fresh.

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3.2.18. Plants

Most of the work on Sanctuary plants was carried out during surveys in 2002 (Jacobsen, 2002) with additional information being added from occasional visitors and management staff. To date a total of 240 species of terrestrial plant have been identified on Sanctuary. 75 of the known species were grasses, ferns, mosses or sedges, another 75 were flowers, small shrubs or succulents while the remaining 90 were woody plants or trees (Table 23).

Table 25. A summary of the number of species, by plant description type, on Sanctuary following Jacobsen, 2002.

Plant description	Number recorded
Grasses, ferns, moss and sedges	75
Flowers, small shrubs & succulents	75
Trees, large shrubs and woody plants	90
Total	240

In numbers the plant diversity on Sanctuary appears to be fairly evenly split in terms of numbers of species that are “simple plants”, “typical flowering plants” and “woody plants” these three groups (Table 24). Little specific plant work has yet been carried out on Sanctuary and, beyond a basic checklist drawn up in 2002 plus incidental observations since then, the knowledge of Sanctuary plants is poor.

In terms of basic plant taxonomy, the species known to be on Sanctuary are seven ferns and allies (Pteridophytes), one cycad (Gymnosperm) and fairly similar numbers of monocotyledon (grasses, palms and some flowers) and dicotyledon flowering plants (Angiosperms) (Table 24).

Table 26. A summary of the number of plant species, by basic scientific taxon, on Sanctuary following Jacobsen, 2002

Plant group		Number
Pteridophyta *Ferns etc*		7
Gymnospermae *Cone producers*		1
Angiospermae *Flowering plants*	Monocotyledonae	105
	Dicotyledonae	129
Total		242

Most plant species that were on Sanctuary are probably still present, though possibly in reduced numbers, despite the extremely degraded nature of much of the area due principally to slash and burn cultivation. In recent years, since the fencing of the management area, there has been a remarkable recovery of many areas to more “natural” looking systems but it is not clear what the true agricultural impacts on plant biodiversity actually were.

To the casual observer the severely impacted areas appear to be recovering well but it is unclear what proportion of the species present before the impacts are still present or may return. It is the Sanctuary vision to work towards a more “natural” system on Sanctuary that is representative of what was there before man’s impacts and that will protect or enhance all aspects of biodiversity while becoming an internationally known and valued attraction for visitors. To successfully create such an area, it is essential to establish what species, in what abundance, were and should be present and this will entail a large amount of research in the future.

The marine areas, although also severely impacted by heavy seine netting pressure, probably still contain most plant species that were present and probably have a good chance of recovering, unaided, to full species diversity if only some areas can be spared the almost constant seine netting impacts. Marine fringes, particularly the mangrove areas, are very dynamic but fairly robust and still also probably contain almost all the indigenous species despite sometimes extensive use for firewood and the digging up of roots by people seeking crabs.

The wetlands of Sanctuary were not greatly modified by man’s activities and, despite current generally dropping water levels, there is no real reason to believe that aquatic macrophyte or marginal vegetation diversity has, in any major way, been reduced in recent years.

The drier, less nutrient rich areas on the eastern sand spit and eastern side of the peninsula were not as severely impacted by agriculture, as the more western areas, and they are probably among the least impacted of the terrestrial lands.

It is the bulk of the central and western areas where man’s impacts were greatest and unfortunately this accounts for much of the land surface of presently managed Sanctuary. Not only have many species been impacted but the clearing and burning have allowed invasive and fast growing species to invade many of these areas. While many of the currently invasive species are indigenous, and natural progression may cause them to disappear, several invasive alien species, such as dodder and sisal, may require management intervention to remove them.

Fire is the main tool available for veld management and this will be used, in the future, by Sanctuary Management to move towards a more suitable and representative set of

ecosystems. Selective destruction of aliens is being carried out and some rare or threatened species, such as the cycad Encephalartos ferox, may have to be selectively protected or even transplanted.

3.3. Unique value and sensitive features

It is essential to identify any areas, features or habitats that are particularly sensitive, "valuable", important or in need of special attention or protection if the "wise use" approach to managing Sanctuary is to be implemented. These features can be anything from bird breeding colonies to cultural sites to areas prone to erosion and the necessary management actions could vary from intense intervention to complete preservation. The identification of these sites is ongoing and the current list (Table 25) will be updated from time to time when necessary.

Table 27. A list of currently recognized Special Management Areas on Sanctuary

No	Brief description and locality	Reason for listing
1	Mangrove communities	Dynamic yet sensitive and very productive areas important in early life cycles of fish & invertebrates
2	Beaches on eastern shores of Sanctuary	Breeding area for endangered sea turtles
3	Seagrass meadows	Sensitive habitat important to many species including Dugong
4	Inlets and bays on Western side of Sanctuary.	Important "nursery" area for juvenile fish & invertebrates
5	World view cliffs	Olive bee eater colony and sensitive steep sandy slope
6	Sand pits	Olive bee eater breeding areas
7	Southern end of "estuary"	Near "pristine" area with flocks of flamingos etc
8	Dead trees just north of inlet on Western Side	Waterbird roosting and possible breeding area
9	Wetlands	Freshwater marshes and open water

3.3.1. Mangrove communities

The mangrove areas that fringe many of the estuaries and bays of these coastlines are undoubtedly some of the most productive and important marine areas on tropical marine inshore environments. These areas are critically important in the life cycles of many fish and invertebrates and are also powerhouses of productivity and nutrient creation and cycling in areas that are often otherwise characterized by low productivity and nutrient levels. In many areas of the world, including the Mozambican coastline, large areas of mangroves are currently being devastated or degraded by development and other anthropogenic factors. Harbours and tourism developments are being built in mangrove areas and they are also being heavily used for fuel and building materials as well as the collection of living resources such as prawns, fish, crabs and whelks.

The number of mangrove tree species, which help create and characterize these areas increases northwards up the east coast of Africa with the first species being present in the old Transkei of South Africa and numbers increase progressively northwards. By Lake St. Lucia there are four species and at Kosi Bay, on the Mozambique border of South Africa,

there are six species although there is only one specimen of one species. By Sanctuary, the number has risen to seven (Table 26).

Table 28. Mangrove tree species found on the Sanctuary

	Species	Common name	A Main locality	Distinguishing features
1	*Bruguiera gymnorrhiza*	Black mangrove	Pelican Bay	Elbow shaped roots
2	*Avicennia marina*	White mangrove	Pelican Bay	Many thin roots
3	*Rhizophora mucronata*	Red mangrove	Pelican bay	Looping aerial roots
4	*Ceriops tagal*	Indian mangrove	W. side of peninsula	Very long green seeds.
5	*Lumnitzera racemosa*	Tonga mangrove	W. side of peninsula	Buttress roots
6	*Xylocarpus granatum*	Mangrove mahogany	S. end of " estuary"	Large round fruit
7	*Sonnerata alba*	Green mangrove	Pelican Bay	Hard conical roots

Mangrove trees can grow rapidly, under favourable conditions, or very slowly, under adverse circumstances, and can often recruit very well under the right circumstances. Mangrove areas are usually dynamic and often regions exposed to strong wind and tidal action. On Sanctuary there are extensive areas, such as the south end of the "estuary", where there has recently been an extensive "die off" of many very large mangrove trees that is suspected to be a natural occurrence. There are also places where mangrove trees appear to be recruiting very well and rapidly, such as some areas of Pelican Bay.

Figure 15. Rapid and marked erosion of mangroves in an inlet on the west side of Sanctuary during 2012.

It is not only the trees that make this an important and sensitive area. The associated organisms, vertebrates such as mud hoppers, invertebrates such as the myriad crabs and whelks, as well as the microrganisms form assemblages that raise the productivity of these areas well above that of the surrounding areas and provide an invaluable food source and shelter for many juvenile fish and invertebrates.

In some ways this is a robust and dynamic community that has developed over the years due to often extreme but "natural" factors. If, however, new anthropogenic factors such as inappropriate development, extensive use or pollution reach significant levels they can easily have a dramatic and short term impact on the mangroves.

Special Management:

Sanctuary Management has identified mangrove areas as valuable as well as sensitive and special care is given if a proposed development or activity may impact any of these areas in any way. If a development is to proceed with impacts on mangroves it can only do so after an appropriate assessment has been carried out and suitable mitigating and compensatory measures have been identified and implemented.

3.3.2. Beaches on the sand spit on the eastern shores of Sanctuary north of Lighthouse and south of Nyati Lodge

These beaches are mostly pure sand but there are occasional rocky outcrops, such as the one just north of Lighthouse (Photo 6), and most of these are associated with smallish bays where there is a degree of shelter from the ocean swells for a limited distance. There are also some rocky reefs just offshore, such as just south of Nyati Lodge, that provide limited shelter to areas of beach. These beaches run on a north south axis and the main islands of the Bazaruto Archipelago are a northwards extension of this geological feature.

Figure 16. O recife rochoso perto do Farol exposto a uma maré baixa, numa baía relativamente coberta

Despite some shelter, the tidal range that can be in excess of four meters combined with an often continuous ocean swell result in this being a very dynamic, exposed and inhospitable area for plant and animal life. Clean white sands open to extreme levels of sunshine, often strong winds and relatively little shelter due to the absence of trees over most of the area combine to make this area a very challenging one on which any life forms can survive, never mind prosper.

Despite these challenging conditions, from October to March each year endangered marine turtles come to these beaches to lay eggs. Intermittent monitoring and protection was carried out in the past and has been consolidated in recent years. This has resulted in a higher degree of protection and hatching success for these animals. Recent monitoring has confirmed the presence and breeding of the loggerhead turtle (Caretta caretta), leatherback turtle (Dermochelys coriacea), green turtles (Chelonia mydas) and hawksbill turtle (Eretmochelys imbricata) in small but significant numbers.

Special Management:

The very exposed and dynamic nature of this area combined with the presence of nesting critically endangered marine turtles require very careful management measures if any development or human activity is to take place in this area. An Ecological Impact Assessment is required to ensure that the development does not cause undue impact to the area, that the development is not seriously impacted by severe weather or erosion and that any development does not negatively impact the breeding activity of marine turtles. No development that results in a substantial light source behind the dunes should be allowed as it would impact the delicate light orientated movement of turtle hatchlings.

3.3.3. Seagrass meadows

Seagrass meadows can be seen as oases of productivity in a desert of relatively barren sand flats. They contain a large biomass of both plants and animals and also a high biodiversity of these groups. In the areas around Sanctuary they are home to many interesting and several almost endemic species and are an extremely important food source to many fish and dugong. They also provide essential habitats for the juveniles of many species of fish and invertebrates.

Man also makes extensive use of seagrass meadows and harvests vast quantities of the sand oyster (Pinctada imbricata), called mapalo by the local people. This one species was almost the basic food for many coastal people in the region during the extended civil war in Mozambique and the use continues at a very high level in many areas. In the past vast numbers of sea cucumbers (figure 20) were harvested, until they became economically not viable. The greatest threat to these meadows is undoubtedly the intense and repeated pulling of often massive seine nets over them. This disturbs the substrate, destroys the plants and removes even juvenile fish. Seahorses apparently used to be fairly regularly seen in Sanctuary waters but are now very scarce. The reduction is probably a result of the severe sein netting combined with collection for the Far East medicinal trade.

Figure 17. A sea cucumber, or makajojo, from the seagrass meadows north east of sanctuary.

Special management:

Seagrass meadows that are of particular importance in terms of biodiversity, productivity, juvenile fish and invertebrate production need to be identified and, where possible, zoned for

protection. This has already been begun on Sanctuary and there are seagrass meadows receiving full protection inside the present two “no fishing” zones managed by Sanctuary. In each of these areas there are already signs of recovery both of the seagrass and its associated biodiversity. More areas need to be identified and protected from at least netting and collection of items such as sea cucumbers, sand oysters and crabs if further meaningful progress is to be made.

3.3.4. Sheltered inlets and bays on Western side of peninsula

On the west side of the San Sebastian peninsula are a series of bays and inlets that provide relatively sheltered areas for biota (Photo 8). With a tidal range of more than four metes and large intertidal areas of almost flat sand there are very few “sanctuaries” for very small fish and invertebrates at extreme low tide. Most of the mangrove areas are above the low water mark, and thus completely dry up, and there are no rocky areas on the west coast to provide shelter or protected pools to these creatures when the tide goes out. The only “refugia” for these animals are small areas where drainage lines and sand movement have resulted in localized backwaters and small lagoons.

Figure 18. A typical view of an inlet south of Pelican Bay; A gravid blue swimming crab, Portunus pelagicus

These areas are where much of the reproduction of many species of fish and invertebrate takes place or at least where larvae have a better chance of survival compared to more open areas. Inside Pelican Bay are larger numbers of some crab species and there is evidence that many of these are involved in reproduction while there. Where these inlets and sheltered areas are undisturbed they often contain masses of tiny fish and invertebrates that would otherwise probably be much more easily predated in open water.

Special management:

These areas need to be identified, described and, whenever possible, included into “no fishing” zones. As these core areas are very small and limited in extent it is critically important to completely protect as many of these places as possible to ensure an adequate supply of fish, prawn and crab recruits to the areas outside.

3.3.5. World View cliffs

Situated on the northern tip of the main part of the peninsula is an extensive area where relatively high sand dunes descend abruptly into the ocean (Photo 10). The substrate is loose sand with no rock and, despite some scattered vegetation, the slopes are prone to erosion from wind and occasional heavy rain. The erosion is also exacerbated by the effects of local people walking up and down as well as along the slopes and also the presence of numbers of goats that often graze on them.

Figure 19. A view from the ocean onto World's View "cliffs" showing a person walking on a footpath below the end of the road that stops at the top of the ridge.

Special Management:

Due to its inherently unstable nature and potential for enhanced erosion no development is allowed on this piece of land and human and domestic stock movement should be stopped – this is an ongoing management activity including a notice Board informing people that they may not descend the slope. A new vehicle track has been set out to allow vehicle access to the eastern side of the slope to allow walkers to traverse the north end of the peninsula.

3.3.6. Southern end of Estuary

At the south end of the inlet on the east side of the San Sebastian Peninsula is an area identified by Sanctuary Management as 'special" in that it is seen as "near pristine" and also contains sensitive features such as aggregations of flamingoes (Figure 23) Most structured large conservation areas contain core "wilderness" areas but Sanctuary is too small to have a formal "wilderness" area and this is the closest that can be achieved on Sanctuary. It is far from the "beaten track" and, apart from a very few temporary shelters and rudimentary fishtraps, has very few signs of the actions and activities of man. It does apparently drain a fairly large wetland to the south and west of the area and water flows but the tidal range is so great that it is unclear how much of the water flow in the channels in the south is similar to that of a river and what is due to tidal movement.

Figure 20. A flock of greater flamingoes on a sandbank at the south end of the "estuary".

Special management:

Management of this area is aimed at simply maintaining the "unspoilt" nature and appearance of this region and ensuring that any development or activities are carried out in manners that do not detract from or negatively impact the values for which this area has been listed. Generally, this would mean no motorised transport, either on land or water, and no permanent structures made of cement should be built without a specific application and full evaluation process.

3.3.7. Dead trees in bay on west side of peninsula

On the shore on the west side of the peninsula, around the inlet is an area of large mangrove trees many of which are dead or appear to be dying. In the evening these trees are often the roosting site of many waterbirds including herons, egrets, storks, cormorants and pelicans. In recent years the numbers of these birds have not been great but local residents and Lodge owners, who have been present for many years, report that numbers used to be much greater.

The apparent decline in numbers may be due to reasons outside Sanctuary, such as overall reduced bird numbers or better alternative sites elsewhere or it may be due to simple localised disturbance. In case it is due to disturbance, steps should be taken to reduce this as much as possible, particularly after dark, and damage to the trees and the area immediately around them should be prevented.

Special management:

Movement in and around this area near and after dark should be kept to a minimum and extra care should be taken to ensure that these trees are not cropped for firewood or building materials.

3.3.8. Wetlands

The San Sebastian Peninsula consists mostly of fairly low undulating vegetated sand dunes. The average annual rainfall, at about 900 mm. per annum, is fairly high and this combined with a usually high water table results in a series of freshwater pans and lakes scattered over the land. These can vary in size and permanence from Lake Noni, a relatively permanent waterbody, about four kilometres long and half a kilometre wide, in the middle of the south

of the managed area, to small perennial pans that only fill for short periods following heavy rains. There are also several marginal tidal inundated areas, such as a large one on the west side of the "estuary" and one on the east side of Dugong Lodge. There are also semi-permanent pans that contain fresh water for extended periods but then dry up, sometimes for extended periods, during low water table conditions.

Sanctuary waterbodies are also still home to a small relic population of Nile crocodiles (Crocodylus niloticus) and although it is not known if they are still breeding successfully, several small specimens were seen during 2011 and one was measured. During a nighttime count in November 2011 a total of nine Nile crocodile were recorded in this lake alone and it is suspected that other waterbodies may still harbour crocodiles.

Figure 21. A small Nile crocodile caught in Lake Noni in 2011 for examination and measurement and then released.

As there is basically no natural running water on Sanctuary and no true pans have outlets to the ocean they would be particularly sensitive to any buildup in pollution if there was even a small amount being added on an ongoing basis. Many of the organisms dependent on them, but particularly the amphibians, have very low tolerance to changes in water quality and thus developments must be carefully sited so that fuel, rubbish or septic tanks cannot easily contaminate them.

Special Management:

Care must be taken to ensure that no effluents or other pollutants contaminate either ground or open water on Sanctuary. Localised clearing of dense marginal vegetation may be carried out if it is done through the normal conservation management process. Netting, fishing and the killing of birds needs to be prevented and all disturbances needs to be kept to a minimum to allow fish and bird populations to recover and enable the breeding of birds and crocodiles.
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3.4. The use of Sanctuary's living resources

For many generations Sanctuary, both the land and marine areas, have been extremely intensely used by almost the entire population of the area for food, medicine, building materials, fuel and cultural activities. This use was mostly traditional and at subsistence levels until the long civil war that resulted in large numbers of people migrating to the coastal areas,

such as Sanctuary. During the war years there was exceptional pressure on many resources as food and other essentials were often in short supply and employment was at very low levels. Many people had to find much of their food, fuel and other basic daily needs from local living resources.

After the war ended circumstances improved but the local people had learned to use almost any available living resource and opportunities then arose to sell many of the resources for cash. From being mostly focused on household level use much resource use took on a local or larger scale nature and, instead of being aimed at supplying household needs, much was then harvested for sale for profit.

Commercialisation, and a degree of improved equipment and access, combined to increase use and, in several cases, push it well beyond sustainable limits. A clear example of this use was the “boom and bust” sea cucumber fishery that grew from almost nothing in the 1980’s to become an important local industry in the 1990’s and then collapsed, due to overfishing, in the early 2000’s.

Sanctuary living resource use can be split into two categories, use by local communities and that by recreational visitors. Local community use is, in turn, best split into three components consisting of marine resource use, freshwater use and use of terrestrial resources.

3.4.1. Uso artesanal dos recursos marinhos

This use is often described as “Artisanal” which refers to use that can be for own consumption or for sale at a small scale level. It includes true subsistence use, where resources are only collected for household use, but also larger scale harvesting where harvests in excess of immediate needs are sold for cash.

This use is, by far, the most important aspect of resource use in Sanctuary, in terms of negative impacts on resources and positive ones to the local community and economy. There are several different aspects to it, some of which are seasonal while others are not. Although estimates of amounts and values have been given for the regions around Sanctuary, such as the Bazaruto Archipelago, there are currently no useful data sets to assist in quantifying the amounts or values of this use from Sanctuary.

It has been estimated that, on the Bazaruto Archipelago, there were around 1 500 people in 60 artisanal fishing communities who annually harvested over 1 500 tons of dried marine products (Dutton 1990). There was also an organized fishery exporting an estimated 4 000 tons of frozen fish and 42 tons of crayfish annually from the Inhassoro and Vilanculos areas (Dutton 1990) but these estimates are from over twenty years ago.

Although much has changed over the past few decades the use of marine resources is still exceptionally important to the local people and economy in terms of food and cash produced. It is also very clear to even the casual observer that many of the target resources are nowhere near their pristine levels and many have been degraded to almost sub economic levels. The use, however, will continue and Sanctuary management has to accommodate suitable marine resource use while working towards improving biodiversity and rebuilding marine resource stocks.

Towards the end of the last century this fishery was locally very important (figure 25) and it is estimated that almost 6 tons of dried sea cucumber was exported from Bazaruto to the mainland in 1989/90 (Dutton 1990). During the same period a total of 39 tons of dried sea cucumber was processed from the islands and shore based fishing (Dutton 1990). Subsequently populations of sea cucumbers, particularly the main target species Holothuria scabra, collapsed and the fishery declined markedly.

As the cucumbers had to be boiled and dried, large amounts of firewood were used and this was reported to have had significant negative impacts on local vegetation. Levels and amounts of sea cucumbers harvested in Sanctuary waters are not known but there was substantial use, stocks declined and the fishery is much smaller than it was in the past. Sea cumbers, or Magajojo as they are locally called, still occur and it may be that in some areas stocks are beginning to recover. If, however, management is not put in place as soon as stocks reach economically exploitable numbers they will crash again and the cycle will be repeated.

At present sea cucumber harvesting appears to be mostly at low levels within Sanctuary waters.

Figure 22. A sea cucumber being harvested

a) Seine netting

These nets can be set either from the beach or on sandbanks from boats. The nets can be very long or short nets can be used to capture fish in small inlets or over reefs. The most common way of using seine nets is to drop the end of the net from a dhow onto a sand spit and then pay the net out as the boat loops out into deep water and then drops the other end back at the bank. In terms of quantities of food produced this is undoubtedly the most important fishery. It was estimated to have produced over 1 000 tons of dried fish on Bazaruto in 1989 (Dutton 1990) and the use was probably universally intense throughout the whole region that was accessible to the local dhows.

Figure 23. A typical seine net being pulled onto a sandbank having been set using a dhow

Seine netting is now carried out wherever the dhows can reach that might prove fruitful to net. With the ever increasing use of mechanized dhows the range of these craft is being increased and thus the number of areas where the fish can still be found in abundance is declining. Many dhows are based at Vilanculos but every fishing community has some and, although there is a degree of local control over who fishes where, there appear to be many areas open to general exploitation. On one trip from Sanctuary to Vilanculos 42 dhows were counted setting seine nets on the sand banks.

No good records are available on total catch size or recent species composition but it is clear that the mean size of fish is small (Figure 27) and many of the fish caught are juveniles. It is probable that the mesh size used in nets has declined over the years to catch ever smaller and smaller fish as the fish stocks dwindled and the larger species were greatly reduced in abundance. Many of the fish now caught are small, relatively fast growing species and several species that would be expected to be present in the catches are now rarely seen.

Seine nets are used wherever they can be pulled to catch fish but their use close inshore and in inlets probably has the greatest impact on fish stocks. It is in these areas where juvenile fish find shelter and increased food availability.

Figure 24. A typical seine net fish catch being dried in the sun, note the small mean fish length

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Special Management:
While seine netting has been carried out for many years there is scant useful information on exact levels, impacts or catch composition and size. It is clear that some fish stocks have been reduced and some species are at low levels and small size but the extent of stock depletion is not known. Work should now be initiated to establish some parameters that, when monitored, will track and give useful management information on the extent, value and impacts of this fishing. It is accepted by many fishers that closing some Sanctuary areas to fishing has had marked and noticeable positive impacts on fishing but, to date, no quantifiable data has been collected to confirm and exhibit this. Simple baseline information needs to be collected on a routine basis to track present and future fishing success in areas in and around Sanctuary so that any improvement, or otherwise, in fishing can be identified and quantified. If there is an improvement the challenge will be to prove that it is due to Sanctuary fisheries management. While both Sanctuary and fishers are currently confident that current zonation and management is working and improving fishing this needs to be confirmed and, if it is, this can be used to motivate for further areas to be identified for increased protection.

b) Gill netting

The setting of nets to catch fish by the gills as they pass through the net is also used in different ways in different localities. They can be set in fairly open deep waters, with weights at the bottom and floats at the top, in shallower areas supported by sticks or across inlets or along vegetation lines or over shallow rocky reefs. The setting of large mesh nets in deep waters is discouraged, as it also catches dugong, turtles and dolphins, but its current extent in Sanctuary waters is unknown. The setting of nets along lines of sticks set in the sand in tidal areas was widespread but appears to have declined in some areas in recent years. It was practiced in the lower reaches of the “estuary” on the east side of the peninsula and on the sandbanks west of the peninsula.

c) Line fishing

This method is used extensively in some areas using boats or from the shore. Rods are most often used from the shore while much use from boats is using hand operated lines. Most shore fishing is carried out on the beaches of the eastern shores of Sanctuary where it is possible to fish directly into fairly deep water and the open ocean. Many boats operate from Vilanculos and Bazaruto but the current extent of usage by Sanctuary residents is not known. Many dhows often trawl a lure or bait while traversing deeper water or areas where the boaters feel there may be fish.

d) Spearfishing

A short metal tipped spear is often carried by local fishers who wade around in the shallows of the region targeting crabs, mostly the blue swimming crab, Portunis pelagicus. These people will, however, also spear anything else that is edible or has value.

Spearfishing, using a shop bought speargun, was facilitated on Bazaruto where about 40 fishers used to capture about a ton of fish each per annum (Dutton 1990). Unfortunately, it is reported that this use was probably unsustainable and numbers of large fish, such as rockcods, dwindled rapidly. This was not a traditional fishing method and was brought to the region to try and assist local fishers to reach new resources and the larger fish caught could be sold to tourism developments. As far as is known this type of artisanal spearfishing is not regularly practiced in Sanctuary waters.

e) Sand oysters

The sand oyster, Pinctada imbricata, called Mapalo by the local people, is heavily used in many regions around the San Sebastian peninsula. Large heaps of shells of this species can be seen close to the ocean in many areas. One of the most extensive areas of these shells is in the north end of Pelican Bay where these shells have been used in Lodge Foundation as well as road construction.

Figure 25. An extensive sand oyster midden at the north end of Pelican Bay.

This species grows mostly in the seagrass beds and women often come together in large groups to exploit sand oysters. During much of the war period this species was a major food source for a large proportion of the local population when shop food was limited, travel was dangerous and money scarce.

While this use can be described as "sustainable" in that the species will not be made extinct, even locally, the use does have serious impacts on the seagrass beds and associated flora and fauna. This species will also benefit from the Sanctuary approach of fishing by zonation where, in some areas, fishing will not be allowed and thus breeding stock can build up.

f) Marine turtles

Until a few years ago extensive use was made of marine turtles all along the Mozambican coast and continues in many areas. Turtle carapaces can still be found near almost every homestead or old habitation in or near Sanctuary. These animals were killed when caught in normal fishing operations and also, during turtle breeding season from November to March, people would specifically target breeding turtles and dig up the eggs for food. The use has undoubtedly declined and everyone now knows that they should not kill turtles nor dig up their eggs. The monitoring and protection programme provides employment, and thus cash, to the local community far beyond any benefits that they may have obtained from killing and eating a few turtles and their eggs that were previously "harvested".

No turtles should now be killed or eggs dug up and all Sanctuary residents and neighbours know this. The local community authorities have assisted Sanctuary management in reducing turtle poaching and also in dealing with poachers.

3.4.2. Terrestrial resource use

In the past local residents made extensive and intensive use of the land of the Sanctuary. Following negotiations, agreements and then payments and follow up, the residents have now moved out of most of the fenced area of Sanctuary. Part of the payment and goods given to

past residents was to compensate them for their land but also their use of the resources, including indigenous and alien fruit trees (see detail in community section).

These agreements markedly reduced the scope for local residents to use the terrestrial resources of Sanctuary. Local people may no longer cultivate lands inside the fenced area, collect firewood or building materials, collect medicinal plants or hunt animals or fish for freshwater fish. Exceptions were made for people needing traditional access or reasonable and practical walking access through the Sanctuary. As a result, there is still an extensive network of paths transecting most areas of Sanctuary that are used regularly by local residents and Sanctuary neighbours. Many people still traverse broad areas of Sanctuary to access places of work or to access fishing camps.

Current allowed terrestrial resource use is limited to the harvesting of jecca in some of the wetlands of Sanctuary on a sustainable basis though permission and close monitoring is carried out. The jecca is used by the communities for buildings and infrastructural developments on the Sanctuary. The controlled use is seen as suitable, sustainable and a great and direct benefit to local residents. No firewood collection from indigenous trees is allowed but, from time to time, management allows the harvesting of exotic trees which have to be removed for management purposes. Exceptions are made for people still resident in the Chiloguene area on the north east of the peninsula. In this community area cultivation is still allowed as are other essential day to day harvests such as firewood for household use. This community has a growing number of goats that graze on Sanctuary land and this is also currently under discussion. Negotiations are under way to identify a fair and practical fence line demarcating the Chingonguene area from the rest of Sanctuary and identify the area in which local community members may harvest resources and allow their goats to feed. One continuing challenge to management is the cutting of firewood for export, by dhow, to Vilanculos. Firewood stocks have now been greatly reduced near many towns and so its value has increased making it viable for people to come from Vilanculos to “poach” firewood on Sanctuary.

Figure 26. Community land outside the game fence (orange) , indicates excessive bush clearing activities versus protected conservation area inside the reserve

a) Freshwater resource use

Lake Noni and similar areas were used extensively by local communities in the past to catch freshwater fish and collect fresh water. Part of the agreements around translocation and

compensation covered these aspects and no freshwater fishing should now be carried on inside Sanctuary. To allow the community continued access to water part of the translocation agreement was the establishment of boreholes with manual pumps inside community areas to “replace” the need of going to the lakes. This situation is fully understood by the local community and recently they have assisted Sanctuary management with dealing with some offenders found fishing within the fenceline.

Fresh water is still occasionally collected by people living just outside the Sanctuary fence from places such as Lake Noni, but this is also dealt with successfully through the local traditional systems on an ongoing basis

b) Recreational use of marine resources.

The area around Sanctuary has, for several decades, been the focus of intense attention by several groups of recreational visitors even during the war years. More recently, with the cessation of hostilities and the progressive development of infrastructure, numbers of visitors have increased and their fields of interest have diversified. The region has attracted local, regional and international visitors, the main drawcards being the quality of the fishing, beauty of the area, year round benign climate plus specific attractions such as excellent snorkeling and birding opportunities. Before the war the whole area was targeted by recreational visitors, mostly from South Africa but also from Zimbabwe. Their main focus was fishing along the shore and by boat out to the islands and deep water. During the war land based tourism all but collapsed but tourism on the Bazaruto archipelago continued, albeit on a much reduced scale.

From the springboard of the islands, tourism rapidly rebuilt after the war and slowly both the tourism and transport infrastructure have been rebuilt and developed. Due to the relative difficulty in accessing Sanctuary there was only sporadic tourism on the peninsula until well after the war ended and it was only when Sanctuary development began in earnest that recreational use of the area really increased.

A large part of the current attraction of Sanctuary to recreational visitors is the marine resources of the region. While local people require access to marine resources for food, or to make money, visitors need access to make their experiences visiting Sanctuary really worthwhile. Consumptive and non-consumptive use is allowed in the forms of rod and line fishing, spearfishing as well as snorkeling and goggling and also fishing. All recreational fishing has to be carried out under a Mozambican license and the national regulations for recreational fishing. Swimming and snorkeling /goggling to view the underwater attractions of Sanctuary are allowed in all areas, provided they do not interfere with local users or management. Recreational angling is only allowed outside the areas zoned for no fishing and normal Mozambican size and bag limits are applied.

Shore linefishing is now mostly restricted to the open areas on the eastern shores of the peninsula. Fishing up the eastern sand spit, from near Lighthouse right up to the north end of the spit near Nyati Lodge, is permitted and can be successful. Particularly good catches have occasionally been reported from parts of this shore near rocky outcrops, often after dark. The region around Linene Island is well known as an area where exceptionally large kingfishes have regularly been caught and this attracts many enthusiastic anglers to this area.

Boat fishing is currently the most popular form of recreational angling and the region is well known worldwide as a center for excellent billfish fishing. Most of the boat fishing is carried out in deeper waters and there is little of this kind of area within the boundaries of Sanctuary. Sanctuary does, however, provide suitable launch sites from which to access these fishing

grounds. If fishing, or any other boats, leave Sanctuary waters and enter BANP a predetermined amount has to be paid to MTA for entry into BANP waters, including Bangwe Island.

Some of the Bazaruto Lodges are well known destinations for billfish fishing and it is probably only a matter of time before some Sanctuary Lodges build up a similar reputation.

3.5. Socioeconomic and cultural characteristics

SBV continuously initiates programmes to promote / improve the socio-economic standards and subsequent well-being of the people living within the project area, by improving health care, education, production and agro-industries. Sanctuary has drafted a "Community Development Plan that details the vision, approach and outlines the actions necessary to work towards the vision. As indicated in Section A, excellent progress has been made to date and SBV will continue to support and engage with the communities on various levels.

The establishment of a protected area, supported by funding derived from nature tourism on the Sanctuary, will restrict the local communities' access to certain resources but the long term success of this project is dependent on the attitudes of the local community towards the project. These will be shaped by a many perspectives including whether each community member benefits more from the conservation and tourism based land use, than from his or her free access to natural resources. The substantial benefits of the Sanctuary must not only be demonstrated materially but also become the mind-set of the majority of community members.

The project vision for local communities is: To establish and maintain a fair participatory partnership between project and community which ensures that the material and community perceived benefits of the project in all its phases are of greater benefit to the community than those of the previous status quo.

3.5.1. Community Objectives

- Develop formal, transparent and trusting relationships with local communities and involve them early in the planning process.
- Ensure that Communities earn optimal direct income and benefit from Sanctuary activities.
- Provide on-going community benefits by remuneration for work done rather than intermittent hand outs.
- Ensure that communities understand and appreciate sustainable resource use.
- Empower the community with the skills to actively claim benefits from an economy based on sustainable use.
- Ensure that all projects meet the highest environmental sustainability standards.
- Ensure cultural preservation by establishing cultural tours (living museum concept).
- Enhance the socio-economic standing of the agricultural community by assisting with technical advice.
- Carry out rigorous environmental education programmes, focusing on the need for sustainable activities and the problems associated with slash and burn agriculture.
- Promote a strong sense of ownership and empowerment amongst communities and ensure a strong institutional base.
- Recognise and respect common law rights of local people.
- Enhance the livelihood activities and systems of local communities.

3.5.2. Community Overview

The local population is estimated at approximately 5 000 people that live in the area immediately south of the Sanctuary fence. Most people live in the central areas of the peninsula, but the highest concentration is in the extreme south-western portion closest to the Vilanculos mainland. There are several communities, the six main ones being Chingonguene, Matsopane, Marape, Chibo, Machuquele and Chicuinine. When the project started, the level of education was low with approximately only 19% of the population able to read and write. This has increased considerably due to new schools, informal education at the Sanctuary's staff village and community members being employed by Sanctuary.

3.5.3. Agriculture

The majority of the population carries out subsistence swidden agriculture (slash and burn) with only approximately 4% depending solely on fishing for their livelihoods. Almost half the population carry out agriculture and fishing. Common crops include maize, groundnut, sunflower, sorghum, beans, cassava, sugar cane and fruit trees – papaya, mango, orange, cashew nuts and coconut palms. Animal husbandry is practised on a very small scale and includes small-scale poultry, and goat farming. An organic farming system was introduced in 2004 that resulted in the creation of several community vegetable gardens (Photo 18), which today supply many of the lodges.

Figure 27. A vegetable garden run by the community

3.5.4. Community structure, function and leadership

There are 15 local traditional community leaders representing the various zones as well as the community leaders of the Locality of Queuene, with whom monthly meetings are held. The meetings are held to build trust with the community through sharing information, decision making, recognising each other, discussing problems and solutions and for Sanctuary to recruit workers.

The community meetings, are generally held at Matsopane as this is the area closest to most communities. They are attended by representatives of all the local communities as well as the Queuene Community leader and his deputy. Conflicts that have arisen and been dealt with include fishing in closed areas, cutting firewood and thatch grass as well as human animal conflicts. All conflicts that have arisen, so far, have been amicably resolved and there has never been the need to request the intervention of a third party.

Matsopane community has requested that a health post be built by Sanctuary in their area as the one that was first built is located at Machiquele which is far from them. This is in the process of being negotiated with the Ministry of Health so that they can provide the staff as was done previously.

3.5.5. Community opportunities & threats

No initiative such as Sanctuary can achieve sustainability and long term success without the fundamental support of the communities living in, near and depending on Sanctuary. When Sanctuary was first established promises were made to both developers and local communities that were simply not able to be fully met.

While investors could withdraw, disgruntled local people could either ignore Sanctuary or actively work against it either at a political level or in practical terms. The infrastructure of Sanctuary, and its relatively wealthy investors, is extremely vulnerable to theft or damage but, so far, there have been no serious instances of sabotage and little theft.

Despite Sanctuary taking many years to achieve some of the objectives, the local people have generally shown amazing patience and tolerance towards Sanctuary. Deep seated and responsible communication between Sanctuary and local people has resulted in a level of trust between the two partners that is seldom seen in Africa.

There are many examples of this and it is important to list a few in order to show the level of cooperation and support shown by the community.

3.5.6. Examples of communities supporting Sanctuary

- Several times the local community have informed Sanctuary of the presence of unlicensed firearms used in poaching resulting in their seizure by Sanctuary Guards.
- Following poaching events the local community have pointed out to Guards where poachers lived and where their firearms were hidden.
- When Sanctuary built a hide on Lake Noni some of the wood was stolen. The matter was reported to the local Chief and the end result was that the thieves were identified, the material recovered and the thieves rebuilt the hide.
- Fishing in Lake Noni is no longer allowed but when people are found they are taken to the local Chief who deals with them
- Despite introduced game increasing markedly in numbers none have so far been poached.
- Petty theft has been at low levels and, when it occurs, it is successfully dealt with through the local structures.

3.5.7. Examples of Sanctuary investors supporting communities

- After two areas were closed to fishing a problem arose with dhows from Vilanculos poaching inside them. Identification of dhows was not easy so, at a meeting, the community asked Sanctuary to provide paint to paint community dhows particular colours to make them easily identifiable. Sanctuary investors provided support for the purchase of the paint.
- Near Linene Island most local fishers wanted an area closed to fishing. To increase support a Lodge Owner organised for old yacht sails to be converted for dhows and to be given to the local fishers (Figure 31). These sails allowed for improved sailing so the fishers could reach areas outside the closed ones.
- Lodge Owners and visitors are encouraged to support the provision of reading glasses for older community members and several hundred have now been handed over at Community Meetings.

Figure 28. Dhow sails donated to local fishers by Lodge Owners.

3.5.8. Relations between Sanctuary and local residents

Relations between the developers and the community were not always good and, in recent years, both parties have had to work very hard to achieve the current situation. What could have been a threat or even "fatal flaw" to the Sanctuary concept and its development is currently a very positive aspect. This is, however, and always will be a delicate and sensitive situation and will need continued attention and work.

Any new development has implications to the local people that must be fully discussed with and explained to them. No development can take place that has not gone through this process and no promises should be made unless there is a firm expectation that they can be realised within the stated time frame and within the current capacity. All too often in the past, in other areas in Africa, promises have been made and expectations raised only to be dashed. Community members often do not understand world financial circumstances and political realities and simply expect promises to be carried out. Sanctuary has carefully nurtured an atmosphere where they are now trusted in that promises made will be honoured within the time frame given. This is invaluable and must not be jeopardised by impatience on behalf of managers, developers or politicians.

3.6. Infrastructure: Buildings, Roads and Communication

The Sanctuary as an operating company, now has sufficient infrastructure to manage the reserve, provide adequate accommodation to employees and deliver a satisfactory service to all stakeholders. As with any such project, however, the reserve is continuously developing and new infrastructure will be developed according to the project's needs, policies and resources.

3.6.1. Roads

Sanctuary currently contains and maintains an adequate road network that is occasionally modified or added to as required. Any changes are motivated and approved through the usual management procedures. There are no hardened roads on Sanctuary as there are no rock quarries and nearly all the roads follow gentle contours through sandy areas. As far as possible all vehicles are 4 x 4 and people are requested to use this and drive within the speed limit as these reduce damage to the roads. The road network is to allow reasonable access for all users, allow management to go where it needs and also allow visitors access to interesting and beautiful areas.

3.6.2. Game Fence

Several years ago a 28 km game fence was erected, dividing the Sanctuary into the area north of the game proof fence, where the Lodges and game are located, and the area south of the fence which is inhabited by communities (Figure 1). The boundary is a standard game fence with several small gates for the community to have access for traditional access to areas of Sanctuary. The game fence is sufficient to restrict current wildlife except for the occasional eland as they can jump over most game proof fences.

3.6.3. Energy supplies

There are currently neither overhead power lines from the National Grid nor any gas pipelines from the mainland. Green energy in the form of solar panels is generally used for running electrical lights and small appliances, while diesel generators provide power for high energy needs. Gas geysers using movable gas bottles (48 kg each) locally purchased create most hot water.

The companies ELGAS and ENH carried out feasibility studies to put in a gas pipeline to Sanctuary with the aim of providing electricity and gas to all stakeholders (investors and communities). At present it seems unlikely that the companies will proceed under current conditions. Should it be approved by the EIA and Government and proceed it will positively influence the project development and also the livelihoods of local communities.

3.6.3. Water supplies

The principal water supply for Lodges and other development is water from five boreholes that vary in depth from 12 – 26 m. An independent report, drawn up by engineers, confirmed that current and estimated water usage on Sanctuary has an insignificant impact on the water table and is of a very limited risk to the hydrological systems as a whole.

In the communities water was originally collected from hand-dug shallow wells in the immediate vicinity of pans and lakes. Sanctuary has completed the drilling of boreholes in the communities and they have been fitted with manual pumps. Boreholes have been well received by the communities and Government, and the Sanctuary's obligations in terms of the original agreements have all been achieved and surpassed.

3.6.3. Artificial reefs/jetties and gabions

The building of these structures can be on land or water and also be for management or aesthetic reasons. Sanctuary has a draft document (Appendix 5) dealing in some detail with jetties and similar structures.

On land the most common forms of this development and challenge are gabions to reduce or try and prevent erosion and raised "walkways" generally used to ease foot access over difficult terrain or remove the impact of foot traffic through sensitive areas.

Gabions are currently used on several steep slopes above which lodges or other infrastructure have been built. They are often temporary in nature as, sooner or later, it is likely that the elements such as heavy rains, very strong winds or these combined in serious cyclonic events will subvert them. Some of these, such as those in front of Dugong Lodge, are substantial and try to protect valuable property.

As far as is possible, future developments should not be built on sensitive areas but gabions already in place need to be managed. They should be made of suitable material and monitored and managed to ensure minimum impacts and maximum effectiveness. Rubble and other building refuse should not be used if there is a chance of it being fed into marine ecosystems and the structures should not be built above the level of the surrounding land. Anyone building gabions is responsible for the removal of debris should they be washed away.

Walkways can only be built if they have been authorised by Sanctuary Management and are made of poles and planks. They may be appropriate, and even required, where significant foot access is necessary over sensitive areas such as partially inundated areas or steep slopes. They should allow free movement of water, wind or animals so that they do not impact or modify the environment in which they have been erected.

Jetties generally have a marked impact on their environment, are expensive and subject to intense environmental pressures. Wrongly built they can have serious impacts and the approach of Sanctuary has been to promote the construction and use of "clustered" jetties sited so that one jetty can serve several Lodges. Applications for individual jetties have to go through a Management Process that has been set up to ensure that they are kept to a minimum, suitably sited, well-built and used correctly.

It has been accepted by Sanctuary Management that these structures will modify water flow patterns, become encrusted with invertebrates and act as fish aggregating devices. Management has agreed that, suitably built in appropriate areas, jetties can assist in working towards some of the marine management goals of Sanctuary. Jetties will cause localised eddies and reduced flow rates that will result in aggregations of fish as well as build up species numbers as fish usually associated with reefs begin to populate these structures.

Since some of the impacts have been recognized as advantageous to management it is critical that all jetties are built to maximize the advantages and become as permanent and stable as

possible. It will not greatly benefit management if a jetty is washed away after it has built up a population of reef fish and become an important fish breeding area.

In general, Sanctuary accepts that jetties have a place but that they must be authorised through Management to coordinate use, maximize effectiveness and positive impacts while avoiding pollution, unsightly structures and minimizing negative impacts.

3.7. Future Sanctuary Strategies

The Future Objectives of SBV include the following:

- To conserve indigenous natural resources and restore and maintain biological diversity while rehabilitating degraded areas and re-establish fauna and flora indigenous to the area.
- To promote appropriate land and natural resource use including harvesting, research, environmental education and ecologically sustainable and economically viable tourism operations;
- To establish and maintain partnerships between Sanctuary and government, neighbouring communities, tourism operators and conservation organisations that will enhance the ecological integrity of the greater area, add to the biological diversity and scenic beauty, as well as improve the economic viability of Sanctuary;
- To promote and facilitate development of residential and commercial lodges to stimulate job creation and training for the Queune Community, uplift the local economy and invest in a manner not in conflict with the environmental objectives.
- To draw up and implement a suitable zonation map and activity schedule to work towards the achievement of the main objectives

3.7.1. Development and activity zonation

Throughot the world conservation managers have struggled to wisely and easily manage and contain human activities. One of the best options is often designating areas for different levels and types of use. This effectively “zones” the protected area to allow suitable activities while maintaining and enhancing the biodiversity and allowing the recovery of impacted areas and ecosystems.

Problems have arisen in establishing the best number of types of zones and levels of use. This becomes important when two protected areas or reserves are contiguous or able to be combined and then it is found that they have incompatible zonation activities or numbers and types of zones. There has thus been a movement worldwide standardize zonations to facilitate consolidations and also achieve some consistency from area to area and country to country.

It is best to have large protected areas where there are few people but the realities in today’s world often render this impossible. Instead of simply not proclaiming areas, however, a partial answer is to delineate smaller areas and implement a suitable “phased” approach where there are “core’ areas, usually towards the centre of the area, where strict management is enforced. Surrounding this are other zones where increasing amounts of activity, impact and use are allowed.

Sanctuary’s current reserve area is not large, in terms of ecosystem functioning, and it is an area with a long and continuing history of extensive and intensive human use of the environment and its resources. It was proclaimed by the Mozambican government to become

a tourism and development asset to the region and country by becoming a "Conservation area" that appeals to and attracts outside tourists.

The goal of Sanctuary management is thus to restrict use to allow the natural attributes of the area to recover, and become more attractive to visitors, while allowing sustainable use that will appeal to visitors and accommodate, as far as possible, the needs of local residents.

In recent years there have been a series of international conventions that have been signed by many southern African countries. Among these is the World Heritage Convention that the Mozambican government recently signed and it is hoped that their first candidate site, the Ponta D'ouro Partial Marine Reserve, will be submitted soon.

Many of these conventions require management plans and most of the plans require an activity zonation. Fortunately, in the last few years there has often been good cooperation between countries in drawing up these plans and a consensus is being reached, if not on the naming of the zones, in the number of zones and types of activities. Most recent plans in this sub region, including the Bazaruto Archipelago National Park Management Plan, the Maputo Special Reserve Management Plan, the iSimangaliso World Heritage Site Integrated Management Plan and the Ponta D'oro Partial Marine Reserve Management Plan, have decided upon a maximum of four zones. The zone of most protection, usually called "Wilderness", is only applicable to very large areas where there are extensive tracts of land with no inhabitants or signs of them.

Most protected areas are simply not large enough to have a "Wilderness" zone and so they are implementing three types of zones often called Sanctuary, "Restricted Use" and "Multiple Use" areas. These types of zone are applicable to both the terrestrial and marine areas although the listed activities may vary to some degree.

As long as two conservation areas have the same numbers of zones, and they have tried to apply the same principles, there should be few serious challenges if two of these areas are contiguous or are able to be consolidated or even amalgamated. In the case of Sanctuary, it currently shares boundaries with the Bazaruto Archipelago National Park (BANP) but, as both management authorities have adopted the same approach, the management of the two areas should be very similar and through careful cooperation could almost blend into each other.

Bangwe Island, for example, has been identified by both the BANP and Sanctuary Managers as a sensitive and special area that requires extra protection. It is thus logical that both sets of managers will want to apply the same zonation around this island.

Sanctuary management has thus adopted the current internationally accepted norm of three types of activity zones as follows.

1. "Sanctuary": Highest level of protection and least activities allowed. Applied mostly to sensitive natural areas that generally already show little impact by man.
2. "Restricted Use": Medium protection where generally non consumptive use is allowed and access is mostly non motorised and numbers of people are low. Applied mostly to areas previously impacted by man but are recovering or have good potential to recover.
3. "Multiple Use": Highest level of use and development. Nodes are identified for development of infrastructure and use levels are greatest and some consumptive use is allowed.

Sanctuary today is not large enough to have areas that truly could be classified and managed as “Wilderness”. Marine and terrestrial areas are currently zoned separately but the activities allowed in one correspond directly with those in the same zone in the other. In order to be as closely aligned as possible to zonations of other protected areas in the region the zonations of these other areas were used as the basis for that of Sanctuary but have been adapted according to the realities and approach of Sanctuary Management.

Sanctuary has not yet fully implemented its zonation but a document “A zonation plan for Sanctuary” is included in Appendix 10 and is in the process of implementation. Unfortunately the name “Sanctuary” applied to the area discussed in this document is the same as the zone of highest protection but corresponds to the “Closed areas” in the marine areas of Sanctuary. The areas on Sanctuary closed to fishing have grown from very modest beginnings to well over 1 000 ha and there seems every possibility of more area being added. It is thus not yet possible and advisable to draw up maps of the proposed zonation until the possibilities and needs are clearer.

Generally the “Restricted Use” areas will be the areas that are not “Closed Areas” and not areas identified for development, which will be the “multiple use” areas.

3.8. Ecological challenges/opportunities on Sanctuary

Sanctuary management is faced with a wide variety of ecological realities that vary from factors that are threatening in the short term to others that may be probably advantageous in the long term. These realities may be completely “natural”, such as severe weather conditions, man enhanced, such as climate change, or man’s direct impacts, such as his bringing in invasive alien plants and animals.

In this section of the Plan many of the most important ecological challenges and opportunities so far identified are discussed separately under various headings and dealt with individually.

3.8.1. Alien and problem species

Many southern African protected areas are seriously threatened by non-indigenous and some indigenous plants and animals and substantial budgets are used up, often in apparently useless endeavours, combating these species. To date, Sanctuary appears to have been fairly fortunate in that most identified threats from both plants and animals seem to be manageable or at least currently not critical. Many of the most problematic species in neighbouring areas or regions of southern Africa do not yet appear to have reached Sanctuary and a top priority of any management plan must thus be to identify and take every suitable precaution to prevent these species getting to Sanctuary.

1. **Alien plants**

So far Sanctuary management has identified sixteen species (Table 27) of alien plant on Sanctuary that are or could become problematic. While several are large scale problems, such as several of the tree species, most of these are not really invasive and thus there is less urgency in removing them. Some, such as coconut and mango, are recognized fruit trees and although in the past there was a reluctance to remove these trees, numbers are now being reduced progressively. Other plants, such as prickly pear, are aggressively invasive but only localised in occurrence. These are being tackled on an ad hoc basis as and when capacity becomes available.

Possibly the largest problem plant currently identified is that posed by dodder (Cuscuta campestris). This species is widespread and can achieve intense levels of infestation and kill indigenous host, plants. The greatest problem posed by dodder is probably the potential or real direct impact on Sanctuary grazing as numbers of antelope increase. Steps are being taken to deal with this challenge and monitor the effectiveness of the different techniques available to combat dodder and investigate and quantity the impacts of the infestation.

To date no invasive alien water plants have been identified but this is one aspect that needs constant alertness and attention as, once an aquatic macrophyte appears on an area like Sanctuary, it will be almost impossible to eradicate. In order to deal with many different species in a logical and prioritized manner, Sanctuary Management drew up the "Strategic Plans". Under these plans all species are prioritized in terms of level of threat and the most appropriate management action is identified while rate of implementation depends on the level of threat and management capacity.

Localised increases in indigenous plant species, as a result of man's actions, is often called "bush encroachment" and is also often seen as a challenge and yet it can also be viewed as a natural process or even nature reasserting itself.

Table 29. A list of currently recognized invasive alien plants on Sanctuary, giving the common and scientific names.

No	Name	Species
1	Cashew tree	*Anacardium occidentale*
2	Coconut tree	*Cocos nucifera*
3	Casuarina tree	*Casuarina equisetifolia*
4	Sisal	*Agave sisalana*
5	Mango tree	*Mangifera indica*
6	Madagascar periwinkle	*Catharanthus roseus*
7	Jambos tree	*Syzigium jambos*
8	Prickly pear	*Opuntia aurantiaca*
9	Prickly pear	*Opuntia ficus indica*
10	(Semi prostate herb)	*Boerhavia diffusa*
11	Guava	*Psidium guajava*
12	(Rhizomatus shrub)	*Hydrocotyle onariensis*
13	Blackjack	*Bidens spp*
14	(Climbing herb)	*Cassytha filiformis*
15	Cassava	*Manihot esculentia*
16	Dodder	*Cuscuta campestris*

2. Alien animals

long period, yet there appear to be relatively few invasive alien animals yet recorded. This is probably due to the fact that most residents were relatively poor and did not bring in large quantities of material, that could have housed alien animals, and the temperatures and other conditions are challenging for many organisms.

In terms of impact on biodiversity the most problematic alien invasive animal is probably the wild domestic cat, which is now to be found in almost all habitats in Africa. Its main impact is predation on a wide variety of indigenous animals exacerbated by its ability to breed successfully and rapidly. Feral cats are to be found on Sanctuary while nearly all local homesteads have cats probably in order to try and control rodents that may eat their stored crops.

Apart from the common European house sparrow the other known or suspected alien animals (Table 28), developed from Picker & Griffiths 2011) are insects, like cockroaches, or arachnids that will be virtually impossible to completely eradicate even if it was attempted. On the other hand many alien animals known to be "pests" or serious problems elsewhere are not currently known on Sanctuary. For these the required management is simply to be aware of and alert to the possibility of them reaching Sanctuary and dealing quickly with them should they arrive. Specifically, Sanctuary Management needs to be aware of birds like Indian crows and mynas and the Asian freshwater snail Tarebia granifera.

This snail has recently infected many waters in northern areas of South Africa, probably coming in on boats or outboard motors, and infestation levels can reach 20 000 per square meter. It is a hardy snail that few indigenous mammals, birds or fish seem to be able to eat and, if it comes to Sanctuary it will spread rapidly.

One interesting invasive alien species is the brown button (or widow) spider (*Latrodectus geometricus*) a native of South America. While reported to be about one quarter as toxic as the related, but indigenous, black button (or widow) spider (*Latrodectus indistinctus*) the former species is more closely associated with human habitation and thus much more obvious.

Table 30. A list of currently recognized invasive alien animals on Sanctuary, giving the common and scientific names.

	Common name	Scientific name
1	Domestic cat	*Felis catus*
2	House sparrow	*Passer domesticus*
3	Grey silverfish	*Ctenolepisma longicaudata*
4	American cockroach	*Periplaneta americana*
5	German cockroach	*Blattella germanica*
6	Ring legged earwig	*Euborellia annulipes*
7	Sand earwig	*Labidura riparia*
8	Black field earwig	*Nala lividipes*
9	Common greenbottle	*Lucilia sericata*
10	Moth/drain fly	*Clogmia albipunctata*
11	Brown button spider	*Latrodectus geometricus*
12	Smooth woodlouse	*Porcellio laevis*

Alien is the term usually used to describe species that were not historically found in an area but many species are currently and inexorably expanding their range usually as a result of anthropogenic actions. Similarly densities of many plants and animals may be changing as a direct result of man's actions.

The extension of range of species like hadeda ibis (Maclean 1993) or the localised increase in abundance of species like the pied crow or vervet monkey can also be viewed by management with concern. These will change predation patterns, pressures and levels and could locally impact priority species. Recently concern has been expressed about the impact of hadeda

ibises on localized Breviceps frogs in the Cape Province in South Africa where the ibis is a newcomer.

Management must thus not only be on the lookout for completely alien species arriving on Sanctuary but also for marked and progressive increases in indigenous species abundance that may change habitats or threaten priority species

3.8.2. Bush encroachment

This can be seen either as one of the greatest environmental management challenges facing Sanctuary management or a natural process depending on the perspective and objectives of the commentator. Within the last few decades much of the land area of the San Sebastian peninsula has been subjected to slash and burn cultivation, often repeatedly and over many years. Since the fencing of the management area this extremely severe impact has been suddenly and completely removed and the net result is that the habitats are returning to their "natural state".

It is clear in the north west of the peninsula that much of the land used to be fairly high canopy forest, probably mostly closed canopy, but there were also more open grassy areas. There are still single tall greenthorn trees (Balanites maughami), clearly relics of this earlier forest. These areas must have been almost complete and mature forest patches but probably interspersed with grassy areas. These grassy areas were possibly also man induced from earlier slash and burn cultivation.

People have been resident in the area, and using slash and burn techniques, for hundreds of years but it was only during the latter stages of the civil war that densities of people escalated. Almost all the land had to be cleared for crops and in the cleared areas the root stock of many trees and hardier plants did not die. As soon as the annual clearing and burning stopped, these plants sent up new shoots. The original trees, however, were probably mostly large single stem trees that formed a high, mature canopy. The new growth, particularly with common species such as Brachystigia spiciformis and Julbernardia globiflora, is a multistem form. The net result is that, instead of a recovery of the forest to what it had been, there is a transformation from open, recently cultivated land, to a low canopy extremely dense thicket that allows very little grass to grow and that blocks the movement of people or even many animals.

In the more grassy areas when the annual clearing and burning is stopped there is often an apparent invasion by "bush encroaching species" such as the sickle bush (Dichrostachys cinerea). The net result is rapid growth of this species that effectively fills up the grassy areas between larger trees and results in reduced grazing. van Wyk & van Wyk report that it is often "invasive and thicket forming" and in many areas throughout southern Africa sickle bush is regarded as the main species involved in this kind of "bush encroachment".

Sickle bush is often almost the only woody plant to quickly reestablish itself and it appears to prevent or repress other woody species that may have grown to larger sizes thus resulting, at least in the medium term, with dense low canopy fairly impenetrable low grazing potential areas.

It is the vision of Sanctuary Management to create throughout the managed zone a mosaic area that resembles what the peninsula used to look like, contains many of the species that are appropriate to the region and be a conservation and tourism asset. It will carry out whatever actions are seen as appropriate and necessary to manipulate the environment towards this goal.

For this reason management will, from time to time and guided by the normal management decision making process, carry out a series of actions to modify the "bush encroachment process."

Possibly the greatest tool in this process will be the use of fire and controlled burning. Other, more localised, management actions could be the selective pruning of some multistem trees to produce single stem, larger trees. In some areas species such as sickle bush may be selectively removed to maintain or enhance grazing while in other areas coppicing species may be cleared from near roads. This will improve their function as fire breaks but it will also create better game viewing from roads and create grazing corridors along the roads.

The end result of management will be to create a suitable diversity of natural landscapes containing a wide variety of habitats that are both necessary for the diverse biota of the area and that will enhance its tourism potential. Present management interventions will, however, markedly affect the outcomes of the recovery of the transformed areas, especially on a localised basis.

3.8.3. Concerns over water table

Actual measurements are scarce but it is clear from the dwindling size of many freshwater pans that, despite fluctuations, the water table on the San Sebastian Peninsula has dropped overall since 2002. It is also clear that ever increasing amounts of water will be taken from the water table by Sanctuary Management for development, core functions and the needs of introduced game. Local residents will also continue to use water and all of this will impact the water table to some degree.

Earlier it was estimated that the current impact of water abstraction by Sanctuary was extremely small, compared to the loss of water through evapotranspiration. While this is the situation every effort must still be made to keep water use to a minimum and efforts should be made to monitor what is actually going on.

To assist in monitoring actual water table height gauge plates should be erected at suitable sites on open water areas and routine recordings made of levels. Records should also be kept of estimates of the total amount of water being abstracted. Efforts should be made to make Lodge Owners aware of the value of and challenges to a good water supply and to assist them in keeping demands to a minimum. Sanctuary is prohibiting the establishment of new "lawns" and gardens that need watering to keep "landscaping" water use to a minimum.

3.8.4. Climate change

It is now generally accepted that climate change is real and it is becoming ever more evident that changes are happening faster than most people anticipated and the impacts will be many, varied and severe. The location of Sanctuary puts it in the path of extreme weather events while its infrastructure and activities make it particularly vulnerable. Management is fully aware of the challenges and is doing what it can to establish what the impacts may be and ameliorate and minimize them

There is now clear evidence that mean temperatures in many areas around the world have been increasing at rates much higher than in the recent geological past. There is much discussion as to the rates, what is causing it and what this means but Sanctuary management needs to be aware of the changes and their impacts and implications. It needs to build this into its decision making process and also identify and carry out some actions to mitigate

impacts or even benefit from them. Management must do all it can to reduce its "carbon footprint" but it cannot affect the global outcome and so it needs to anticipate some changes and manage accordingly.

The first responsibility for management is to reduce to a minimum the carbon footprint of its actions. While, overall, this changes nothing it shows acceptance of the reality, a good example and a willingness to take action. Management must also use every means possible to find out what could be the direct and indirect implications of climate change to Sanctuary habitats, infrastructure, priority species and goals.

One immediate known impact of climate change is sea level rise and, in places like Sanctuary, this could have severe impacts within the not too distant future. While debate rages about the rate of sea level rise, Sanctuary's relatively low level, very great tidal range and infrastructure built near the shoreline combine to make this a management priority. Management needs to identify threatened infrastructure and ensure that new developments are positioned suitably far from threatened areas.

There is also mounting evidence of climate change induced localised extinction of many species, especially on places like cold mountain tops where organisms cannot move to ever cooler regions. Overall, Sanctuary is fortunate in that it is part of a land mass continuum and it is possible for mobile species to move southwards if temperatures become less suitable. There are many well documented cases of tropical fish, such as Zambezi sharks in the Breede River in South Africa, being recorded in lower latitudes. There are currently indications that hard corals, that generally favour warmer climates and were rare south of Sodwana Bay, are establishing on reefs well south of this.

While these types of changes may affect the checklists of species found on Sanctuary they are unlikely, at the present rate of change, to markedly affect, or be affected by, current management. In one group of animals, however, there may be some impact in the foreseeable future. In some of the more ancient reptile groups, including the turtles and crocodiles, the sex of a hatchling is determined after fertilization and is governed, to a degree, by the mean ambient temperature after it being laid. Strangely each of these groups are affected in the opposite way by warming temperatures. As temperatures rise there are more female crocodile hatchlings while in marine turtles it is the other way round.

Changes in geological times must have been able to be accommodated by these species but it is possible that the current rate of temperature change may result in skewed sex ratios among these species in some areas. It is conceivable that there would be an increase in the proportion of males among crocodiles hatching in future on Sanctuary and a reduction in male marine turtle recruits.

Work is being carried out on these aspects and Sanctuary management just needs to keep abreast of current knowledge on these issues. No specific management action is recommended at this stage on this overall aspect of climate change.

i. Cyclones

Cyclones result from a combination of weather features that include temperature and it seems clear that part of climate change is an overall increase in the frequency and virulence of cyclones, hurricanes and typhoons. This has been particularly obvious on the eastern seaboard of the United States of America, parts of Asia and even on the east coast of Africa.

The frequency of cyclones in Mozambique appears to be increasing with four recorded in the 1980's, eight in the 1990's and nine in the 2000's. Cyclone Favio, in 2007, produced significantly stronger winds than any other cyclone yet recorded. Cyclone Idai, in March 2019, was one of the worst ever recorded, killed and estimated 1 300 people in Mozambique and brought rain of up to 600 mm in a very short period. It also caused more infrastructure damage than any other cyclone in the region.

While clearly Sanctuary Management can do nothing to modify or avoid cyclones, it does everything in its power to anticipate them, warn of their arrival, mitigate possible damage and injury and facilitate repair and recovery in the aftermath.

ii. Erosion

The general low lying nature of the San Sebastian Peninsula, mostly gentle gradients and sandy nature of the soils combine to reduce the erosion challenges faced by Sanctuary Management. There are also no hardened roads, bridges or structures that can easily be undercut by erosion. On the other hand the area is prone to periods of extremely heavy rainfall and wind erosion in exposed areas can cause considerable sand movement.

It must be borne in mind for any future development and infrastructure that a degree of erosion is one of many natural processes constantly taking place and modifying areas like Sanctuary. Sand cliffs, for example, must continually erode and so any development near them must take this reality into account.

Erosion challenges on Sanctuary may be split into two sub headings

a) Terrestrial

Erosion of land on Sanctuary may be caused by rainwater runoff, wind, the passage of many feet/vehicles and by marine water undercutting the land. The "natural" state of a land area such as Sanctuary is of gentle sloping gradients and anything resembling a steep slope will tend towards being eroded, especially when disturbed by the elements.

The relatively few terrestrial erosion challenges that have been identified so far on Sanctuary are where steep slopes have been open to the elements or subjected to man or his activities. Specific areas where problems have been identified are where the fence line goes down the steep sand slope opposite Lighthouse as well as the path down this fence. The trees and then ground cover were removed and then the passage of many feet created a depression going down the hill that freshwater runoff quickly worsened.

At various points along this sandy ridge that extends for several kilometres on an almost north/south axis down the west side of "estuary" there are footpaths that are facilitating erosion. There are also other similar situations, such as in the center of the World's View cliffs, where footpaths again induce erosion. Steps have already been taken to begin to address these issues.

Fortunately most of the structures built on slopes, mostly walkways, are made of poles and do not cause focused runoff and thus problems.

The road system on Sanctuary consists exclusively of sand tracks and, with only a few exceptions, they follow gentle gradients. On these exceptions there is erosion and in some places it is beginning to cause problems. If all traffic had and used four wheel drive the problems would be minimal but the use of only two wheel drive on sandy gradients and

excessive speed lead to sand movement and thus the progressive deepening of the road and the wheel tracks.

Wherever possible the use of 4x4 vehicles should be mandatory and all vehicles should continuously engage four wheel drive while driving on Sanctuary. No speeding is allowed and the maximum speed limit is 30km per hour.

b) Marine

Marine erosion in Sanctuary waters is out of sight but it can be marked and is continuous due to natural processes. The massive tidal range combined with vast areas of shallow water create very strong currents and these, over sandy substrates, result in large scale sand movement. These movements, however, have been going on for thousands of years and are in some kind of equilibrium with the environment. It is only when man builds structures in the more affected areas that these sand movements become evident or troublesome.

Sandy shorelines are not stable but usually, on balance, either build up material (prograde) or are eroded (retrograde). The beaches on the east side of Linene Island and at World's End are retrograding while other areas appear to be prograding. The sandy shores on the seaward side of the sand spit north of Lighthouse appear to be particularly dynamic but in some areas they seem to building up and in others eroding away and this seems to change over time. There is reported to be a massive net northwards movement of sand up the east coast of Africa but, on Sanctuary, this is not seen as a concern as it does not threaten infrastructure.

On the west side of Sanctuary there are areas where some mangroves are dying due to becoming sanded up while in other areas they are being washed away. On balance, this is mostly seen as a natural process over which we have no control and, unless a specific threat is identified, no management is currently required.

iii. Pollution

It is inevitable, as Sanctuary develops, that increasing amounts of waste products will be produced and these must be efficiently and safely dealt with. Many products are relatively innocuous, but bulky, while others are toxic and pose a potential pollution threat. In the past Sanctuary was very little impacted by man's wastes as very few plastics, fuels or toxic compounds were brought to the area and thus there has been little cause for concern about pollution.

As modern man's activities develop it is essential that steps are taken to identify and deal with potential and unavoidable pollution threats. Effective and efficient routine processes and procedures must be put in place to reduce waste to a minimum and effectively deal with that produced.

Pollution can be split into several aspects as follows:

a. Water pollution

Natural waters on Sanctuary, either groundwater or open water, are characterized by having very little nutrient and probably little dissolved chemical content. The organisms associated with them have developed dependent on these characteristics and it is essential for their survival that they are maintained and not markedly modified by pollution. The simplest way

to avoid pollution of Sanctuary waters is to keep any waste or other products away from natural waters.

Waste water from development sites can broadly be split into two types, “grey” water that is produced from washing and other activities and sewage that is produced from toilets. While grey water may seem less toxic it often contains detergents and other agents that are very toxic to some forms of life such as amphibians.

The best way of dealing with “grey water” is to recycle it for uses such as watering gardens of flushing toilets. If recycling is not possible it may be channeled into suitable “French drains” while a two chamber septic tank is best for dealing with the sewage. Suitable standard designs for each are supplied by Sanctuary Management to developers and builders but it is the siting of these that is often of critical importance. Many Lodges are built close to the ocean, and thus at near sea level, and so the siting and construction of septic tanks or French drains must be carefully considered.

While it is relatively easy to ensure that French drains or septic tanks are not built near open water it is not so easy to ensure that they do not pollute groundwater as this is often only a very few meters below the surface and the septic tanks clearly have to be well below the level of the toilets.

French drains simply dissipate waste water and take it from the surface but it does not change the chemical composition. It is thus particularly important that these drains are kept as far away from groundwater or open water as possible. A properly designed and operated septic tank “processes” the sewage by using microorganisms to break down the organic compounds, and also deal with the smell, but the water produced cannot be described as “pure” or clean. It contains large amounts of nutrient and it is best for septic tanks to be as far as possible from any natural water, but particularly a borehole or well point.

There should be few other potential ways in which natural water on Sanctuary could be polluted as there are no motorised boats on the freshwater pans and no plans to allow this.

It is estimated that about one third of the lubrication oil in a two stroke outboard is vented unburnt in the exhaust. The huge tidal range and currents in the marine environment around Sanctuary dilute any such pollution markedly but the best way to deal with this problem is to use four stroke outboards that do not use such oil in the fuel. All Sanctuary boats are now four stroke and Management encourages Lodge owners to purchase these engines.

Direct leakage of fuel from boats in the Sanctuary Marina and elsewhere are a potential pollution threat but Standard Operating Procedures have been drawn up and implemented to minimise this threat.

b. Litter and refuse

Ever more complex and often toxic waste materials are being produced by modern society and, at the same time, easy and or cheap ways of dealing with this difficult challenge are dwindling. On Sanctuary each Lodge produces considerable amounts of household refuse and, as the number of developed lodges increases, so does the amount of refuse produced. At Lodges the refuse is placed into standard containers that are regularly collected by management and taken to a central waste disposal area. At this fenced facility combustible material is burned and the remaining matter is put into carefully placed pits dug to receive the refuse.

Recycling would be encouraged but the remoteness from any recycling possibilities and expensive transport costs currently render recycling not economically viable.

In the last few years many of the homesteads that were in the now fenced area were abandoned and most of these have now been "cleaned up" in terms of the removal and disposal of all refuse and items left behind. The remaining homesteads, in Chingonguene community, are producing more refuse, particularly in terms of plastics and glass, but this will be dealt with when the future of these homesteads becomes clearer.

General littering has been tackled and is much better that it was in the past. The casual dropping of litter by people walking through Sanctuary had become a serious problem but paths have been consolidated and most foot traffic is now directed along one main pathway from the Administration area straight southwards to the main gate. Litter bins have been set out along this path and sweeps are routinely carried out to collect and remove litter.

The situation with regard to refuse and litter is being managed in a much better way than in the past and it is constantly being modified to continue this improvement.

c. Noise

"Unnatural" or loud sounds can impact people living in or visiting Sanctuary as well as some indigenous animals. The most serious impact of sound disturbance affecting indigenous species on Sanctuary is probably that of aircraft flying low over wetland areas where there are dense aggregations of waterbirds such as flamingoes. This could be a limited temporary impact, and the birds soon return, but it could be more serious if birds are scared from nesting colonies or important feeding areas. Low flying aircraft also disturb many of the larger mammals and could possibly drive them through fences or into infrastructure or the community area.

Much of the current low flying aircraft traffic is associated with ferrying in visitors and owners to some of the lodges, particularly on the eastern side of Sanctuary, and this traffic is mostly by helicopter. While helicopters are particularly suitable for this kind of work, as they do not require extensive airfields and can land on any small area, they are particularly noisy and can fly at very low altitudes. It is illegal for aircraft to fly low over Sanctuary and Management has made everyone aware of this situation and is ensuring compliance with the law.

The other main source of noise pollution is that of the generators at many of the lodges. Current machines vary from suitable and well maintained to unsuitable and poorly maintained. New generators have to comply with strict requirements, in terms of noise and other aspects of pollution, and efforts are being made by Management to improve or upgrade the current generators.

Noise from neighbouring communities is a concern and measures are being taken to try to reduce such pollution as it negatively affects tourism.

iv. Light

Light is produced by all developments on Sanctuary where there was none in the past. In most situations this is not seen as a serious challenge and some degree of artificial light is essential for the functioning and success of development. There are fairly minor localized impacts, such as attracting and killing many insects and disturbing birds. There are also localized significant impacts, such as lights disturbing fish where lights are left burning near marine waters, and

more serious scenarios where, for example, lights adjacent to turtle beaches can cause turtle hatchling mortality.

All these aspects need to be recognized and minimized through mitigatory measures that will be identified during the standard Ecological Impact Assessment process. The only serious light pollution challenge currently identified is that of developments on the sand spit north of Lighthouse where lights left burning after dark, that shine onto the beach, could affect turtle breeding. Clearly this challenge can be adequately dealt with, now that it has been recognized, by carefully siting and/or shielding of the lights that are essential for the running of the facilities.

Lights at the end of jetties should not be left burning as they will attract some fish, repel others, modify predation patterns and could impact essential fish and invertebrate breeding/movement around the jetty.

Generally, only essential lights should be allowed on Sanctuary to conserve energy, reduce the overall impact of Sanctuary and act as an example to other developments. Security and safety lights are seen as essential while reasonable lighting wile visitors are resident should be fully accepted. Casual lights, however, should be turned off whenever possible as should any other unused electric appliances.

v. Fire management

The past use of fire by man in the region has probably been the single greatest factor affecting the ecosystems and habitats on Sanctuary. The current and future use or manipulation of fire is probably going to be the greatest management tool in the arsenal of options that Sanctuary Management has to modify, conserve, preserve or develop the habitats and ecosystems of the area. It is simply not known what the "natural" situation would be or have been, without fire, and this is irrelevant as the current situation with regard to species composition and amount and type of combustible material is probably very different from the historical reality.

The current situation on Sanctuary is a man induced dynamic scenario where there will be natural fires, ignited by lightning, as well as arson fires lit by man both inside and outside the fenced area. There will also be accidental fires and those set, on purpose, by management and all of these will have the potential to markedly impact Sanctuary vegetation and fauna.

a. Natural fires

From time to time fires will ignite from, mostly in the dry season, when storms cause lightning that may strike the ground where there is adequate combustible material. In some areas in Namibia, such as the Etosha National Park, it is one of the greatest challenges that management has to deal with and kills many animals while in other areas, such as the Kgalagadi Transfrontier Park, it is often viewed as a natural phenomenon that should be left to run its course.

On Sanctuary, due to the modified nature of the habitats and landscape, the dispersed and vulnerable infrastructure combined with the introduction of valuable livestock it is most likely that natural fires should be contained and extinguished as soon as possible. Where it is clear that there is no danger to infrastructure or animals and that the fire's impacts may work towards management goals they could be left. Changes in wind direction and speed, however, can markedly alter a fire and its level of hazard and it is probably most often best to extinguish such fires.

b. Wildfires

Fires set by man, other than by managers, can occur either inside the managed area or outside. A reporting network has been set up and most fires are quickly reported to Sanctuary authorities. If a fire is reported inside the managed area it is seen as a priority to immediately investigate, assess and deal with until it is completely extinguished. An investigation will then be carried out to try and establish who set the fire and why the fire was started and then the matter may be handed over to the police.

One serious challenge with “internal” fires is the Chingonguene Community, in the north east of Sanctuary, as they still cultivate areas and in recent years several fires have spread from their demarcated communal area to the broader Sanctuary.

Fires outside the fenced and managed area are more difficult to deal with as fire is clearly part of the “slash and burn” cultivation practiced throughout the region. In the past, most serious fires on Sanctuary have entered from the south and “jumped” the fence and firebreak associated with it. The best way of dealing with this challenge is to maintain a suitable sized cleared area on both sides of the fence, maintain good relations with neighbours, and request the local population to be aware of the danger of runaway fires and report them to Sanctuary.

These measures are already in place and in recent years the incidence and severity of fires entering Sanctuary from this direction has been greatly reduced

4. STRATEGIC VISION

4.1. Vision Statement

To establish and maintain a world renowned conservation area which as far as scale will allow, preserves the indigenous marine and terrestrial biodiversity, to the benefit of and without prejudice to the local community, sustainably funded through nature based tourism activities that have a net positive impact on biodiversity and community. To achieve this through an effective and sustainable partnership between Sanctuary Management and the Mozambican Government, private investors and participating communities

4.2. Mission Statement

As a mission, the Sanctuary of Bravio de Vilanculos, seeks an effective and sustainable partnership involving the GoM, private investors and communities such as PIAs, in the Management of the Sanctuary. The scientific and academic community will be an integral part of the Sanctuary's management and will actively support with continuous research aimed at areas of vocation aimed at better management and conservation of natural resources ensuring the sharing of the resulting knowledge.

4.3. Values and Purposes

- Conserving all the indigenous natural resources that occur in the Sanctuary and thus restoring and maintaining biological biodiversity, while rehabilitating the degraded portions of the system close to their natural state and restoring indigenous plant and animal species to the area within the current evolutionary period;
- Promote the appropriate use of land and natural resources that is compatible with the first objective, including harvesting, research, environmental education and tourism operations that are economically sustainable and viable;
- To Establish partnerships between the Sanctuary and the government, neighboring communities, tour operators and conservation organizations that will strengthen the ecological unification of a large area and add ecological diversity and scenic beauty as well as the economic viability of the Sanctuary;
- Promote the development of residential and commercial lodges to stimulate job creation and training for the Queuene community, improve the local economy and invest in a way that does not conflict with environmental objectives;
- Develop and implement an appropriate mapping and agenda of activities in order to achieve the main objectives.

5. ZONING PLAN

5.1. Zoning Objectives

The main objective of zoning is fundamentally to separate the various land uses, maintain the connectivity of habitats, provide unique experiences for visitors, and provide an investment environment that is socially and economically acceptable to the Sanctuary's users, allowing a better understanding of activities that can occur in different parts of the SBV area.

This zoning focuses on the geographic distribution of biophysical components and tourist attractions in order to provide effective conservation of natural resources and provide a better experience for different tourists. Consequently, this will provide a better revenue collection in order to guarantee the financial sustainability of the conservation area.

5.2. Zoning categories

The zoning of the BLS conservation area was carried out considering the limits of the allocation area following the following criteria:

- Protection of natural resources / ecosystems of exceptional value;
- Physical and functional sensitivity of ecosystems;
- Strict control in order to guarantee an appropriate level, type and location of the development of the Sanctuary.

Thus, the SBV comprises three management zones, shown in the table below that follows:

Table 31. List and contribution of the SBV management areas / List and contribution of the SBV management areas

Zone Designation	Current SBV situation	
	A4rea (ha)	%
Resource management zone - Sanctuary	29.447,85	67.12
Special Protection Zone Restricted use	1.185,81	2.70
Multiple Use Zone	13.241,99	30.18

5.2.1. Resource management zone - Sanctuary

a) Description

The areas of the Sanctuary without permanent human settlement, development of infrastructures, consumer activities or motorized access and where the landscape shows signs of animal vision of these having occurred in the recent past.

The zone has a pristine appearance, or at least the potential to be restored accordingly. It must also be large enough to achieve its purposes.

b) Objectives

Maintain a scientific landmark area for biodiversity and ecosystem processes and provide visitors with a wild experience.

5.2.2. Special Protection Zone Restricted use

a) Description

The areas of the Sanctuary that may have some tourism and management infrastructures and / or consumer activities and some visual evidence in recent years. Changes to the environment must not pose significant threats to the purpose of the zones or it is possible to mitigate their impact over time.

To qualify as a restricted area, the area must have the potential for restoration to a stage where the general public and other stakeholders consider it to be a largely unmodified landscape.

b) Objectives

Conservation of biodiversity and ecological processes and provide visitors with a quality view of the animals / landscape and close to nature's day period or an evening experience.

5.2.3. Multiple Use Zone

a) Description

Sanctuary areas where the landscape and ecological processes may have been noticeably transformed in past or present development projects or human activity but, with significant interventions over time, can be restored to:

1. A natural environment: which appears to have been largely unmodified;
2. A system where, in some aspects, ecological processes work naturally;
3. A situation where, as a combination to achieve the above, the zone could be considered to have been partially modified and therefore could be upgraded to a Restricted Zone. Proactive and reactive management interventions that may be necessary indefinitely to maintain the above.

b) Objectives

Restoration and maintenance of natural landscapes and ecological processes and provide recreational experiences based on nature for the entire spectrum of user groups.

6. MANAGEMENT PROGRAMS

The first responsibility for management is to reduce to a minimum the carbon emissions of its actions and development in the Sanctuary. The administration has all possible means to discover the direct and indirect implications of climate change for the sanctuary's habitats, infrastructure, priority species and targets.

6.1. Environmental Impact Assessment

It is the policy of SBV that all new major physical developments and activity proposals should be subjected to an Environmental Impact Assessment (EIA). It is incumbent on the proposed developer to submit an EIA to SBV for approval prior to proceeding with any proposed development or activity, with the knowledge that it also requires Government approval.

6.2. Habitat and species conservation program

Objectives

- Wisely managing the environment, both the biotic and abiotic components;
- Securing of the whole project area to ensure that the activities proposed can be sustained;
- Restoring adequate populations of appropriate wildlife;
- Involving and encouraging local communities in the conservation and protection of biodiversity inside and outside the reserve;
- Promoting the wise, sustainable and appropriate use of living resources to sustain the natural biodiversity of the area while producing long term benefits;
- Collaborating with the local and provincial authorities in the monitoring and preservation of the wildlife and forestry areas of the reserve and surrounding areas;
- Complying with the Mozambican rules on protection and conservation of the environment with regard to the project area and its surroundings.

6.2.1. Soil Management.

Objectives

- Maintaining the structural and ecological integrity of the dynamic and mobile dune cordon system along the coast, and to identify the system as an area of special concern;
- Maintaining and controlling all man-made structures, such as roads and landing strips, in a state that will not in the long term negatively impact natural systems or biota;
- Identifying any eroded or unstable areas, including exposed dune faces, that may warrant special attention and implementing suitable remedial action;
- Where appropriate, facilitating the implementation of a system of organic or otherwise improved agriculture.

The deep aeolian sand of the San Sebastian Peninsula and the surrounding regions, and especially the dynamic dune cordon along the coast, contribute to the extremely sensitive and vulnerable environment of the Sanctuary. Management actions will thus be directed at preventing, or minimizing, the effect of any activity or land use which could result in significant

impacts on natural dynamic processes or that may lead to unacceptable levels of soil disturbance.

6.2.3. Soil erosion

Objectives

- Monitoring the condition of all roads and tracks and implementing corrective measures as and when necessary;
- Prohibiting any vehicular activity on the tidal sand flats, beaches or on the sensitive supratidal salt marshes;
- Ensuring vehicles maintain correct tyre pressures and low driving speeds to minimise the need for track maintenance.

The dynamic and mobile eastern dune barrier cordon and eroded dune faces at other areas will require specific management attention: When finance and time permits, Sanctuary will also:

- Facilitate a baseline geological survey to determine the physical processes that shaped the Sanctuary in order to identify management priorities and formulate proper and feasible management actions;
- Establish a monitoring system to determine any long-term dune accretion rates as well as seasonal variations;
- Design and implement an interim dune stabilisation programme.

6.2.4. Vegetation Management

Objectives

- Conserving plant biodiversity resources at ecosystem, community and species levels in the long term, and preventing the regression in the status of any plant indigenous species or community due to human impacts or activities;
- Ensuring adequate management attention is given to maintaining or improving the status of priority species while effectively working towards controlling alien invasive or indigenous problem vegetation;
- Closely monitoring the effect of reintroduced herbivores on the vegetation and on vulnerable communities and species;
- Regulating and monitoring the effect of development actions or activities on the vegetation, and ensuring that adequate impact assessments and biophysical surveys are undertaken and mitigation actions implemented;
- Closely monitoring the effect of fires on vulnerable species and communities such as bush clumps, and investigating and implementing a suitable burning programme and fire control system as would be necessary to maintain fire-dependent plant communities;
- Regulating the introduction of plants into Sanctuary to ensure that only suitable species are brought in.

i. Alien plants

Alien plant species are being identified and prioritised in terms of eradication and steps are being taken against those that threaten indigenous vegetation, reduce grazing or are seen as a threat to the objectives of sanctuary.

ii. Beach access

Access to beaches and boat launching and mooring sites will be strictly controlled to avoid damaging the sand binding plants located along the beach or littoral zone. Such access would be via boardwalks constructed, especially in mangrove areas, above the air roots to prevent the indiscriminate trampling of these roots.

iii. Roads and airstrips

It is important to site any new roads and airstrips where these will impact least on sensitive plant and animal communities. This means avoidance of ecotones, seepages, dune forest, salt marshes and mangroves, and compliance with the EIA's that must be carried out.

6.2.3. Fire management

Fire is an essential tool to manage the fauna as well as the flora of Sanctuary. It will, however, be necessary to prevent fires in dune thicket and to reduce the impact on bush clumps as far as possible. Increasing the size and health of bushclumps and re-establishing the integrity of the coastal thicket will recreate lost or damaged habitats for thicket loving species. This can be done by reducing the frequency of fires and by subdividing the area into burning blocks creating a mosaic of conditions, with a burning frequency of every 2 -3 years, or according to the build-up of moribund material. The re-establishment of these communities should be considered a priority as they currently house some of the rarest and most threatened plant and animal species.

i. Firebreaks

Os quebra-fogos são essenciais para controlar fogos florestais naturais e controlados no Santuário. Uma rede de estradas bem planificada irá contribuir para o controlo dos incêndios.

6.2.4. Unique/sensitive habitats

i. Mangroves

Mangroves are valuable, in terms of biodiversity, productivity and their function as a "nursery" for juvenile fish and invertebrates and as they area also sensitive environments they require strict protection. The largest mangrove forests on the Peninsula are found from just south of Chingonguene and north of Sanctuary Hotels Lda as well as towards the fishing village known as Marape and around the southern end of the estuary" on the east side of Sanctuary. Many forests are relatively unscathed with the one south of Chingonguene in almost pristine condition. However, it is expected that the mangrove forests will increasingly become targets as firewood becomes scarcer on the Peninsula, so a specific monitoring and management plan, including environmental education, will be drawn up for mangrove protection.

ii. Vegetação das dunas

Every effort will be made to protect natural dune vegetation as the dunes are sensitive and yet dynamic areas. It is now generally accepted that planting casuarinas in order to "stabilise" dunes was inappropriate and that whenever possible and appropriate these alien trees should be removed. Any developments in the mobile dunes will have to undergo and comply with a rigorous EIA.

6.2.5. Fauna Management

Objectives

- Conserving a wide diversity of suitable animals without causing long-term degradation of the natural vegetation resulting from accelerated soil loss, bush encroachment, or an unfavourable shift in herbaceous and woody species composition and structure. A comprehensive wildlife monitoring programme will be developed and implemented;
- Continuing with the reintroduction of appropriate species and numbers of wildlife species to the Sanctuary;
- Identifying any species that may need additional or special conservation measures or management attention;
- Working towards eradicating feral cats, rats and dogs north of the fence.
- Working towards eradicating all alien species from Sanctuary according to priorities and capacity through a Strategic Plan.

i. Bird management

- Collecting baseline data on the occurrence, breeding, feeding and abundance of birds and work towards a complete inventory;
- Identifying any species needing additional or special conservation measures or management intervention.
- Preventing any long-term deterioration of priority bird habitats, such as wetlands, and mature forest patches.
- Managing suitably any identified breeding or roosting sites and preventing disturbance or destruction.

ii. Reptile and amphibian management

- Collecting baseline data on the occurrence, abundance, breeding and requirements of species and work towards a complete inventory;
- Determining the status of priority herpetofauna species using appropriate survey techniques.
- Identifying any species that may need management intervention;
- Preventing any long-term deterioration of the preferred habitats of priority species, such as wetlands, dune thicket and bushclumps;

Sanctuary management will continue to implement a comprehensive turtle monitoring and protection programme along the eastern dune cordon and submit annual reports on breeding success for the Mozambican National Turtle Monitoring and protection report. The programme will benefit the local community by employing members as Monitors and thus ensure community support for turtle protection. The programme will involve working closely with all stakeholders and contribute to regional conservation efforts and international knowledge.

6.3. Resident Communities Management and Resource Use Program

6.3.1 Community Development

Objectives

- Create and maintain a reciprocal and mutually beneficial relationship between the Sanctuary and the resident communities;

- Promote and support lifestyles and economic activities that are more in harmony with the environment and the preservation of the social and cultural fabric of the communities concerned;
- Ensure that local communities are informed about, and have access to, health care units and information about major health issues;
- Encourage support for scientific and environmental educational activities that contribute to the long-term well-being of resident populations and public support for the environmental protection of the area;
- Facilitate the creation of sustainable small-scale alternative companies.

The Sanctuary continually develops programs aimed at promoting / improving socio-economic standards and the subsequent well-being of people living in the project area, improving health care, education, production and the agricultural industry. The Sanctuary is also open to suggestions made by members of the community through routine meetings.

6.3.2. Water management

Objectives

- Maintaining natural water bodies in conditions that support the animals and plants linked to such bodies as well as the human populations that rely on them.;
- Monitoring both short and long-term trends in monthly and annual rainfall and water consumption patterns.
- Instituting a program to monitor water levels is the larger pans as well as groundwater levels in important or sensitive areas.
- Working towards preparing a full water management plan, including the construction of artificial water points, bearing game introduction in mind.

For Water for wildlife management its ncessary to:

- Ensuring that water for wildlife is supplied adequately and in the most appropriate places and ways.
- Ensuring that there is a suitable process in place for dealing with animal water needs.

A management plan, including a complete inventory of all natural perennial and non-perennial water sources is to be drawn up. Implementation of the management plan, including potentially the construction of artificial water points where necessary will be carried out in accordance with the overall aims and objectives of Sanctuary.

6.3.3. Marine Management

Objectives

- Creating and implementing suitable areas closed to fishing where fish and invertebrate breeding stock is protected and can grow to maturity and spawn.
- Ensuring that local and, in due course, regional fishers are informed about and support the objectives of the marine resource management strategy of Sanctuary.
- Ensuring that all non-local employees, investors, and visitors are informed about and adhere to the marine management controls.
- Ensuring that management is equipped and empowered to manage marine resources effectively.

- Determining the levels of exploitation of marine resources that can be sustained over time, taking into account the combined needs of local and visiting fishers.
- Viewing the management of the shared marine resources as a regional priority and involving all role players in a concerted and unified action;
- Carrying out sustainable resource management education programmes with all fishermen.
- Promoting "catch and release" sport fishing among visiting sport fishers.
- Drawing up and implementing a marine zonation plan to work towards the objectives listed above.

Priority marine management issues:

a) Overfishing: Government closed fishing seasons are to be rigidly followed in Sanctuary waters.
b) Setting up additional and appropriate "no fishing" areas to protect breeding stock and juvenile fish and invertebrates.
c) Seine netting: As seine netting can cause significant damage to sea grass meadows and other biodiverse communities in the tidal sand flats careful management is essential.
d) Interference with nesting turtles: Strict monitoring and protection of marine turtles while they are nesting is critically important.
e) Local harvesting systems: There is an urgent need to address marine harvesting systems through an environmental education programme, focusing specifically on young fishers.

6.3.4 Agricultural development

Objectives

- Enhancing the socio-economic standing of the local communities involved in agricultural production by assisting with technical advice;
- Carrying out and facilitating rigorous environmental education programmes focusing on the need for sustainable resource management and the problems associated with slash and burn agriculture.

From time to time Sanctuary may support and facilitate suitable development initiatives in the community by the community, local authorities, NPO's or NGO's.

6.4. Tourism Development and Activites

Objectives

- Providing excellent nature and culture based tourism and recreation opportunities within the Sanctuary.
- Encouraging the conservation and sustainable use of flora, fauna and tourism resources.
- Promoting and facilitating Community Based Tourism
- Generating socio-economic development and sustainable employment opportunities for local communities.
- Generating income that can directly contribute to the maintenance and running costs of the Sanctuary, conservation activities and continuance of community programmes.

- Encouraging appropriate tourism education, training, awareness and capacity building programmes using tourism as a catalyst for human development.
- Promoting knowledge about the historical and cultural aspects of the people as well as the natural environment.
- Establishing and running a monitoring and evaluation system aimed at ensuring the sustainability of tourism operations and maintaining high standards of visitor services and facilities within the Sanctuary.

The Sanctuary ensures that the development of lodges and tourism units is carried out in accordance with the reasonable requirements and technical requirements of the relevant legislation that governs the hotel and tourism industry as well as environmental protection, preservation and conservation of natural resources.

6.4.1. Private and Commercial Development and Involvement

The responsibilities of the private and commercial developments complement the responsibilities listed above and additionally include:

- Designing, planning, constructing and implementing developments in accordance with the Sanctuary's internal regulations.
- Managing and administering the resultant developments as private or commercial enterprises within the parameters set by the agreements with the Sanctuary.
- Establishing tourism and tourism related activities that confirm the Sanctuary as a key contributor to the socio-economic growth of the community and region.
- Conducting their affairs in accordance with recognised environmental principles and embracing environmental best practice as far as possible.
- Marketing and managing the commercial developments in manners that not only ensure income sustainability, but also provide for wealth creation in the greater region.
- Offering employment first to persons from local communities.
- Where possible giving contracts to local communities for services, opportunities and produce.
- Setting up appropriate capacity building and training programmes.
- Maintaining facilities and infrastructure to the required standards set by the Sanctuary.

The Sanctuary ensures that development of lodges and tourism facilities is carried out in accordance with the demands and technical requirements of the relevant legislation governing the hotel and tourism industries as well as environmental protection, preservation and the conservation of natural resources.

The Sanctuary is situated adjacent to the Bazaruto Archipelago, and situated just outside the Bazaruto National Park. A number of world class holiday resorts have been developed in the area, attracting international regional and national tourists. Development on and off the Sanctuary has evolved around the concept of low density tourism with minimal impact on the environment.

At full development, a very small percentage, less than 0, 35% of the total Sanctuary land area, will be taken up by roads, physical infrastructure and lodges. The balance is managed for the protection of the environment and biodiversity, use for tourism and, where appropriate, sustainable use of living resources.

i. **Guiding Principles**

- Tourism development on Sanctuary is underpinned by sustainable environmental practices and the maintenance of the ecological integrity of the Sanctuary. Tourism is used as a development tool for the empowerment and financial benefit of local communities through job creation, business opportunities, as well as for the socio-economic benefit of the local communities.

6.4.2. Integrated Environmental Management of Tourism Development

The potential and actual impact of tourism related activities on the environment are mitigated, minimised and managed through a strict "Integrated Environmental Management Process". Strict building guidelines are in place to ensure responsible development and standard approaches to building are enforced to create a unique "sense of place" and atmosphere for Sanctuary.

Rules of conduct have been drawn up and are applicable to commercial and private sites which regulate how members and their guests interact and behave within Sanctuary in order to ensure best practices are maintained.

The diverse habitats, both marine and terrestrial, abundant game and interesting and diverse birds plus some excellent fishing combined with visits to the neighbouring communities provide many opportunities for tourism and, for some, Codes of Conduct or protocols, have been drawn up. Activities include:

a) Game driving (Code of conduct Appendix 3 B)
b) Walking and running on game paths (Code of conduct Appendix 3 D)
c) Bird watching
d) Scenic viewing
e) Canoeing/kayaking safaris
f) Snorkelling
g) Scuba diving (Code of conduct Appendix 3 A)
h) Fishing
i) Fish viewing at the jetties
j) Exploring mangrove and other communities
k) Yachting
l) Kite boarding
m) Boating that includes dhow safaris (Code of conduct Appendix 3 C)
n) Relaxing with amazing vistas
o) Cultural experiences through community engagement including buying local products ((Code of conduct Appendix 3 F) and visiting farming and fishing communities.

6.5. Sanctuary Protection and Security Program

6.5.1. Polluation

Objectives

- Identifying and managing all forms of pollution on Sanctuary and ensuring best practice is followed to optimally deal with all aspects.
- Keeping all pollution to an absolute minimum.
- Keeping up to date with new developments in pollution management.

- Encouraging recycling and minimal use of fossil fuels.
- Suggesting lower polluting alternatives to Lodge owners in terms of electricity generation etc.

6.5.2 Water pollution management

Objectives

- Reducing water use wherever possible.
- Encouraging recycling of "grey" water.
- Ensuring suitable septic tanks and French drains are in place and well maintained.
- Discouraging the planting of exotic or water requiring plants at Lodges.

Water used for domestic use, such as bathing, laundry and kitchen, should be recycled as "grey" water or passed directly into a biological filtration system such as a reedbed / watergrass plot/French drain. All sewage effluent water should pass through a septic tank (bio-digester) system before being released into biological filtration system. Diesel and oil pollution and contamination of the aquatic environment by fragments of discarded monofilament gillnets and seine nets, are identified challenges and will be addressed during routine management operations in an environmental education programme.

6.5.3 Litter and refuse management

Objectives

- Reducing all waste to a minimum.
- Encouraging recycling of all materials.
- Bringing to a central depot all Lodge litter and refuse for central efficient disposal.

Refuse generated at all human habitation sites within the Sanctuary should be handled sensitively and separated into categories of bottles, combustibles, plastics, tins and fuel. Materials will be collected by management for processing at a suitable central depot. Recently a recycling company was set up in Vilanculos and Sanctuary now sends all waste material, except glass, to this company. Sanctuary has purchased a glass crushing machine which turns all glass into usable building material.

6.5.4 Scenic, light and noise pollution management

Objectives

- Reducing all scenic and noise pollution to a minimum.
- Identifying and mitigating any serious challenges.
- Informing Sanctuary staff and visitors about this pollution.
- Actively exploring new alternatives to current polluting entities.
- Ensuring that all structures, vehicles etc. are painted with appropriate colours.

The construction of all buildings, waterpoints, bird hides or other permanent or semi-permanent structures should be designed, sited and carried out in ways that blend as indiscernibly as possible into the landscape. All structures should be built of natural materials

and painted in colours that enhance the concept of camouflage and the reduction of the visual impact upon the Sanctuary landscape.

All vehicles should be maintained with effective silencers and drivers of all land water and aircraft should be trained to drive in a manner that minimises the noise created by the vehicle. Observing the Sanctuary speed limits will contribute to the reduction of vehicle noise and to the visual impacts of moving vehicles. Generators' noise levels should be reduced to an acceptable level by means of "silent housings", not to intrude in the tranquillity of the Sanctuary.

6.5.5. Climate Change Management

Objectives

- Checking and prepare for extreme weather events
- Drawing up protocols for preparation and dealing with the aftermath of cyclones
- Monitoring weather conditions continuously as well as water table and similar parameters

The low-lying and coastal nature of Sanctuary makes it particularly vulnerable to increases in sea level and ever more and more severe tropical cyclones associated with global climate change. Following the severe cyclone of February 2007, Sanctuary management took steps to deal with such events in the future as well as draw up a longer-term strategic to deal with the potential impacts of global warming and fire dangers.

Sanctuary has, however, always been an area associated with extreme weather events such as very heavy rain and extremely strong winds and thus the flora, fauna and even the land have survived many extreme events in the past and, to a degree, can continue to do. The relatively small and low lying nature of Sanctuary and porous nature of its sandy soils allow rain to sink down to the water table or flush into the comprehensive network of wetlands.

It is only really the man-made infrastructure on Sanctuary that is under severe threat from these events while to the natural systems they are almost a requirement. Extremely high rain events are probably required to lift the water table from time to time and the very high temperatures are the conditions under which the flora and fauna have developed and evolved.

i. Cyclone preparation and management

To deal with the potential cyclone impacts on infrastructure a Plan has been drawn up which addresses cyclone preparedness, event action plans and post-event reconstruction and development, for investors, tourists, staff, communities and infrastructure. It describes how to deal with all aspects and impacts of severe cyclonic events.

6.5.6. Archaeological, Palaeontological and Historical Management

Objectives

- Constantly being aware of potential sites early in any development process.
- Protecting and managing any identified sites
- Working towards identifying and assessing any sites of importance.

Sanctuary management supports the communities in protecting and allowing suitable use of their sacred and cultural historical sites and no development will be allowed until a site has been checked for cultural significance. As yet, no specific sites of particular archaeological or palaentological significance/importance have been identified on Sanctuary but Management remains alert to the possibility that some may exist. Sanctuary has recently contacted a group of renowned archaeologists with a view to visiting Sanctuary to identify and assess any important sites.

6.6. Research Programmes

Objectives

- To conduct such research as is necessary for the effective management of the reserve and to achieve the objectives set.

While Sanctuary capacity is limited there is critical research and monitoring that has to be carried out. Sanctuary also facilitates research by recognised institutions into priority issues. The following priority research and monitoring projects have been identified for the 5-year period 2020 – 2025:

i. Monitoring and management of wildlife
ii. Comprehensive turtle survey and protection along the sandspits
iii. Identify, demarcate, implement and monitor “no-fishing” zones
iv. Detailed terrestrial mapping of indigenous vegetation and habitat types
v. Detailed terrestrial mapping of alien vegetation
vi. Baseline surveys of important taxa and improve inventory checklists
vii. Investigate the best way to ensure the wise use and protection of natural resources
viii. Set up monitoring programmes to quantify and describe local fishing
ix. Implement monitoring to determine the differences, if any, between closed and areas open to fishing
x. Investigate the effects of fire on vulnerable biological populations.
xi. Investigate the status of rare, endangered and endemic species
xii. Investigate the best ways to manage and eradicate alien organisms

Other programs designed by the SBV focus mainly on the following essential points:

i. Monitor rainfall, temperature and other weather parameters on an on-going basis
ii. Monitor and record fauna populations: Set up and implement suitable bird, amphibian, reptile and herbivore recording and counting programmes by the most suitable and appropriate means
iii. Monitor the effects and impacts of climate change on Sanctuary and the subsequent effect on beach erosion and elsewhere.
iv. Monitor the impact of local fishing on the fish populations and stocks within Sanctuary waters.
v. Carry out a community census in order to determine population size, growth and human pressure on natural resources.

Para aprovação e registo dos peojectos de pesquisa o Gestor de conservação irá fiscalizar os pesquisadores, gerir e fazer parte da implementação de todos os projectos relacionados com a conservação.

6.7. Administrative and Infrastructure Management

The overall management of the Sanctuary is carried out by the SBV Manager, under the guidelines of the Board of Directors of SBV. It should be noted that Internal Regulations for SBV have been drafted and are in the process of being approved by the Board of Directors. The SBV Manager is supported by a management structure as indicated in the organograma attached.

6.7.1 Board of Directors

- The Board is administratively and financially autonomous.
- The Board is responsible for overseeing the management and development of the Sanctuary. It will ensure that the latter, including conservation, community, tourism and commercial activities, meet the provisions of the Authorisations, Management Plan and other relevant legislation.
- The Chair of the Board is elected annually.
- Decision making is by consensus and a series of deadlock breaking mechanisms (such as mediation and arbitration) are in place.

6.7.2 Co-Management with the Community

Whilst there is provision made for community involvement, as described in the Community Development Plan, it would be all too easy for their opinions and interests to be overshadowed by other parties. In the interests of on-going good relations with local communities and to ensure their support for the Sanctuary and its benefiting from their insight and knowledge, it is important that this issue not be overlooked. This is particularly important as the community are de facto managers and support base of the Conservation Zones and "custodians" of the Sanctuary at the ground level. The routine monthly meetings with the local authorities and communities are the main forum for good two way communication between Sanctuary and the communities. Lines of communication, for emergencies and ad hoc developments, are also well known to both parties and well used.

6.7.3. Human Resources Management

Objectives

- Continuing with a transparent and equitable personnel management system.
- Ensuring the promotion of optimal personal growth potential for each staff member.
- Fostering a sense of belonging and promoting "esprit de corps".
- Providing adequate appropriate training to staff members.
- Ensuring that personal performance is directed towards Sanctuary objectives.

i. Guiding Principles

- A vibrant and enthusiastic working spirit is striven for and encouraged and a healthy working environment should thus be maintained.
- The Sanctuary Internal Regulations must be observed by all staff at all times.
- Equitable and reasonable employment opportunities are offered.

ii. Staff Training and Capacity Building Requirements and Programme

- Each member of staff receives the necessary in-service or specialised external training to equip him/her to cope with the task at hand.
- In-service training applies to all members of staff.
- The training programmes are monitored and evaluated by Sanctuary Management.
- Where a member of staff cannot be adequately trained by means of the in-service training programme, full use is made of external training facilities and opportunities wherever possible.

6.7.4. Financial Management

Objectives

- Ensuring the most effective deployment of the available capital/cash resources.
- Optimising income/operational benefit.
- Continuously striving towards the attainment of the Sanctuary's objectives.
- Planning efficiently for future activities/developments.
- Ensuring effective control over the financial aspects of the Sanctuary.
- Implementing financial accounting according to generally accepted accounting practices.
- Securing adequate sustainable income.

Sound financial management should not only be seen as the accurate recording of the financial implications of past activities, but also that of directing future activities in order to obtain the maximum benefit whilst striving simultaneously towards achieving Sanctuary objectives.

The scope of financial management for the Sanctuary includes the effective execution of three decisions, namely the investment decision, the financing decision and the operational feasibility decision.
In the context of the Sanctuary, financial management is seen as:

- The accurate recording of all financial activities
- Exercising control over the financial aspects of the Sanctuary.
- Implementing accepted accounting practises for recording, control and planning purposes.
- Securing adequate and sustainable income.
- Reporting on the operational activities of the Sanctuary.
- Reporting on the assets and liabilities of the Sanctuary.

i. Guiding Principles

It is accepted that financial management aspects of the reserve should be executed according to the General Accepted Accounting Practices (GAAP), as formulated by the accounting profession. Full compliance with the financial legislation and requirements set by Government of Mozambique is essential.

ii. Management Actions

- Establishment of an operational plan containing guidelines and procedures for the financial management function.
- Ensuring that all officials are acquainted with the guidelines and procedures.

- Ensuring that the financial management is executed according to the guidelines and procedures.

iii. Budgeting Process

The SBV Manager is responsible for compiling the annual budget, with assistance from the various Heads of Departments. The budget is divided into three sections; income, capital and an operational budget. Once approved, the budget forms the guideline for all expenditure. The SBV Manager, together with the Financial Department, is responsible for budget control and variances from budgeted expenditure are well controlled and documented.

iv. Financial Procedures

Sound financial procedures, according to the usual norms and standards, are well established and in place. Full audits are carried out annually and these are checked regularly by both the Mozambican Government Officials and SBV auditors. Full financial disclosure is made at the SBV Annual General Meeting.

6.8. Infrastructure Development and Management Program

Objectives

- Ensure that the entire infrastructure is used and / or stored and / or maintained in an appropriate and responsible manner.
- Ensure that all infrastructures adhere to the construction guidelines of the Sanctuary.
- Ensure that all infrastructures are maintained in accordance with the level of satisfaction of the Sanctuary.
- Delegate responsibility for certain infrastructures to individual staff members.
- Avoid misuse of the infrastructure.
- Indicate the need for maintenance and / or replacement of specific infrastructures.
- Ensure that the infrastructure is durable.
- Support in the compilation of budgets for infrastructure.

Infrastructure management includes the planning, construction, maintenance, replacement, control and monitoring of all fixed structures, equipment and movable assets. This, including inspections and inventory control, is carried out in accordance with generally accepted norms, standards and practices.

6.8.1. Infrastructure Development

All new infrastructures must be erected in accordance with the rules and regulations of the BLS construction and the legislation in force in the country.

7. MONITORING THE SBV PERFORMANCE

Objectives

- Avoid or at least minimize environmental impacts or pollution during waste disposal.
- Provide adequate waste management capacity;
- Minimize the possibilities of health risks to humans, animals and plants;
- Promote the concepts of minimum use and recycling within the owners of the lodges and the local community;
- Recycle and produce fertilizer where possible.
- Encourage local communities, investors and staff to minimize use, reuse and recycling;
- Add a component of waste management and environmental education within local communities.

Table 32. SBV Management Plan Monitoring and Evaluation Form

Management Plan Monitoring and Evaluation Form			
Activities	**status of implementation**	**Relevance**	**Reprograming**
Internal General Managerial Actions			
a) Habitat and species conservation program			
Wisely managing the environment, both the biotic and abiotic components	PR (Partially fulfilled), R (Fulfilled), NR(Unfulfilled) R	Various management committees have been established and a substantial workforce employed to ensure the achievement of this objective. Two Boards oversee the management of SBV, with an additional Executive Committee, Conservation and Community Development Committee, Finance Committee, and Building and Development Committee actively engaged in all management decisions. SBV also engages regularly with ANAC and MIMAIP as required.	
Securing of the whole project area to ensure that the activities proposed can be sustained	R	The project area has been designated and nationally gazetted, and the land intended for wildlife conservation has been appropriately fenced. The project area is sustained by a robust low-impact ecotourims model which reliably funds the annual activities and objectives of the project. Furhter donor funding has been received from BIOFUND and other philanthropic	

		organisations to support and reinforce management activities.	
Restoring adequate populations of appropriate wildlife	R	Substantial numbers of plains and woodland game were introduced between 2008 and 2011, and annual game counts show that the numbers have grown as expected. The	
Involving and encouraging local communities in the conservation and protection of biodiversity inside and outside the reserve	PR	Community members have long been involved in biodiversity conservation and protection through employment as Field Rangers, Wildlife Monitors, Turtle Monitors, and Alien Plant Removers. Local community members are encouraged to participate in Beach Clean-Up days and educated about the importance of reducing marine litter.	The Sanctuary in future aims to broaden its community reach by implementing a community conservation education programme targeting school children and adults in the community, and is seeking funding and engaging with potential partners to execute this.
Promoting the wise, sustainable and appropriate use of living resources to sustain the natural biodiversity of the area while producing long term benefits	R	A clear set of rules and guidelines around natural resource use has been produced and implemented for all Sanctuary users. In addition CCPs have been established with local communities and no-fishing areas have been agreed to and are enforced, and areas where fishing is permitted have been allocated. Harvesting of natural resources in the terrestrial environment is policed and local people are granted controlled access to wood and jekka.	

Collaborating with the local and provincial authorities in the monitoring and preservation of the wildlife and forestry areas of the reserve and surrounding areas	R	SBV enjoys a sound cooperative relationship with Fisheries, Maritime, ANAC, African Parks, and the police. Regular inspections take place, and police also maintain an active presence when required and support SBV when cases of wildlife crime are presented to them .	
Complying with the Mozambican rules on protection and conservation of the environment with regard to the project area and its surroundings	R	The Sanctuary enforces a strong set of rules in respect of development, zonation and resource use, has been issued with an environmental licence and has carried out the required EIA on its inception. SBV also facilitates routine government inspections to check compliance. SBV employs a substantial team of marine and terrestrial Rangers to enforce the national conservation legislation and regularly brings cases to the local police for prosecution.	
b) Communities Management and Resource Use			
Create and maintain a reciprocal and mutually beneficial relationship between the Sanctuary and the resident communities	R	Very early in the project, a committee of local Chiefs was established and monthly management meetings continue to be held with all local Chiefs. The Chiefs' meetings are used to involve community heads in decisions about management of the project and to hear the needs of the community which SBV aims to assist with.	

Promote and support lifestyles and economic activities that are more in harmony with the environment and the preservation of the social and cultural fabric of the communities concerned	R	Development and investment into the Sanctuary has been focussed on including the local community and governmet to ensure that the communities are protected and livelihoods improved by the project. The development plan set in place is low density and high value. Communities that reside within the CA are allowed limited natural resource use and artisinal fishing to ensure their social and cultural access to resources is not negatively impacted.	
Ensure that local communities are informed about, and have access to, health care units and information about major health issues		A clinic was build in consultation with the Department of Health in the Quewene Community located in the Mashukela Area. The facility is managed by the DoH and supported by the Sanctuary. SBV also provides healthcare education amongst employees and supports healthcare initiatives in the community such as vaccination campaigns.	
Encourage support for scientific and environmental educational activities that contribute to the long-term well-being of resident populations and public support for the environmental protection of the area	PR	Two recent student research projects were carried out focused on resource utilisation by local communities, and fish stocks in the Inhamambane estuary. Environmental education is provided to Sanctuary employees focused on lsubjects such as litter and overfishing.	SBV recently constructed a twelve-bed research facility which will enable future research and environmental education initiatives. Plans are underway to source funding to partner with an NGO to execute in-school conservation lessons, teach children to swim and educate CCPs about marine conservation issues.

Facilitate the creation of sustainable small-scale alternative companies	R	To date we have established 4 CCP fishing councils for the communities that have access to the protected area. Agreements are in place for areas to utilise and areas that are set aside as sanctuaries/total protection zones. Funds are allocated to these CCPs to enable small business development based on sustainable fishing. SBV also assists dhow operators to establish logistics businesses and uses these local operators for its operational needs. Small permaculture projects have been attempted previously, but have not worked due to the logistics involved in managing a centralised garden. The communities have more success farming at their places of residence.	
c)Desenvolvimento e Gestão do Turismo (Tourism Development and Activites)			
Providing excellent nature and culture based tourism and recreation opportunities within the Sanctuary	R	Twenty-two twelve-bed private lodges have been established and two commercial developments have been completed. A well-maintained road network, boat launching facilities, hides, viewing decks and signage have all been established to support nature-based tourism.	
Encouraging the conservation and sustainable use of flora, fauna and tourism resources	R	SBV, through its Conservation and Community Committee, frequently evaluates the impacts of tourism developments and activities on its natural resources, and enforces a rigorous set of rules that govern utilisation of the CA.	

Promoting and facilitating Community Based Tourism	PR	Currently, through the Sanctuary's low density tourism model, community-based tourism is executed through the mandatory employment of local people in its private holiday homes. The CA's commercial entities are encouraged to develop skills and mechanisms to enable community-based tourism and to this end, activities such as dhow cruises are offered that directly involve and benefit local communities.	SBV constantly seeks out funding and training opportunities to enable community-based tourism, and will continue to encourage its commercial partners to pursue this objective.
Generating socio-economic development and sustainable employment opportunities for local communities	NR	The Sanctuary permanently employs 140 local people through its conservation and development activites and indirectly benefits in the region of 8000 people through economic activity. In addition a large contingent of temporary labour is sourced locally from the surrounding communities in consultation with the Locality Chief and local chief's council. 50% of the reserve's operational budget is set aside for staff salaries.	A large number of Sanctuary sites remain undeveloped and there is capacity for employment and beneficiation to be further increased when these homes are built and completed. The Sanctuary is pursuing additional marketing campaigns in order to encourage development.
Generating income that can directly contribute to the maintenance and running costs of the Sanctuary, conservation activities and continuance of community programmes	R	The operating budget for SBV is generated entirely from its tourism investors, who pay an annual fee for membership of the CA to cover all operational costs, including conservation and community support. Ths is a robust and resilient model and is supplemented by donor funding for special projects, as well as income generated by additional service fees billed to developed homeowners for service provision.	
Encouraging appropriate tourism education, training, awareness and capacity building	R	Tourism capacity-building is executed within both private and commercial developments.	

programmes using tourism as a catalyst for human development			
Promoting knowledge about the historical and cultural aspects of the people as well as the natural environment	R	A website, information booklets and brochures, socail media channels and newsletter termplates have been developed for ongoing information-sharing, including historical, cultural and environmental elements.	
Establishing and running a monitoring and evaluation system aimed at ensuring the sustainability of tourism operations and maintaining high standards of visitor services and facilities within the Sanctuary	R	Two management boards and various committees have been established for ongoing evaluation of the performance of SBV in terms of its tourism objectives. The boards represent both private and commercial siteholders.	
d) Protection and Security			
Identifying and managing all forms of pollution on Sanctuary and ensuring best practice is followed to optimally deal with all aspects	R	Solid waste generated on the Sanctuary is collected and sorted at a central waste management facility and ecyclables are stored and shipped to a recycling partner in Vilanculos . Organic waste and non-recyclables are incinerated on site. With ocean waste the CA's biggest pollution threat, annual beach clean-ups are conducted in July and between September to February each year in conjunction with our turtle monitoring programme. Sewage is well-regulated through SBV's development rules and building inspections.	
Reducing water use wherever possible and encouraging recycling of “grey” water	R	Water meters are installed at all usage points and strictly managed, with sites billed for usage above a certain threshold to encourage savings. When development plans are presented, grey-water systems are	

		recommended and have been installed at some recent sites.	
Discouraging the planting of exotic or water requiring plants at Lodges	R	Sanctuary Rules do not allow for the planting of invasive alien species, and routine site visits are carried out by the CA Administrator to monitor this.	
Reducing all waste to a minimum and encouraging recycling of all materials	R	A waste centre was established in 2019 and we currently sort 3 items (glass, tins and plastic) that are removed from site and taken to Vilanculos for recycling. As far as possible waste items are repurposed and reused on site (e.g. milk containers for planting seedlings; plastic bottles for water reused by staff and community members).	
Reducing all scenic and noise pollution to a minimum	R	Sanctuary rules dictate that downlighting and solar systems are utilised to prevent light and noise pollution from generators. Generators are allowed a maximum operatinglevel of 57db at a distance of 7m. Motorbikes, quadbikes and jet skis are prohibited. 4-stroke motors are preferred and encouraged. These elements are policed by SBV security staff and managements, as well as by SBV users themselves who are able to report non-compliance of neighbours.	
Checking and prepare for extreme weather events	R	A tropical cyclone action plan has been drawn up and is in place, and the SBV Administrator is subscribed to all warning services. SBV is insured against named cyclones. All staff are trained and preparation drills are regularly carried out.	

e) Research			
Conduct such research as is necessary for the effective management of the reserve and to achieve the objectives set	NR	Studies were carried out originally by a team of experts to document all known biological resources of the project.Ongoing research and monitoring programmes are in place with various organisations including Eduardo Modlane University, BIOFUND's PLCM, the University of Stockholm, ParCo, WIORI, Marine Megafauna Foundation, BirdLife International, University Federal Fluminense and Federal University of Rio de Janeiro.	This activity is oingoing, as new issues emerge and research questions are presented. A new donor-funded research camp has been built resulting in a renewed focus on encouraging research now that adequate facilities are available.
f) Infrastructure Development			
Ensure that the entire infrastructure is used and / or stored and / or maintained in an appropriate and responsible manner	R	Annually a substantial maintenance budget is allocated for maintenance of infrastructure to high standards. New infrastructure projects are developed and funded annually through a dedicated CAPEX budget. A Maintenance Manager is employed full-time with a team of assistants and provided wiht the necessary tools required.	
Ensure that all infrastructures adhere to the construction guidelines of the Sanctuary	R	The CA Administrator and a board-appointed Building Committee are responsible to conduct audits and ensure compliance during any building phase and at any stage thereafter. Building inspections are facilitated with the relevant authorotes to ensure compliance with national regulations.	
Ensure that all infrastructures are maintained in accordance with the level of satisfaction of the Sanctuary	R	The general manager and the Building Committee are responsible to conduct audits to ensure compliance during the building phase and at any stage thereafter. To date all development has complied with both local and national regulations.	

Delegate responsibility for certain infrastructures to individual staff members	R	The Maintenance Manager is responsible for all SBV infrastructure repairs, maintenance and upkeep and has a team of staff comprising specialists with dedicated focus areas - e.g. a mechanic, a water technicia, a builder, etc.	
Ensure that the infrastructure is durable	R	Material quality and durability are a priority in the coastal environment and for cost-effectiveness. Local hardwoods are used where wood is required. Galvanised steel, stainless steel or aluminium is used in exposed areas to prevent damage from the environment.	

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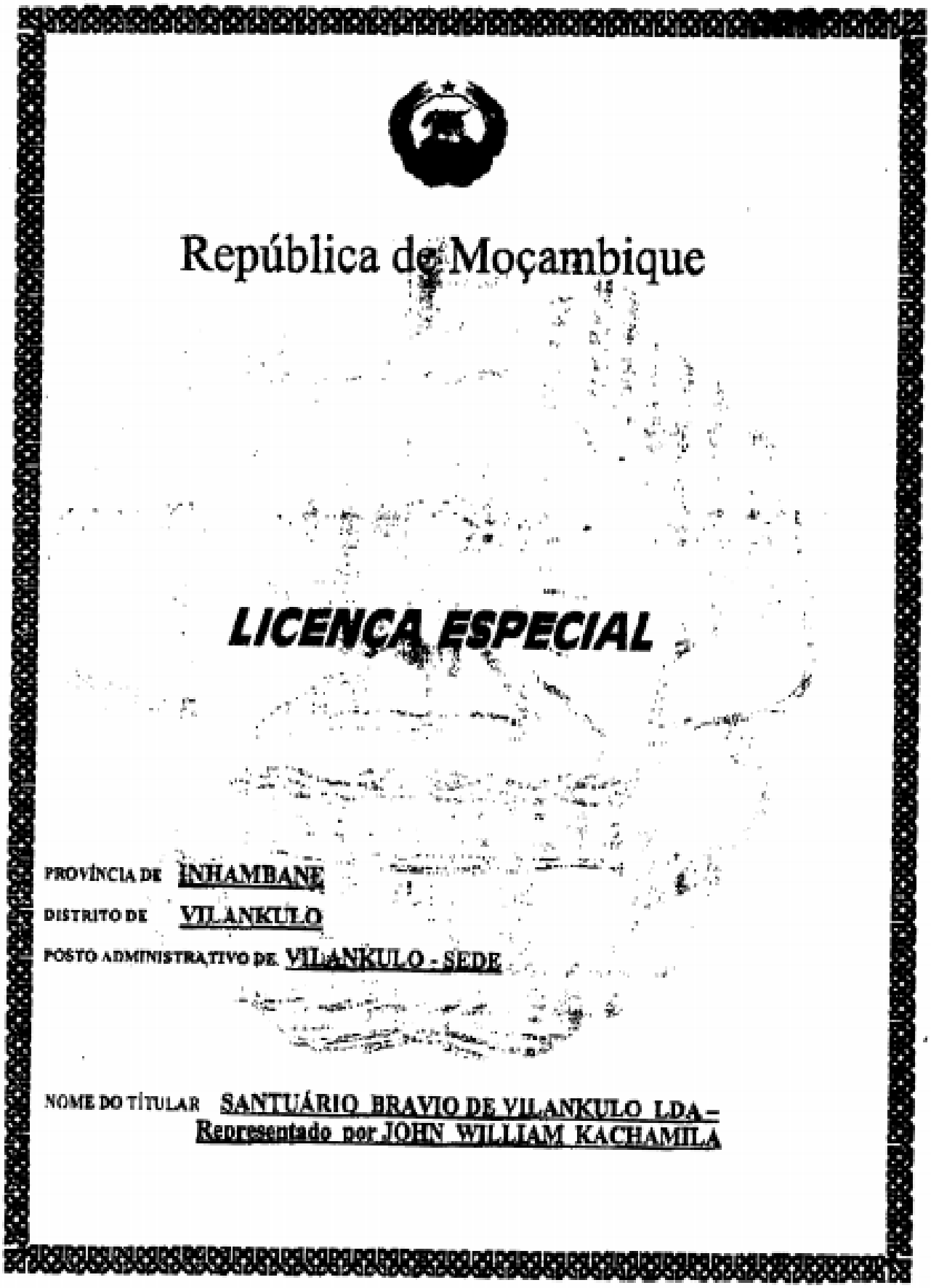


República de Moçambique

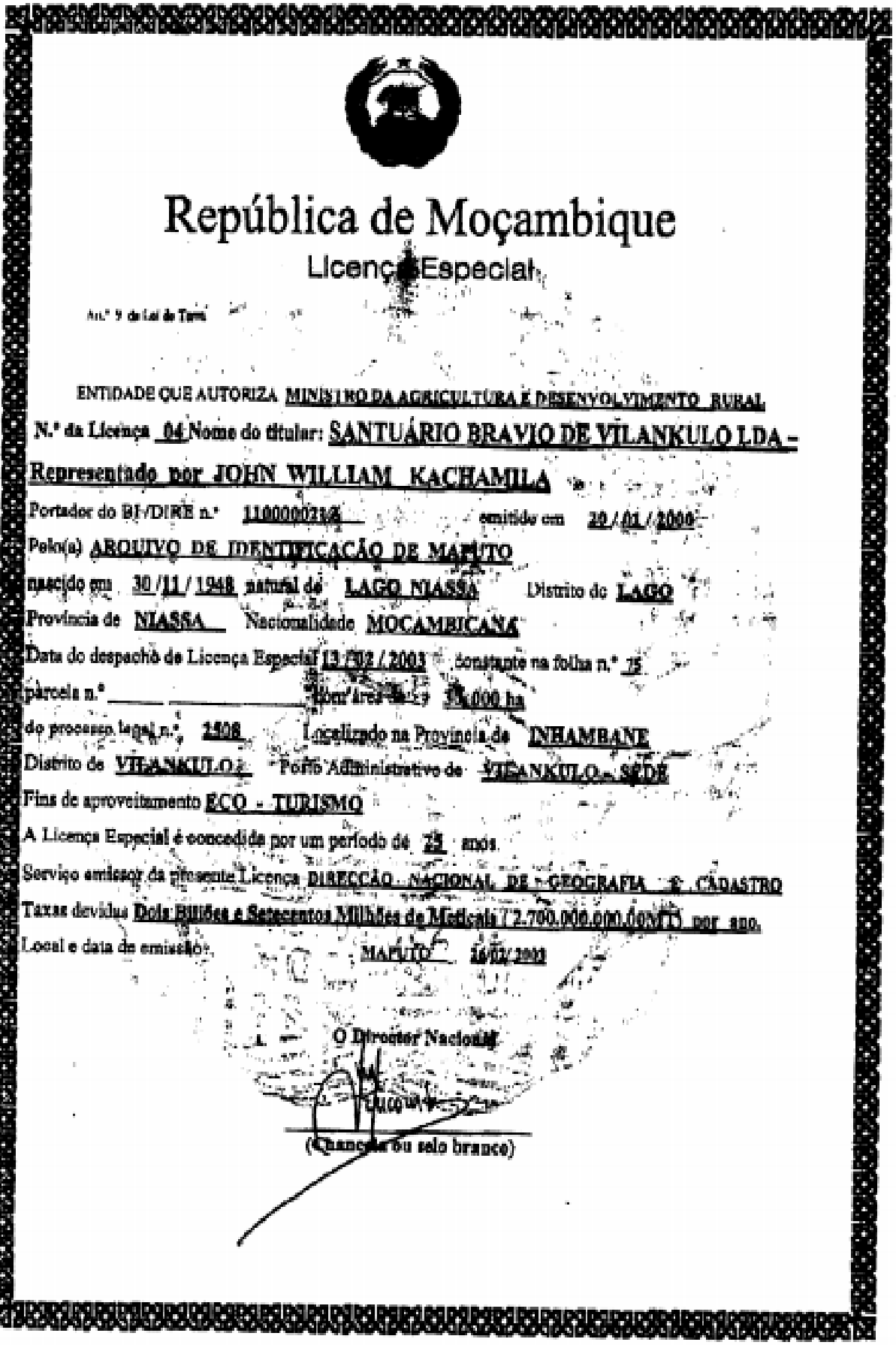
LICENÇA ESPECIAL

PROVÍNCIA DE INHAMBANE

DISTRITO DE VILANKULO

POSTO ADMINISTRATIVO DE VILANKULO - SEDE

NOME DO TÍTULAR SANTUÁRIO BRAVIO DE VILANKULO LDA – Representado por JOHN WILLIAM KACHAMILA



República de Moçambique

Licença Especial

Art.º 9 da Lei de Terras

ENTIDADE QUE AUTORIZA MINISTRO DA AGRICULTURA E DESENVOLVIMENTO RURAL

N.º da Licença 04 Nome do titular: SANTUÁRIO BRAVIO DE VILANKULO LDA -

Representado por JOHN WILLIAM KACHAMILA

Portador do BI/DIRE n.º 110000021[illegible] emitido em 29/01/2000

Pelo(a) ARQUIVO DE IDENTIFICAÇÃO DE MAPUTO

nascido em 30/11/1948 natural de LAGO NIASSA Distrito de LAGO

Província de NIASSA Nacionalidade MOCAMBICANA

Data do despacho de Licença Especial 13/02/2003 constante na folha n.º 75

parcela n.º _____ com área de 3[illegible],000 ha

do processo legal n.º 1508 Localizado na Província de INHAMBANE

Distrito de VILANKULO Posto Administrativo de VILANKULO - SEDE

Fins de aproveitamento ECO - TURISMO

A Licença Especial é concedida por um período de 25 anos.

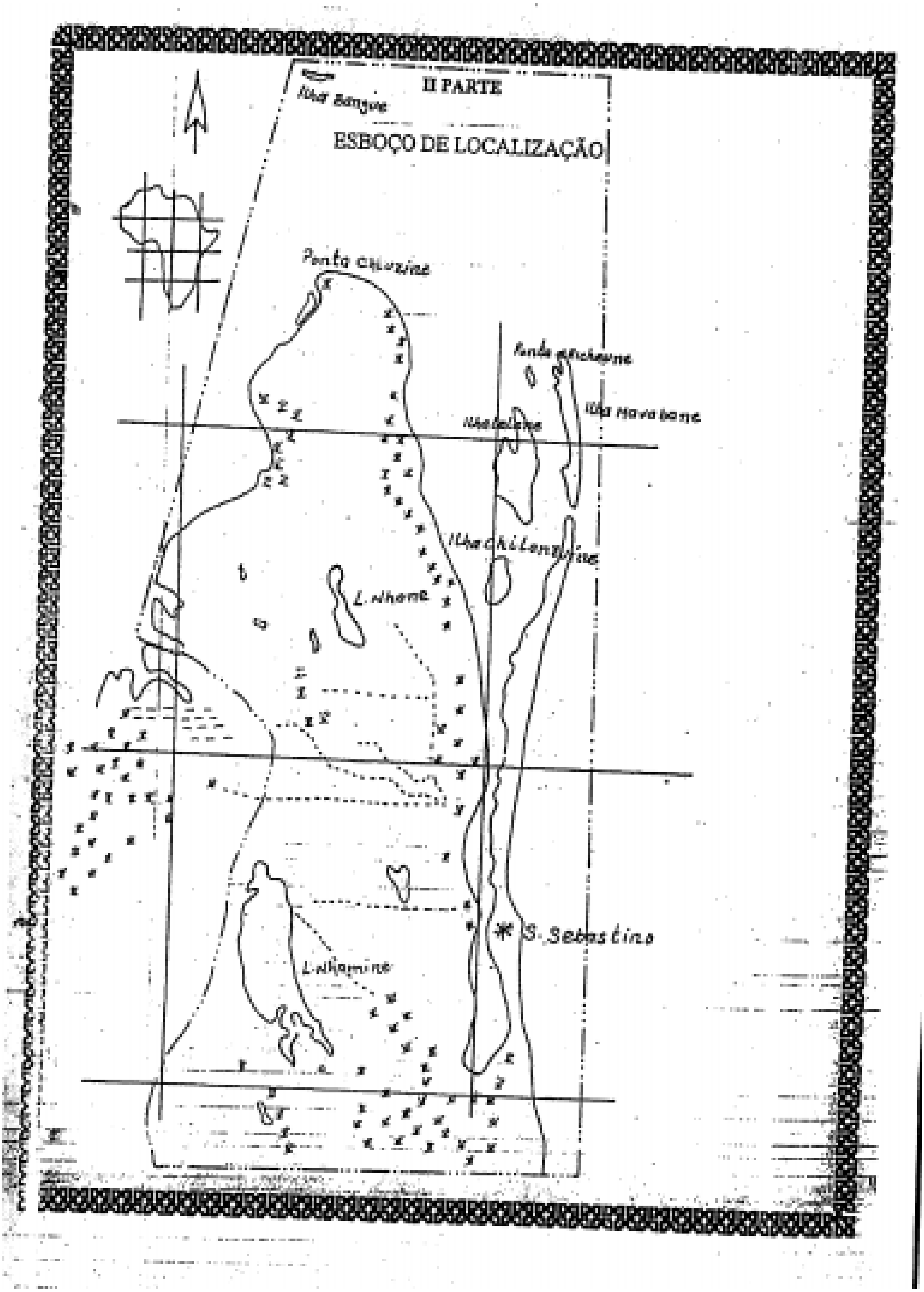
Serviço emissor da presente Licença DIRECÇÃO NACIONAL DE GEOGRAFIA E CADASTRO

Taxas devidas Dois Biliões e Setecentos Milhões de Meticais (2.700.000.000,00MTS) por ano.

Local e data de emissão MAPUTO 26/02/2003

O Director Nacional

(Quando for selo branco)


II PARTE
ESBOÇO DE LOCALIZAÇÃO
Ilha Bangue
Ponta Chuzine
Ilha Mavabone
Ilha chilonzuine
L. Nhone
S. Sebastino
L. Nhamine

são designados de entre os membros mencionados na alínea *a)* do nº 1 do presente artigo."

Art. 2. A presente Lei entra em vigor na data da sua publicação.

Aprovada pela Assembleia da República, aos 17 de Abril de 2003.

O Presidente da Assembleia da República, *Eduardo Joaquim Mulémbwé.*

Promulgada em 19 de Maio de 2003.

Publique-se.

O Presidente da República, JOAQUIM ALBERTO CHISSANO.

CONSELHO DE MINISTROS

Decreto nº 17/2003 de 29 de Abril

Tornando-se necessário adequar o instrumento legal que regula as actividades de distribuição e comercialização de produtos derivados de petróleo, com vista a tornar mais eficiente o mecanismo de revisão de preços, ao abrigo da alínea *e)* do nº 1 do artigo 153 da Constituição da República, o Conselho de Ministros decreta:

Artigo 1. Os artigos 45 e 46 do Decreto nº 1/97, de 28 de Janeiro, passam a ter a seguinte redacção:

"ARTIGO 45

1. O preço base é determinado para cada produto, em qualquer momento, como:

a) A média ponderada dos preços CIP das importações efectuadas nos noventa dias anteriores à data de cálculo; ou

b) O preço base em vigor, caso não tenha havido importações do produto nos noventa dias anteriores à data do cálculo.

2. Para efeitos de aplicação do disposto neste artigo:

a) Será usada a taxa de câmbio do metical da data de cálculo, publicada por uma instituição idónea; e

b) A data de importação é considerada a data de entrada em armazém.

a sua publicação.

Aprovado pelo Conselho de Ministros.

Publique-se.

O Primeiro-Ministro, *Pascoal Manuel Mocumbi.*

Decreto nº 18/2003 de 29 de Abril

Havendo necessidade de alargar o actual sistema de protecção ao longo da faixa do Canal de Moçambique de modo a assegurar protecção dos recursos naturais na península de São Sebastião, permitindo uma gestão integrada, ao abrigo do preceituado na alínea *b)* do nº 3 do artigo 22 da Lei nº 19/97, de 1 de Outubro, conjugado com o nº 4 do artigo 10 da Lei nº 10/99, de 7 de Julho, o Conselho de Ministros decreta:

Artigo 1. É criada uma zona de protecção total, que compreende a península de São Sebastião bem como as águas adjacentes de acordo com as coordenadas em anexo ao presente decreto e que dele são parte integrante.

Art. 2. A zona de protecção total criada passa a designar-se "Zona de Protecção Total de Cabo de São Sebastião".

Art. 3. No prazo de sessenta dias, o Ministro do Turismo aprovará por diploma ministerial o Plano de Maneio respectivo.

Aprovado pelo Conselho de Ministros.

Publique-se.

O Primeiro-Ministro, *Pascoal Manuel Mocumbi.*

Anexo

As coordenadas a que alude o artigo 1 do presente decreto:

	Latitude	Longitude
D	22° 02' 55"	35° 24' 01"
E	22° 02' 55"	35° 32' 30"
F	22° 11' 34,8"	35° 24' 53,6"
G	22° 20' 29,5"	35° 32' 38"
H	22° 20' 11,5"	35° 25' 26,8"
I	22° 20' 26,8"	35° 33' 33,6 "
J	22° 10' 28,6"	35° 33' 31"

Área ~ 439 260 916.86m².

FEB-2001 12:02 FROM:JORDAN PROPERTIES 01

REPÚBLICA DE MOÇAMBIQUE

CONSELHO DE MINISTROS

RESOLUÇÃO INTERNA Nº 4/2000

de 17 de Outubro

A empresa East African Wildlife Prop. Ltd. e o Senhor John Wiliam Kachamila, submeteram para aprovação, nos termos da Lei nº 3/93, de 24 de Junho, e do respectivo Regulamento, o projecto de investimento denominado "SANTUARIO DA FAUNA COSTEIRA DE VILANCULOS", cujo objecto será o estabelecimento e a gestão de uma fazenda do bravio para a conservação e preservação de espécies indigenas, marinhas, faunisticas e florestais, a instalação e estabelecimento de turismo de baixa densidade, acampamentos turísticos comerciais e privados e desenvolvimento de propriedades.

Ao abrigo da alínea c) do nº 1 do Artigo 15 do Regulamento da Lei nº 3/93, de 24 de Junho, o Conselho de Ministros, autoriza, de conformidade com os Termos da Autorização em anexo, que constituem parte integrante da presente Resolução Interna, a realização e a subsequente exploração do projecto "SANTUARIO DA FAUNA COSTEIRA DE VILANCULOS" envolvendo investimento directo estrangeiro da empresa East African Wildlife Prop. Ltd. e investimento directo nacional do Senhor John Wiliam Kachamila.

Aprovada pelo Conselho de Ministros.

O PRIMEIRO-MINISTRO

PASCOAL MANUEL MOCUMBI

REPÚBLICA DE MOÇAMBIQUE

MINISTÉRIO DA TERRA E AMBIENTE
ADMINISTRAÇÃO NACIONAL DAS ÁREAS DE CONSERVAÇÃO

Exmo. Senhor:
Hermenegildo Ali Américo
Cidade de Maputo

N./Ref.n.º 226/MTA/ANAC/GD/ 309/2020 Maputo, 01 de Setembro de 2020

Assunto: **Solicitação de Registo de Consultor para inventariação e maneio de Recursos Naturais submetido pelo Senhor Hermenegildo Ali Américo.**

A Administração Nacional das Áreas de Conservação – ANAC acusa a recepção de um pedido de registo de consultor para elaboração de Planos de Maneio, inventariação de recursos naturais submetido pelo Senhor Hermenegildo Ali Américo.

Nos termos do n.º 2 do Artigo 74 do Regulamento da Lei de Protecção, Conservação e Uso Sustentável da Diversidade Biológica, aprovado pelo Decreto n.º 89/2017 de 29 de Dezembro, o pedido para inscrição como consultor para elaboração de Plano de Maneio, Inventário de Recursos Faunísticos e Florestais e Plano de Encerramento deve conter:

a) Requerimento a solicitar a emissão do cartão de Autorização;
b) Duas fotografias tipo passe;
c) Certificado de habilitações;
d) Certidão de equivalência para cursos efectuados fora do país;
e) *Curriculum Vitae*.

Analisado o pedido e os documentos apensados pelo requerente verifica-se que encontram-se preenchidos os requisitos de elegibilidade para inscrição como consultor para elaboração de Planos de Maneio e inventariação de recursos naturais, possuindo o mesmo o grau de

ANAC

mestrado em Tecnologia e Utilização de Madeira, nos termos da alínea a), do n.º 1, do Artigo 74 do Regulamento em referência e experiência de trabalho considerável na gestão de recursos naturais.

Pela presente e nos termos do Artigo 73 do Regulamento da Lei de Protecção, Conservação e Uso Sustentável da Diversidade Biológica, aprovado pelo Decreto n.º 89/2017 de 29 de Dezembro, comunica-se que é deferido o pedido de inscrição como Consultor para elaboração de Planos de Maneio e Inventariação de Recursos Naturais, estando condicionado ao pagamento da taxa única de inscrição de acordo com o previsto no n.º 3, do Artigo 72 do Regulamento em referência, correspondente a 5 (cinco) salários mínimos da função pública.

Atenciosamente.

O Director Geral

Marcos Mutemba

Number estimates, distribution and comments on game animals on Sanctuary

. Sanctuary, showing the location of the Marape, Chingonguene and Nhone Field Ranger patrol areas.

	%		
Area	Marape	Chingonguene	Nhone
Eland	12.2	33.1	54.7
Waterbuck	10.2	33.3	56.5
BWB	15.4	27.8	56.8
Kudu	7.7	53.6	38.7
Zebra	17.8	40.5	41.8
Nyala	14.2	48.7	37.1
Bushbuck	2.7	91.9	5.4

Percentages of species of introduced game in the three Field Ranger areas from their recent observations.

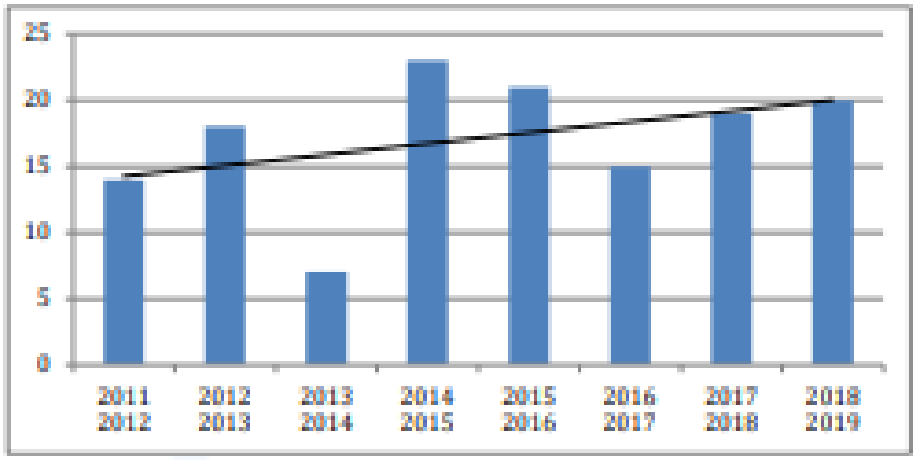
the sanctuary
Santuario Bravio de Vilanculos Lda

A report on the 2018/19 monitoring of marine turtles on the São Sebastião peninsula, Mozambique

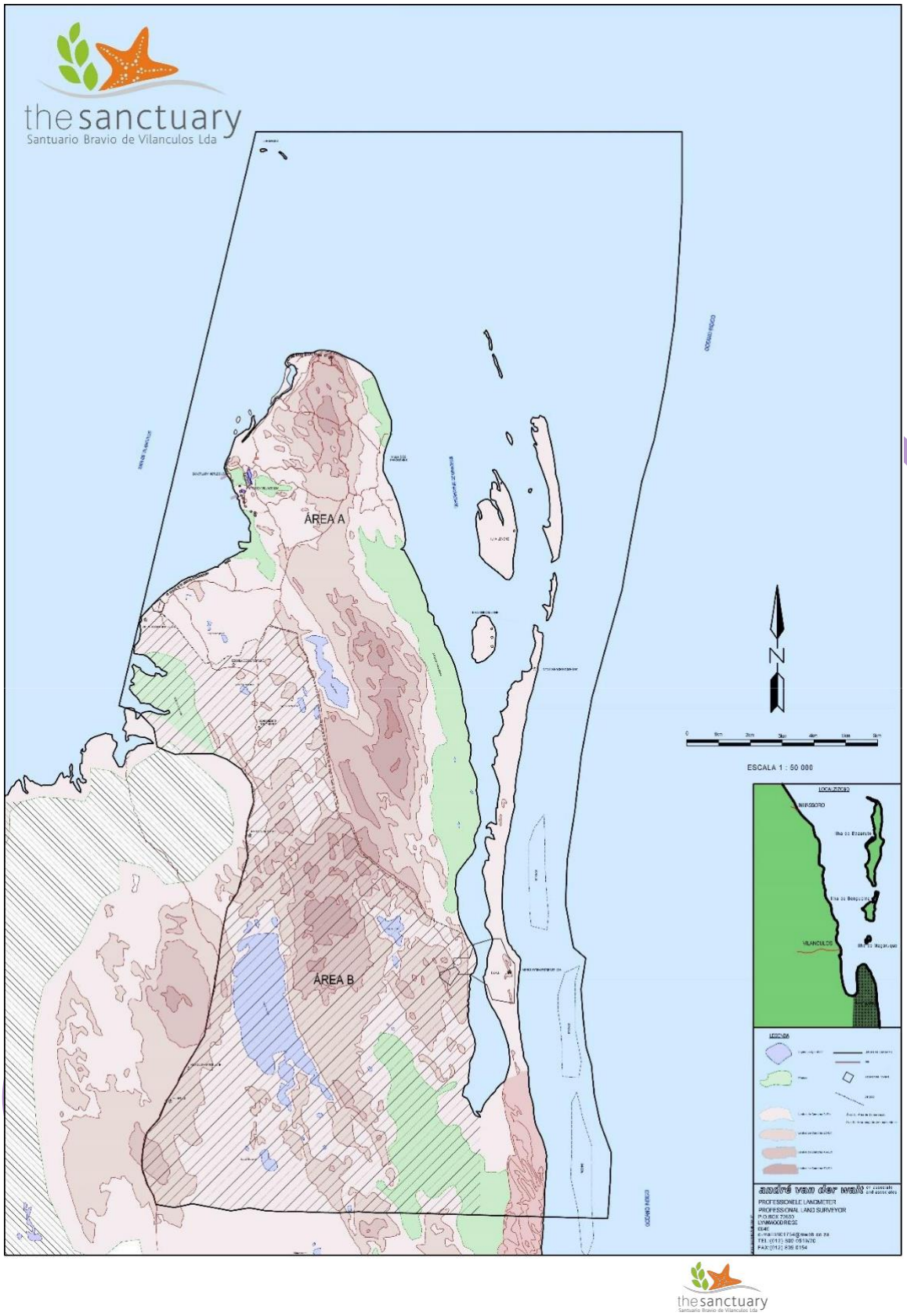
8 June 2019

. Numbers of the different species of turtles, total numbers of tracks and confirmed nests recorded on Sanctuary beaches each year since the first available comprehensive records.

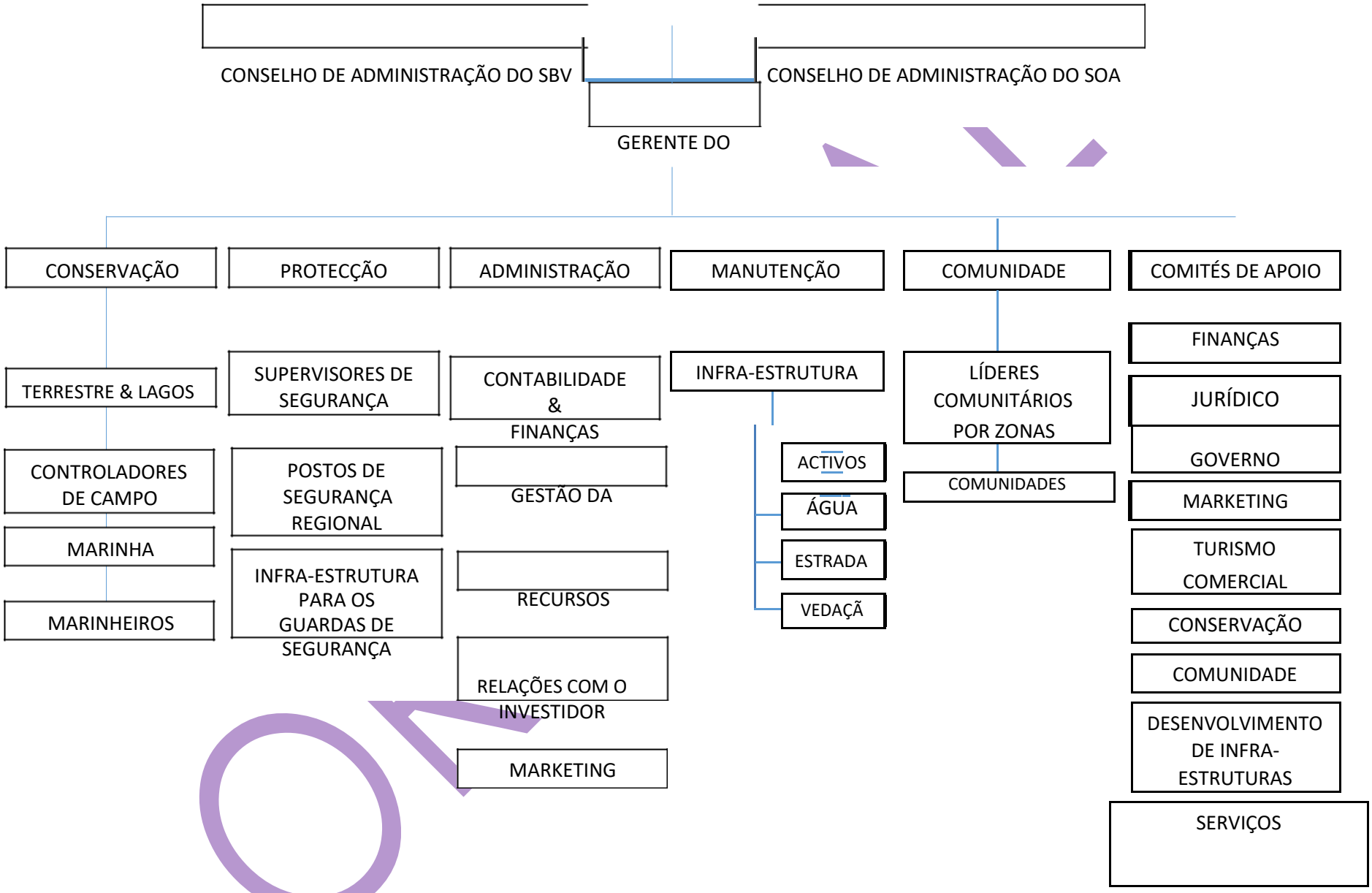
	Species of turtle						
Year	Loggerhead	Leatherback	Green	Hawksbill	Unconfirmed	Tracks	Nests
2011 2012	4				10	14	9
2012 2013	5				13	18	13
2013 2014	3				4	7	4
2014 2015	4				19	23	21
2015 2016	8	1			12	21	18
2016 2017	7			1	7	15	15
2017 2018	8				11	19	14
2018 2019	4		1		15	20	18
Total	43	1	1	1	91	137	112

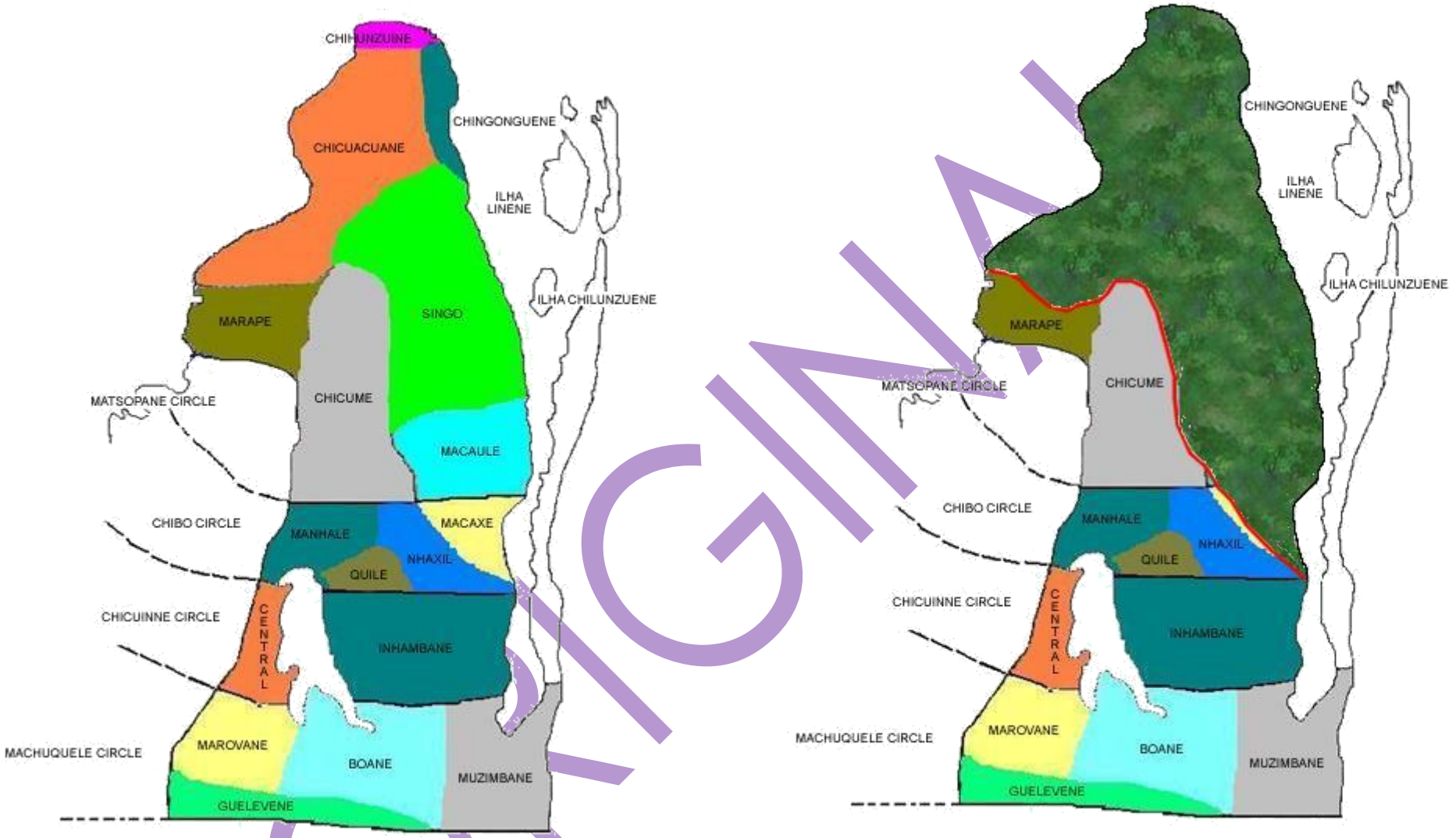


. The total number of turtle tracks recorded each year from 2011 to date



Mapa 1. Mapa do Santuário mostrando a rede de estradas, vedação da fauna, zonas de desenvolvimento e Conservação (Zona A) e Comunidade (Zona B).


CONSELHO DE ADMINISTRAÇÃO DO SBV
CONSELHO DE ADMINISTRAÇÃO DO SOA
GERENTE DO
CONSERVAÇÃO
PROTECÇÃO
ADMINISTRAÇÃO
MANUTENÇÃO
COMUNIDADE
COMITÉS DE APOIO
TERRESTRE & LAGOS
CONTROLADORES DE CAMPO
MARINHA
MARINHEIROS
SUPERVISORES DE SEGURANÇA
POSTOS DE SEGURANÇA REGIONAL
INFRA-ESTRUTURA PARA OS GUARDAS DE SEGURANÇA
CONTABILIDADE & FINANÇAS
GESTÃO DA
RECURSOS
RELAÇÕES COM O INVESTIDOR
MARKETING
INFRA-ESTRUTURA
ACTIVOS
ÁGUA
ESTRADA
VEDAÇÃ
LÍDERES COMUNITÁRIOS POR ZONAS
COMUNIDADES
FINANÇAS
JURÍDICO
GOVERNO
MARKETING
TURISMO COMERCIAL
CONSERVAÇÃO
COMUNIDADE
DESENVOLVIMENTO DE INFRA-ESTRUTURAS
SERVIÇOS



Mapa 2. Nomes e posições das comunidades antes do desenvolvimento e implementação do santuário em 2002. Mapa 3. Nomes e posições das comunidades em 2014 após da implementação do projecto do Santuário. A área em verde norte da linha vermelha representa a zona de conservação.