Outlook of Critical Habitats in WIO – Mangroves

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▪ Background

1. Description and characterisation of mangroves

Mangroves comprise forests and indeed ecosystems that surround estuaries and gentle coastlines in WIO tropical and subtropical areas and now extending into the warm temperate regions. Mangrove are adapted to live under conditions of (i) changing water level that enables them to develop pneumatophores (aerial roots adapted to gas exchange); (ii) change in salinity prompting the development of mechanisms of salt excretion or avoidance of leaf evaporation and transpiration. Mangroves are also (iii) adapted to environmental scarcity of oxygen, enabling the emergence of viviparous fruits common in several mangroves species. Some mangroves species such as *Heritiera littoralis* and *Xylocarpus granatum* possess also (iv) floating, water drifting seeds and fruits respectively.

Five forms of mangroves occur in WIO: (i) fringing mangroves widespread and surrounding the perimeter of mostly gently coastlines; (ii) riverine, surrounding the rivers and are common; (iii) basin mangrove, widespread and occupying larger areas at the back of both fringing and riverine mangroves; (iv) dwarf or stunted mangroves common in abnormal or equinoctial tidal reach, having tidal inundation few days in a month (v) Overwashed mangroves are also common specially dominated by intertidal isolated

stands, such as those by *Sonneratia alba* common in coral limestone areas of northern Mozambique, Tanzania and Kenya.

2. Mangroves occurrence and distribution in the WIO region

Around 6200 Km^2 (620 000 ha) of mangroves occur in WIO corresponding to about 25% of the Africa area and 4.1 % of world's mangrove area (Fatoyinbo and Simard 2013, Spalding et al. 2010, Beentje and Bandeira 2007). The largest extension is found in Mozambique, followed by Madagascar, Tanzania, Kenya and South Africa. Small island states have the smallest areas, nonetheless significant.

The most important mangrove formations of **Somalia** grow in the south and central parts of the country, in the estuary of the Juba River and near the Kenyan border (lower Juba province). Notable formations also occur on the Bojun Islands. North of Mogadishu mangroves are disperse and tend to grow in monospecific stands of *Avicennia marina* that grows behind sand spits (e.g.: in Zeylac, Berbera, Xabo and Caluula) (Carbone and Accordi 2000, Mumuli et al. 2010, Spalding et al. 2010). There are also reports of past occurrence of mangroves in the north, an area currently designated an EBSA site (The Great Whirl and Gulf of Aden Upwelling Ecosystem EBSA) which covers mostly northern Somalia but also Golf of Aden and Socotra Island. The area still needs further assessment regarding historical occurrence of mangroves, however it was declared an EBSA site because of its high productivity and unique megafauna and birdlife as triggered by patterns of currents and winds in the area. The historical occurrence of mangrove might be selected for mangroves restoration activities once each site is thoroughly studied.

Kenya mangroves cover 61 272 ha (GoK 2017) covering the Kilifi, Kwali, Lamu, Mombasa and Tana Counties, the first three areas encompassing around 90% of the

country area. Lamu County contributes to 62% of the total area with 37,350 ha (62% of Kenya mangrove coverage). These forests are dominated by mixed stands of *Rhizophora* but also *Avicennia*, particularly on the landward side as well as stands of *Ceriops* in the mid-zone of the forest. Lamu mangroves occur in the Northern Swamps, Pate Island Swamps, North Central Swamps, Southern Swamps, Mongoni and Dodori Creek Swamps (Figure 1). Twenty percent (or 7,628 ha) of the mangroves of the Lamu County are protected in the Kiunga Marine National Reserve (KMNR), which extends mostly in the Northern Swamps and parts of the Northern Central Swamps. The Lamu-Kiunga EBSA area is considered part of priority landscapes implementing climate change adaptation components.

Tana River County mangrove forests cover a total area of 3,260 ha stretching from Ngomeni to Kipini. Mangroves in Kilifi County, occur in small patches stretching at Mtwapa, Kilifi-Takaungu, Mida and Ngomeni, with approximately 8,535 ha (Ngomeni covering almost 50%). Watamu EBSA encompasses Watamu National Park as part of a complex of marine and tidal habitats along Kenya's north coast south of Malindi covering Malindi Marine National and Park (mostly with seagrasses) and Mida Creek which has important mangrove forests, with a high diversity of species, including *Ceriops tagal*, *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Avicennia marina* and *Sonneratia alba*. It is a key spawning ground for many fish species. Watamu/Malindi Marine Parks and Reserve (WMMPR) covers an area of 22 900 ha and is part of a United Nations Biosphere Reserve that also includes the Arabuko Sokoke Coastal Forest.

Mombasa County, dominated by *Ceriops* – *Rhizophora* and mixed stands of *Rhizophora*, has 3,771 ha, distributed mostly along Port Reitz and Tudor Creeks. The forest is heavily degraded through illegal harvesting, land-encroachment and pollution. Reported 1,850 ha of mangroves in Mombasa County are degraded and in urgent need of rehabilitation. Kwale County mangroves comprise Vanga-Funzi, Gazi Bay, and Ukunda areas, with an area of approximately 8,354 ha and dominated by mixed stands of *Ceriops* and *Rhizophora*, as well as pure stands of *Avicennia*.

Pemba- Shimoni- Kisite EBSAs lies between the border between Kenya (part of Kwale County) and Tanzania and include Pemba Island. In Tanzania, the Pemba Island marine area has high diversity of mangroves species (*Avicennia marina*, *Ceriops tagal*,

Lumnitzera racemosa, *Xylocarpus granatum*, *Xylocarpus molucensis*, *Heritiera littoralis*, *Bruguiera gymnorrhiza*, *Rhizophora mucronata* and *Sonneratia alba*) often associated with extensive seagrass and algal beds. With a coverage of 13 919 ha, the mangrove stands in Pemba Island appear to be in higher quantities than those in Unguja, 5 003 ha (Mangora et al. 2016).

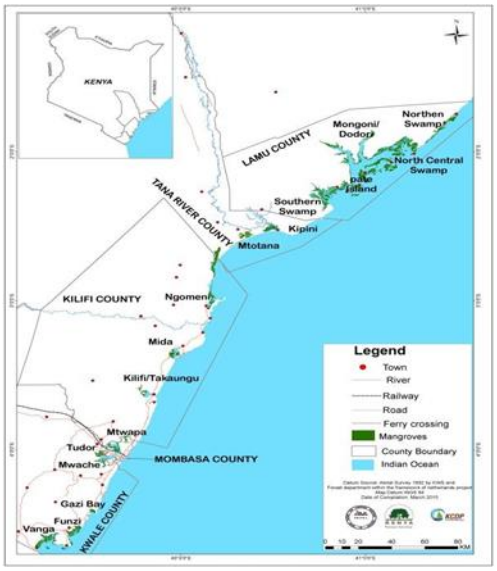

Figure 1. Mangroves distribution in Kenya

Tanzania mangrove area were estimated at 108 300 ha in the mainland (Wang et al. 2003), however recent studies downgraded this number to 80 900 ha in Tanzania (Fatoyinbo and Simard 2013). Meanwhile the area for Zanzibar was estimated in 19 748 ha, with 13 919 ha on Pemba and the remaining on Unguja (Leskinen et al., 1997). For management purposes, the mangroves are divided into 12 blocks (in decreasing order of size): Rufiji, Kilwa, Pemba, Mkinga and Tanga, Mtwara, Unguja, Bagamoyo, Lindi, Mafia, Mkuranga, Pangani and Dar es Salaam. The Rufiji Delta comprises about 50% of the country area, whilst other important formations within the above referred management blocks include Tanga, Pangani, Wami and Ruvu,and Ruvuma estuary (the last one with approximately 9 500 ha) (Ferreira et al. 2009, Mangora et al. 2016). Other formations include those of Zanzibar, Pemba, Mafia Islands (Mangora 2011) and Unguja Island with the great formation of Chwaka Bay (Shunula and Whittik, 1999). Around Dar es Salaam city, mangroves tend to grow shrubby and up to 5-7 m high. Such are the cases of

mangrove formations at Mbewni (located some 30 km north of Dar es Salaam at the mouth of Mpigi river), Kunduchi, and Mtoni estuary (Mremi and Machiwa 2002, Kruitwagen et al. 2008). These forests grow under great anthropogenic pressure, including urban expansion, port activities and other associated services (Kruitwagen et al. 2008).

Tanzania jurisdictional areas is home to the following EBSAs: Tanga Coelacant Marine Park with major mangroves within Tanga Bay; Zanzibar (Unguja) – Saadani in the Unguja main island with 5 003 ha; Rufiji-Mafia-Kilwa with Rufiji concentrations quite half of Tanzania mangroves.

Mozambique coastline (of ca 2700 Km) can be divided into three parts, (i) coralline type in the north covering the province of Cabo Delgado and Nampula; (ii) swampy coast covering the Sofala bank, massive mangroves occur quite continuously, the largest one being the Zambezi Delta mangrove; (iii) sandy dune in the south with major mangroves in Saver River Estuary, Inhambane Bay, Limpopo River Estuary and Maputo Bay. Globally, Mozambique ranks 13th in mangrove coverage, equivalent to approximately 2.3% of the global mangrove forest area (Giri et al. 2011). The country area is estimated in 305 400 ha (Fatoyinbo and Simard 2013), with a highest extent concentrated at Zambézia and Sofala provinces (Table 1, Figure 2). All nine species that occur in the WIO can be found in Mozambique. *Avicennia marina* is widely distributed from north to south, while *S. alba* only occurs from Inhambane province to the north. *Xylocarpus molucensis* has only been recorded at the Zambezi delta so far (Trettin et al. 2015).

Table 1. Mozambique mangrove area (H. Mabilana, H Balidy, Unpublished and ungoing mapping of Mangroves for selected provinces)

Province	**Area (in ha)**
Cabo Delgado	34 730,1
Gaza	465.7
Inhambane	26 055,9
Maputo	17596
Nampula	50 015,1

Sofala	73 553,6
Zambézia	115 337,2
Total	317 753,6

The transboundary formation of the Rovuma River Estuary has approximately 9 500 ha and is the largest in Cabo Delgado province. Other important areas include Quissanga-Ibo-Quirimba Island (4300 ha), Macomia (4395 ha), Pemba (2700 ha), Palma (1010 ha) and Mocímboa da Praia (6536 ha). All these formations lie within the Mtwara- Pemba Bay EBSA created given display of both critical habitats but also charismatic habitats in this region including turtles, wales and dugongs.

In Nampula province largest mangrove areas occur within Angoche (18 135 ha), Mussoril (7354 ha), Moma covering also Ligonha river mangroves (16 119 ha), Monjicual (5128 ha), Memba (2229 ha) and Mozambique Island district Incl. mainland areas (339 ha). Nampula and Zambézia provinces are home to Baixo Pinda-Pembane (Primeiras & Segundas Islands) EBSA, covering in its southern regions one of the largest WIO MPA known as Area of Environmental Protection of the Islands Primeiras and Segundas (covering the districnts of Angoche, Larde, Moma and Pebane). About 570 ha of mangroves are protected within this MPA.

The Zambezia province holds the most important mangrove formation of the country, the Zambezi delta, which is also one the largest single mangrove formations of the WIO region. The Zambezi Delta is also part of an EBSA site which extends between Quelimane city (Bons Sinais Estuary) and Zuni River (wider Zambezi Delta known range), thislast one in Sofala Province. The southern areas of Zambezi River Delta is also a RAMSAR site. Around 33 % of Mozambique mangroves occur in the Zambezi Delta. The immediate seas of the delta give rise to the Sofala Bank, which extends from Save River (south of Beira Town) to the chain islands of Ilhas Primeiras e Segundas (north, in Nampula Province), the largest and among the most productive fishing areas in Mozambique attaining close to 50% of the entire industrial catches (some 50 000 Tones in 2002). Fish comprise the majority of the catch, followed by the shrimp species *Penaeus indicus* and *Metapenaeus Monoceros*. Other important mangrove areas in Zambezia provincein

include Inhassunge (21 112 ha), Pebane (35 772 ha), Nicoadala (4 241 ha) and Namacurra (3 998 ha).

Sofala province has the second most extensive mangroves of the country, extending from north of the Save river up to the southern limit of the Zambezi delta. Sofala Bay and the estuaries of Búzi and Púgue River are amongst the most important areas.

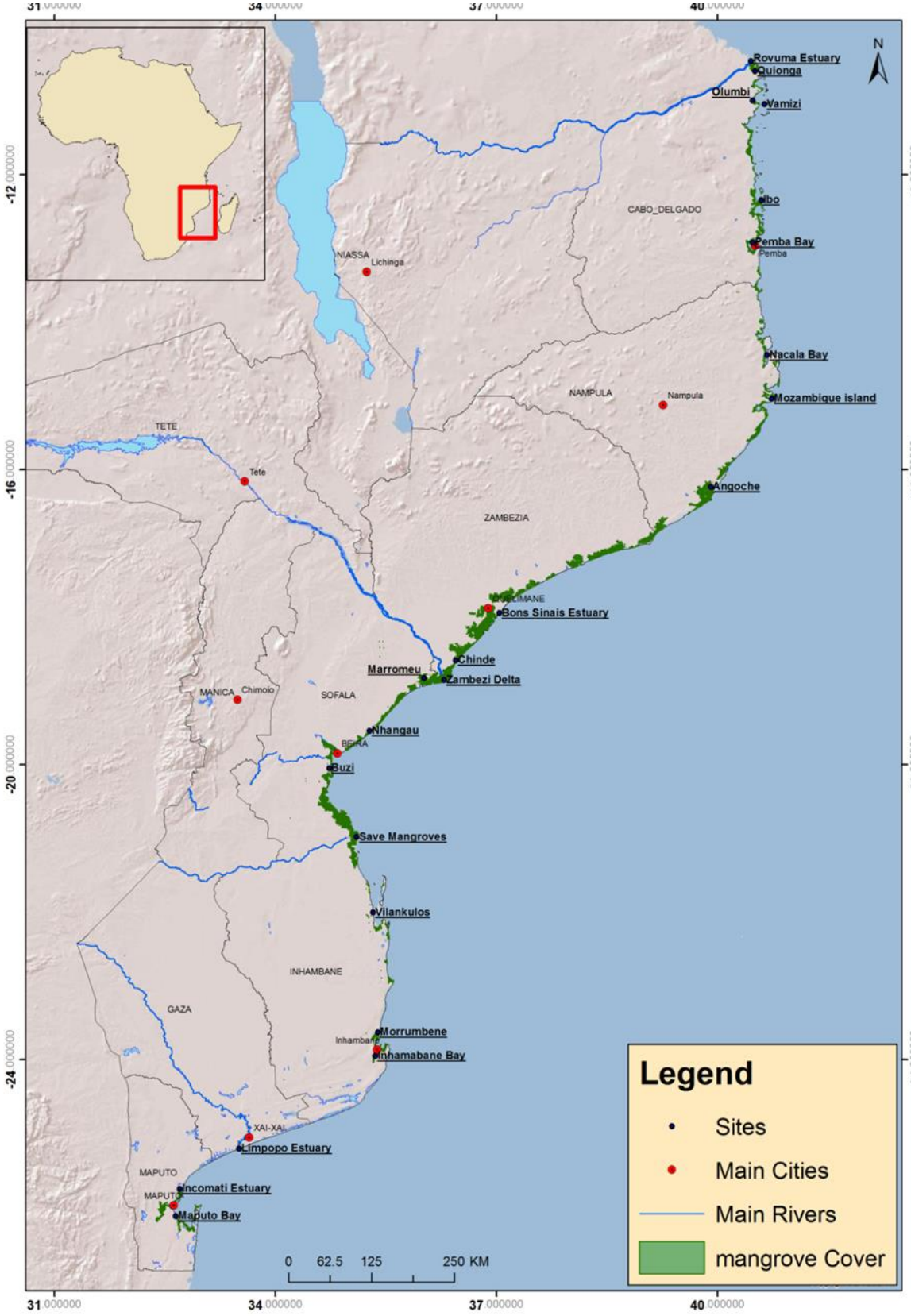

Figure 2. Mangroves distribution in Mozambique.

In southern Mozambique, and there are 4 main areas where they occur more or less abundantly: (1) the area between Save river and Bazaruto National Park, which is also an EBSA site (Save river to San Sebastian). At the Saver river mouth, mangroves was estimated to be as much as 14 500 ha; (2) Inhambane and Morrumbene Bay, with around 4 000 ha (Amone-Mabuto 2017), being part of the Morrumbene to Zavora EBSAs; (3) the Limpopo river estuary, with some 928 hectares (Bandeira & Balidy 2016) and (4) Maputo Bay, with approximately 18 000 ha (Ferreira et al., 2014). Maputo Bay is the second most important fishing ground of the country, and it is known that mangroves play a very important role in supporting shrimp and fish fisheries. These mangroves are also part of an EBSA site (Incomáti River to Ponta do Ouro).

Mangroves in **South Africa** are patchy, limited to the provinces of Kwazulu-Natal and the Eastern Cape, from Kosi Bay (near the border with Mozambique) down to the Nahoon Estuary and Tyolomnqa Estuary. The total area of mangrove forests is estimated in of 1 672 ha (Adams and Rajkaran 2020), with the most important formations occurring in Kosi Bay, Santa Lucia and Mfolozi, Richards Bay, Mngazana Estuary (118 ha) and the Mhlathuze Estuary (the largest formation of the country with ~ 793 ha) (Adams and Rajkaran 2020). Mangroves at Nahoon Estuary were initially planted in 1969 and more recently, mangroves were planted at Tyolomnqa Estuary which are the now the most southern mangroves on the east coast of Africa. In terms of species distribution, six species of mangrove can be found in South African mangrove forests, which are: *Avicennia marina*, widely distributed up to the southernmost limit Nahoon and Tyolomnqa estuaries; *Bruguiera gymnorhiza* and *Rhizophora mucronata*, which can be found at temperate latitudes; *Ceriops tagal*, *Lumnitzera racemosa* and *Xylocarpus granatum* with more limited distribution, and can be found only at Kosi Bay.

Madagascar has the second largest mangrove area in the WIO region which accounts to 2% of global coverage, estimated at 205 900- 210 000 ha (Fatoyinbo & Simard 2013, Jones et al. 2015). The west coast encompasses more than 98% of the cover, while the remaining 2% can be found on the north-east coast. The major formations occur in the

estuaries of major rivers such as the Mahajamba forests (the largest of the country), the Ambaro-Ambaja Complex and Ambaro. Ambaro-Ambanja with estimates of 25 901 ha, Mahanjamba 26 678 ha, Ambaro-Ambaja 25 902 ha, Amabaro 18 490 ha (Ratsimbazafy et al 2016), Table 2 below details over 50% of mangrove area in Madagascar.

Table 2. Major mangrove areas in Madagascar, covering over 50% of the country area (Ratsimbazafy et al 2016).

Location	**Zone**	**Area (ha)**
Ambaro	North	18 490
Tsiribihina	Central West	12 197
Ambaro-Ambanja	North West	25 902
Mahanjamba Bay	North West	26 678
Antsohihy	North West	13 838
Tamboharano	Central west	13 418

The **Seychelles** has an estimated area of 2 500 ha (Appadoo *et al*. 2016) with mangroves here occurring on 17 islands. The largest area is found in the Aldabra atoll, comprising over two thirds (2000 ha) of the total mangrove area of the country (Spalding at al 2010). *Avicennia marina* is the most common species occurring in those areas, followed by *R. mucronata*. Other species are *C. tagal*, *B. gymnorhiza*, *L. racemosa*, *X. granatum* and *Sonneratia alba* (Appadoo *et al.* 2016). Silhouette, Praslin and La Digue have important areas of mangroves. Faunal diversity is also high, with several reported species of crab, fish and birds.

The Comoros archipelago with some 105 ha have mangroves dispersed around Moheli, Grande Comoro and Anjouan Islands, with the first with the largest assemblages (Appadoo *et al.* 2016) (Table 3).

Table 3. Mangrove area and species within Comoro Archipealgo (source Appadoo *et al.* 2015).

Island	Area (ha)	Locations	Species per Island
Mohéli / Mwali	91	South coast, Damou, Mapiachingo, Bangoi Kouni, Chindini	*A. marina, B. gymnorhiza, C. tagal, H. littoralis, L. racemora, R. mucronata, S. Alba,*
Anjouan / Nzduani	8	Bimbini, Chissioini	*A. marina, B. gymnorhiza, R. mucronata, S.alba*
Grande Comore /Ngazidja	6	Domoni, Hahaya, Ouroveni, Iconi Moroni, Voidjou	*A. marina, R. mucronata*

Mauritius has 145 ha of mangroves (Government of Mauritius 2009) distributed between Mauritius main island (mostly in east coast) and Rodrigues, this last one with estimated 24 ha of mangroves forests, originally thought to be planted. *Bruguiera gymnorhiza* and *R. mucronata* are reported to be the only mangrove species in Mauritius. Juan da Nova Island (France) in Mozambique Channel has 700 ha of mangroves as per the global assessment (Spalding et al 2010).

3. Key species associated with the habitat, with identification of nature of association

The WIO region is the second area in the world, after South East Asia, with the most diverse mangroves (Spalding et al. 2010). Nine mangroves species occur in WIO: *Avicennia marina, Bruguiera gymnorhiza, Ceriops tagal, Heritiera littoralis, Lumnitzera racemosa, Rhizophora mucronata, Sonneratia alba, Xylocarpus granatum and Xylocarpus molucensis* (Bosire et al., 2016). All nine species can be found in Kenya, Tanzania and Mozambique; while *X. moluccensis* is excluded from Madagascar only. Comoros and Seychelles have 7 species, Somalia and South Africa have 6, and Mauritius has the lowest diversity of true mangrove species with just 2 species(Spalding et al 2010, Mumuli et al. 2010, Lugendo 2015) (Table 4)

Table 4. Mangrove area coverage and species assemblages in WIO. Sources: Mumuli et al 2010, Spalding et al 2010; Bosire et al 2016, GoK 2017, Rajkaran & Adams 2016, Adams and Rajkaran 2020)

	Mangrove area (ha)	**Am**	**Bg**	**Ct**	**Hl**	**Lr**	**Rm**	**Sa**	**Xg**	**Xm**
Somalia	3 000	X	X	X			X	X	X	
Kenya	45 560	X	X	X	X	X	X	X	X	X
Tanzania	80 900	X	X	X	X	X	X	X	X	X
Mozambique	305 400	X	X	X	X	X	X	X	X	X
South Africa	1 672	X	X	X		X	X		X	
Madagascar	205 900	X	X	X	X	X	X	X	X	
Seychelles	2 500	X	X	X		X	X	X	X	
Mauritius	145		X				X			
Comoros	91	X	X	X	X	X	X	X		

Mangrove associated species in the WIO include the fern *Achrosticum aureum*, palm *Phoenix reclinata* and other woody trees and shrubs such as *Brexia madagascariensis*, *Hibiscus tiliaceus*, *Terminalia catapa* and *Thespesia polpunea*. Among the herbs and succulents, Pemphis acidula, *Salicornia sp*., *Suaeda monoica, Sesuvium portulacastrum*, *Arthcrocnemon* sp., etc.

- **Importance**

a. Ecological importance

The ecological importance of WIO mangroves goes from coastal protection to biodiversity maintenance and mitigation and adaptation to climate changes (Bosire et al. 2016). Mangrove forests sustains extensive fisheries in addition to being directly used mainly as building, material and firewood.

Mangrove degradation in areas such as Gazi Bay, Vanga (Kenya) and Nhangau (Mozambique) had led to coastal erosion and loss of temperature regulatory services, with severe impacts on the housing of local communities and loss of other infrastructure (Bosire et al. 2016). The value of shoreline protection in Kenya was estimated in USD 1 300 ha/year (Kairo et al., 2009). In south-central Mozambique it was also demonstrated that a healthy mangrove can be an effective protection from cyclones and other climatic events, as the mangroves growing along the Save river mouth protected the Nova Mambone Village during the category 4 Eline cyclone in 2000 (Massuanganhe et al. 2015; Macamo *et al.* 2016). Mangrove forests in WIO buffer surge tides, storm water and protect the coastal zones as well. Beira town in central Mozambique, known as being below seawater level, is crossed by a Chiveve small River and, recently its surrounded mangrove river bed was widened for town protection against storm water and extreme tides.

Mangrove can store up to 3-5 times the amount of carbon accumulated by other terrestrial vegetation systems. African mangrove forests carbon storage was systematized by Fatoyinbo & Simard (2013) (See Table 5 below).

Table 5. Mangrove area and biomass in WIO countries (source: Fatoyinbo & Simard 2013)

Country	**Area (Ha)**	**Total biomass (Mg)**	**Mean biomass (Mg ha^{-1})**
Kenya	19 200	2,294,820	119
Madagascar	205 900	24,856,900	121
Mozambique	305 400	30,974,100	101
Somalia	3 000	436,907	143
South Africa	1 200	40,018	100
Tanzania	80 900	11,037,800	136

Mangroves sustain tangible livelihoods especially considerable ecotourism mostly in Kenya and Tanzania. Madagascar and Mozambique with larger stands of mangroves in WIO, sustains largest fisheries such as Sofala Bank (central Mozambique) with high

fisheries production. Similarly to Maputo Bay, with 18000 hectares of mangroves and around 4000 hectares of seagrasses enabling these areas to be the second largest fishing ground in this country. Island mangroves support biodiversity, provide shoreline protection and water quality control, among other ecosystem services. Mangroves are also sites for ecotourism development (Appadoo et al. 2016).

WIO region process around 25 EBSAs and over 3/4 of these have mangroves forests.

Table 6. EBSAs containing mangrove forests in the WIO region

EBSAs	**Country**	**Mangroves**	**Main areas /Observation**
1.The Great Whirl and Gulf of Aden Upwelling Ecosystem	Somalia	X	With historical mangroves, now extinct
2.Lamu-Kiunga	Kenya	X	Northern and southern swamps
3.Watamu area	Kenya	X	Mida creak
4.Pemba- Shimoni-Kisite	Kenya and Tanzania	X	Pemba
5.Tanga Coelacant Marine Park	Tanzania	X	Tanga
6.Zanzibar (Unguja)-Saadani	Tanzania	X	Unguja
7.Rufiji-Mafia-Kilwa	Tanzania	X	Rufiji
8.Northern Mozambique Channel	Tanzania-Mozambique-Comoro - Madagascar - Seychelles(Aldrabra region)	X	Rovuma, Ibo-Quissanga.Messalo, Pemba Bay

9.Pemba Bay-Mtwara	Tanzania-Mozambique	X	Ruvuma,Messalo, Ibo-Quissanga Pemba Bay
10.Baixo Pinda-Pebane (Primeiras & Segundas Islands)	Mozambique	X	Memba, Nacala, Mussoril, Angoche, Ligonha & Pebane
11.Quelimane to Zuni River (Zambezi River Delta)	Mozambique	X	Zambezi Delta
13.Save River to San Sebastian (Central Mozambique)	Mozambique	X	Save River, Govuro River, San Sebastian
14.Morrumbene to Zavora (southern Mozambique)	Mozambique	X	Inhambane Bay Incl. Morrumbene
15. Incomati River to Ponta do Ouro (Southern Mozambique)	Mozambique	X	Maputo Bay
16. Delagoa Shelf Edge, Canyons and Slope	Mozambique-South Africa	X	ST Lucia to regions near the border of Mozambique
17.Natal Bight	South Africa	X	Areas north of Durban city
18Protea Banks and Sardine Route	South Africa	X	Southern most limit of mangrove at Nkqunibi River (Also Nahoon)
19.Mahe, Alphonse and Amirantes Plateau	Seychelles	X	Mahé Island
20. Blue Bay Marine Park	Mauritius	X	Scatered R. mucornata and B. gymnorhyza

The EBSAs concept followed strictly seven criteria namely (i) Uniqueness or rarity, (ii) Special importance for life-history stages of species (iii) Importance for threatened, endangered or declining species and/or habitats, (iv) Vulnerability, fragility, sensitivity, or slow recovery , (v) Biological productivity, (vi) Biological diversity and (vii) Naturalness. Unique or rare mangrove could be those small and limited area as those in South Africa and small state Islands (Seychelles, Mauritius, Comoros). Somalian mangroves need more attention of research as they are quite unknown especially those of the northern and central regions, nevertheless believed to sustain activities such as fisheries.

Social and economic importance

Mangroves are important sources of livelihood for coastal communities throughout the WIO region (Taylor *et al.* 2003; Bosire *et al.* 2016). They provide building material, food, animal fodder, tannins, etc., and are sites for the development of several activities that provide livelihood to the communities (fishing, honey production, salt production among others). For example, it was estimated that mangroves provide 70% wood requirements for the communities in coastal areas in Kenya (Bosire *et al*. 2016). Mangrove pastoralism is quite common in countries like South Africa, also reported for Somalia, where it even represents a threat to forests conservation (Mumuli *et al.* 2010, Rajkaran and Adams 2016). Mangroves are also intrinsically related to the community's cultures. For example, in Somalia the coastal communities from the South Centre obtain frankincense from mangroves while in Mozambique and Kenya mangrove ecosystems are cultural sites where traditional healers perform rituals (Taylor *et al.* 2003).

Mangroves also contribute in a great manner to local economies through the harvesting and commercialization of its products. For example, the communities from the Zambezi delta in central Mozambique claim that the commercialization of mangrove products and mangrove related activities are their primary source of livelihood (Machava-António 2018). Country wise mangroves offer significant economic gains to the country's' economies, by supporting different types of fisheries.

Mangroves of South Africa provide important social and ecological services to the estuarine communities were they occur. The most common uses are wood extraction for

timber, building material, fish traps and fuelwood. Other uses include recreational fishing, and tourism (bird-watching, boat trips, etc.). Mangroves are also sites of high biodiversity of fauna including birds, hippos, crocodiles and terrestrial visitors such as the blue duiker, bush pig and others. However, overexploitation, unsustainable use and coastal development have led to mangrove loss and degradation, particularly in those forests outside protected areas such as Durban Bay were harbour and industrial development caused the loss of 440 ha (Adams and Rajkaran 2020). Impacts on mangroves include livestock browsing, agriculture, pollution, sand mining and also climate change (Rajkaran and Adams, 2016). Regardless these losses, mangrove area seems to be increasing in some areas, particularly in remote areas and those within protected areas, such as in northern Kwazulu-Natal province (Spalding et al., 2010). Mangroves on the east coast of South Africa are restricted to three EBSAs Delagoa Shelf Edge, Canyons and Slope, Natal Bight and Protea Banks and Sardine Route; most of the areas is located in the first ones.

In the Seychelles mangroves provide fishing ground, shoreline protection, fishing bait and ecotoursism. The bark of *R. mucronata* is traditionally used to polish wooden floors.

- **Threats**

Status

Kenya mangroves are both reported being impacted by natural and anthropogenic impacts causes. Between 1985 and 2009, the country lost about 40% (Table 7) of its mangrove

Cover, about 450 ha of mangrove area loss per year. Mangrove loss tends to be pronounced in urban setting than rural, as reported in other countries too, e.g. Mozambique.

Table 7. Kenya mangrove forest area and proportion of degradation

County	**Mangrove area (ha)**	**Degraded mangrove (ha)**	**% Degraded area**
Lamu	37,350	14,407	38.6

Tana River	3,260	1,180	36.2
Kilifi	8,536	3,422	40.0
Mombasa	3,771	1,850	49.1
Kwale	8,354	3,725	44.6
Total (ha)	**61,271**	**24,585**	**40.1**

Loss and degradation of mangrove habitat have been identified as mainly caused directly and indirectly by population pressure, overexploitation as well, poverty and inequality. KMFRI data indicate over 80% loss of mangroves around Mombasa County.
Historical degradation of mangroves in Somalia is yet to be assessed.
Accuracy of mangrove mapping is needed to ascertain historical mangrove lost of 6%, 04% and 8% for Tanzania, Madagascar and Comoros respectively (Wang *et al*. 2003, Lugendo 2015). Similar precision estimates may be necessary for some of the mangrove stands of Mozambique.

Significant deforestation of mangroves occurred in Madagascar, Mozambique and Tanzania. Anthropogenic impacts in Mozambique is related with deforestation for firewood, for shrimp aquaculture, historical salt pans production and to a small extent to a port development in Nacala Bay (Macamo *et al.* 2016). Seychelles mangrove area maintained stable as stated by Lugendo (2015).

Extreme events impacts are those related with impacts of cyclones and floods and, within WIO region Madagascar and Mozambique experiences on yearly basis several cyclones, tropical depressions and resulting in excessive rains, floods and sedimentation or erosion impacting on both mangroves and seagrass beds. Recent studies in Save River estuary (central Mozambique) documented extensive mangrove die back due to mainly the 2000 Cyclone Eline that brought wind and sedimentation as well as an added prolong flooding and drawing of mangrove stands (Massuanganhe *et al.* 2015, Macamo *et al.* 2016). Limpopo River in southern Mozambique is another example of mangrove destruction due

to prolong flooding up to 45 days and extensive sedimentation impacting at least half of the original mangrove stand (Bandeira and Balidy 2016).

Mozambique has 305 400 ha of mangroves. Its condition or status are analysed for 11 sites in all regions of Mozambique. The Table 8 below indicates areas were mangroves stands have been impacted but also expanding. The results show area increase in several locations, but also areas where there is significant loss are notable. In the province of Cabo Delgado, for example, there is a general tendency to increase the area (Ferreira et al., 2009), but there are specific places within this province, such as Olumbi, where there is a great reduction of the area and degradation of its condition in general (Macamo et al., 2018). In central Mozambique, remote areas such as the Zambezi Delta experienced an increase of about 10% between 1994 and 2003 (Shapiro et al. 2015), while the urban area on the Chiveve River (Beira city) suffered a loss of about two-thirds of its area for rehabilitation of the canal to increase its flood regulation capacity (Machava António 2018). In the south of the country, the highest losses were recorded in the Save river mangrove and in the Limpopo estuary, being associated with cyclone Eline and floods of 2000, respectively (Bandeira and Balidy 2016; Macamo *et al.* 2016). It is important to note that area estimates alone may not indicate the ecological condition of the forest. For example, it was estimated that Save mangrove cyclone Eline caused the loss of about 28% of the mangrove area, but the NDVI estimate shows that up to 50% of the entire forest area was impacted without total destruction (Macamo *et al.* 2016). Therefore, it is recommended that mapping studies be accompanied by assessments of forest structure and condition on the ground.

There are other areas throughout the country where there are reports, of non-sustainable exploitation of mangrove wood. Some of these locations are the south of the city of Quelimane in the province of Zambézia and the south of the city of Beira in the province of Sofala.

Table 8. Mangrove status, trend and impacts

Loctions	Regions of Moçambique	Period of the study	Area (km^2)		% of change	Main impacts	Source
			T_0	T			
Cabo Delgado	Norte	1995-2005	325	369	**+13.5**	Uso local como combustível lenhoso e material de construção	Ferreira *et al.* 2009
Olumbi	Norte	1991-2013	7.24	5.56	-**25.4**	Uso lenhoso e material de construção, colheita de invertebrados, abertura de caminhos	Macamo *et al.* 2018
Baia de Pemba	Norte	1991-2013	21.43	31.30	**+23.1**	Aquacultura, salinas, corte para uso local	Macamo *et al.* 2018
Parque Nacional das Quirimbas	Norte	1991-2013	112.44	123.48	**+9.8**	Corte para uso local, sedimentação natural	Nicolau et *al*. 2017
Baía de Nacala (área do novo porto)	Norte	2013-2016	0.365	0.276	**-24.9**	Construção de um novo porto	On-going study
Delta do Zambeze	Centro	1994-2013	333,11	370.34	**+10.1**	Erosão, causas naturais	Shapiro *et al.*, 2015
Canal do Chiveve	Centro	2016-2017	0.23	0.1	**-43.5**	Restauração do canal	Uacane e Ombe 2016; obs. Grupo

							mangais do DCB
Mangal do Save	Sul	1999-2014	147.44	106.66	**-27.7**	Ciclone e cheias no ano 2000	Macamo *et al* 2016
Estuário do Limpopo	Sul	1999-2001	9.28	3.82	**-58.8**	Cheias no ano 2000	Bandeira and Balidy 2016
Estuário do Incomáti	Sul	1991-2003	42,31	44.51	**+5.1**	Uso local	Macamo *et al.* 2015
Baía de Maputo	Sul			175.96		Expansão urbana, uso local	Paula *et al.* 2014

In South Africa, overexploitation, unsustainable use and coastal development are leading to mangrove loss and degradation, particularly in those forests outside protected areas (Table 9). Examples can be seen in Durban Bay were harbour and industrial development caused the loss of 200 ha (Adams et al., 2005); and in other minor estuaries where mangroves were completely lost due to overexploitation and estuarine closure (Rajkaran et al. 2009). Other major human induced impacts on mangroves include livestock browsing, agriculture, pollution, sand mining and water abstraction (Rajkaran and Adams, 2016), while climate change is the most prominent natural threat (Rajkaran and Adams 2016). The Table below summarise mangrove condition in South Africa

Table 9. Mangrove status and trend in South Africa's main forests (more than 10 ha). Sources: Adams and Rajkaran 2020, Rajkaran and Adams (2016); Rajkaran (2011); Spalding et al. (2010). * protected in conservation areas.

Site	**Area (ha)**	**Overall condition**	**Trend**	**Main threats**
Durban Bay	13.4	-	Increasing	Pollution Coastal development

Mgeni	26.8	Good*	Decreasing	Pollution Sand mining Water abstraction Coastal development
Mlalazi	60.7	Good*	Increasing	Mouth closure
Mhlathuze	793	Good*	Increasing	Wood harvesting Sand mining Water abstraction Coastal development
Richards bay	171	Good*		Pollution Coastal development
Mfolozi	60.7			Agriculture Field fires
St lucia	287.7	Good*		Sand mining Water abstraction
Kosi bay	71	Good*		Wood harvesting
Nqabara	11.8			Trampling, Browsing Wood harvesting Agriculture Bush encroachment Pollution Field fires
Xora	25			
Mtata	31			
Mtakatye	10			
Mngazana	118			
Mntafufu	12.4			

Historical records indicated that Madagascar have lost more than 20% of its mangrove forest between 1990 and 2010 (Jones et al. 2016), however some areas experienced slight increase due to accretion (for example, the Mangolovo region increased its area from 981 ha to 1172 between 2000 and 2010; and Sohany increased from 1984 to 2025 within the same period). The main causes of mangrove loss include urban expansion, agriculture, aquaculture, wood harvesting and human population growth and siltation. Natural causes such as cyclones (in areas such as Tsiribihina and Mangoky) and

decrease in precipitation (ex. in the protected area of Ambodivahibe) have also been documented (Ratsimbazafy *et al.* 2016)

Table 10. Mangrove trend comparison between 1990 and 2010 in Madagascar. [1]Biosphere Reserve of Sahamalaza; [2]National Park of Baly Bay; [3]National Park of Kirindi Mitea

Site	**Area (ha)**	**Overall condition**	**Trend**	**Main threats**
Mahanjamba Bay	26677	-	Stable	Conversion to agriculture Logging Conversion to aquaculture Urban development Cyclone impacts
Ambaro-Ambaja Bays	25664	-	Decreasing	
Tsirihibina and Manambolo Deltas	20242	-	Decreasing	
Antsohihy	13838	-	Decreasing	
Tambohorano	13418	-	Decreasing	
Sahamalaza	10956	-	Decreasing[1]	Rice farming
Mahavavy su Sud	10654	-	Stable	
Mahajanga	9574	-	Decreasing	
Mangoky	9431	-	Decreasing	Cyclone impacts
Morondava-Bosy	6213	-	Decreasing	Grazing and browsing Wood harvesting
Kamendriky-Tsilambana	5924	-	Decreasing	
Mahabo-Andramy	5905	-	Increasing	
Maintirano	5900	-	Decreasing	
Boeny	3867	-	Stable	

Baly-Soalala	3507	-	Decreasing[2]	
Besalampy	3287	-	Decreasing	
Rigny-Irody	3231	-	Stable	
Morombe	3035	-	Decreasing	
Mariarano	2330	-	Decreasing	
Narinda	2036	-	Decreasing	
Sohany	2025	-	Decreasing	
Belo sur Mer	1917	-	Decreasing[3]	
Vilamatsa	1847	-	Stable	
Kabatomena	1529	-	Decreasing	
Reharaka	1406	-	Decreasing	
Assassins	1360	-	Decreasing	
Manampatra	1327	-	Decreasing	
Morovasa	1199	-	Decreasing	
Mangolovo	1172	-	Decreasing	
Ambondrombe	1109	-	Decreasing	

Small Island States analysis is provided in the Table 11 below. Generally mangrove are on a decrease, unless in protected areas where it appears stable.

Table 11. Mangrove status and trend in Small Island States. Sources: Appadoo et al. 2016; Spalding et al. (2010). * protected in conservation areas.

Country	Site	Area (ha)	Overall condition	Trend	Main threats
Comoros	Moheli	91		Decreasing	Wood harvesting, Water abstraction for agriculture, Sand deposition
	Anjouan	8			
	Grande Comoro	6			

					Wastewater pollution, water abstracton, Infrastructure development Urbanization Sand, coral extraction
Mauritius	Main Island	121		Increasing from 1980 till 2009, then stable or decreasing	Wetland destruction, coastal development, pollution
	Rodrigues	24 (planted)		Stable	
Seychelles	Mahé	100		Decreasing	Land reclamation Pollution Dredging Agriculture runoff Water abstraction (hotels, tourism) Wastewater discharge
	Cousin	0.8			
	Aldraba group	2000	Conservation area		
	Port Glaud and Port Launay	20	Conservation area		
	Anse intendance	13			
	Anse a la Mouche	10			

- **Threat level**

Mangroves in Seychelles are usually well conserved however reports indicated threatened by land reclamation, pollution by solid waste, rubbish and chemicals specially at Mahé Island (Apoadoo et al 2016). Coast development, overexploitation of mangrove pools and grazing are major threats to South Africa mangroves. Climate change may also threat of facilitate mangrove expansion in new sites as well as its area increase in already existing sites. Mauritius mangroves might be threatened by its clearing for coastal development; past threat were sugar cane pollution on effluents. Comoro mangroves are threatened by deforestation and water abstraction of freshwaters upstream as well sand deposition and wastewater pollution (Appadoo et al 2016)

Kenya mangroves are threatened by mostly climatic issues such as heavy rains sediment deposition as Kitheka *et al.* (2002) has reported widespread mangrove dieback due to heavy rains. Tanzania mangroves have being impacted due to harvesting and conversion of mangrove forests into rice farming in Rufiji Delta; construction of salt plans have impacted mangroves in Tanga, Bagamoyo and Mtwara. Climatic impacts such as flooding and related sedimentation appears being also important issues driving mangrove degradation in Tanzania (Mangora *et al.* 2016).

Mozambique mangroves area threatened by urban expansion and development especially in population centres, aquaculture and salt pans development mainly.

Climate change impacts are those related with impacts of cyclones and floods. Within WIO region Madagascar and Mozambique experiences on yearly basis several cyclones, tropical depressions and resulting in excessive rains, floods and sedimentation or erosion impacting on both mangroves and seagrass beds. Central Mozambique was badly hit by Category 4 Cyclone Idai made landfall in Beira port town on May 14, 2019 (Figure 3), and was the deadliest tropical cyclone recorded in the South-West Indian Ocean and the second deadliest in the Southern Hemisphere. It affected 3 million people (at least 1300 dead) and infrastructure damages amount to more than USD 2 billion. A preliminary aerial survey was conducted a month after the cyclone. Preliminary results of this assessment

show that mangroves were severely impacted by the cyclone Idai. Near Beira the mangroves grow in the south around Púnguè and Buzi estuaries, but they also extend further south to Buzi village and to Govuro near Bazaruto Archipelago; and north of Nhangau (north of Beira city) and beyond to near Zambezi river estuary region. These mangroves suffered from storm surges, wind action and inundation, causing mangrove death, mainly from drowning. However, the impacts were distinct. South of Beira, a rather sparsely populated area, and the mangroves grow extensively, with minimal human impact. Tree defoliation appears to be the main impact, although many trees also fell with the wave and wind action brought by Cyclone Idai. Damages were extensive, giving the forest a greyish appearance, and the tallest trees were more impacted. North of Beira more populated with mangroves and intensively exploited for wood. These forest appears mostly shrubby and it suffered less with the impacts of cyclones with exception to cyclone Impacts accentuated in the frontal mangroves and in the few tall remaining mangrove stands. Just after the cyclone mangrove logging intensified as people needed wood to rebuild their houses. Mangrove logging (including for charcoal production) was also seen as a means to increase family income in the post-cyclone recovery.

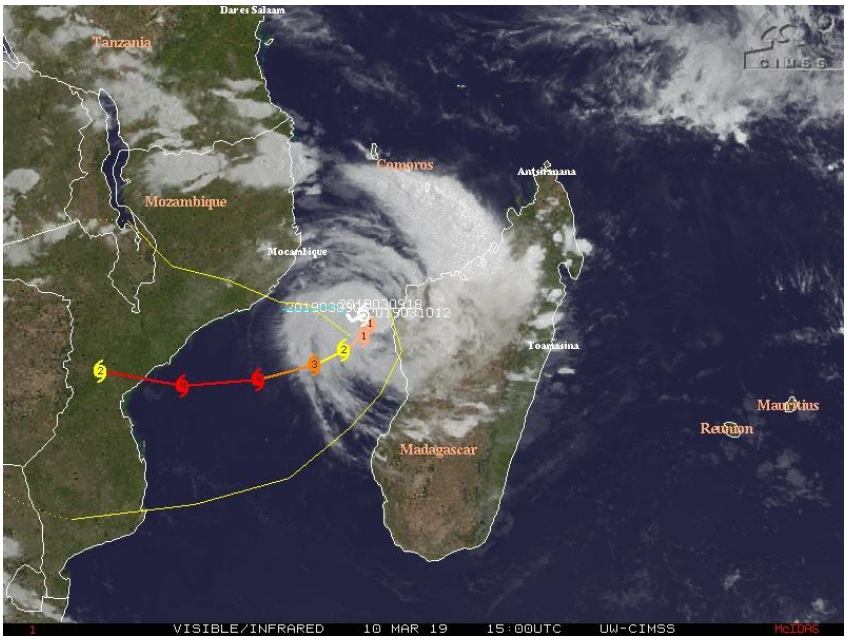

Figure 3. Overview of Satellite image of Cyclone Idai, of March 2019.

Recent studies in Save River estuary (central Mozambique) documented extensive mangrove die back due to mainly the 2000 Cyclone Eline that brought wind and sedimentation as well as an added prolong flooding and drawing of mangrove stands (Massuanganhe *et al.* 2015, Macamo *et al.* 2016). Limpopo River in southern Mozambique is another example of mangrove destruction due to prolong flooding up to 45 days and extensive sedimentation impacting at least half of the original mangrove stand (Bandeira and Balidy 2016). Extreme events such as floods are regularly reported in the coastal towns of Pemba town, Nacala, Quelimane, Beira, Inhambane and Maxixe, and Maputo city.

Cyclone Kenneth (Figure 4) sustained significantly damage in the Comoros, Mozambique and Tanzania. 52 people died due to this cyclone. Kenneth Category 4 Cyclone was the most intense land falling tropical cyclone (on April 25, 2019) in the recorded history of Mozambique (https://en.wikipedia.org/wiki/Cyclone_Kenneth). Known impacts of this in mangroves were reported out around Ibo, northern Mozambique however a detailed assessment on mangrove impacts of this cyclone in Comoros, Mozambique and Tanzania are yet to be undertaken.

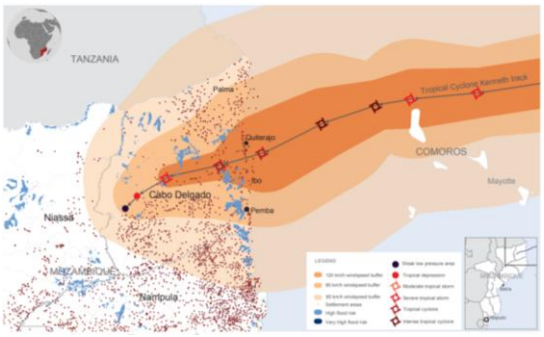

Figure 4. Overview of Cyclone Kenneth (source: UN Office for Coordination of Humanitarian Affairs.

The main causes of mangrove loss in Madagascar include urban expansion, agriculture, aquaculture, wood harvesting and human population growth and siltation. Natural causes such as cyclones (in areas such as Tsiribihina and Mangoky) and decrease in

precipitation (ex. in the protected area of Ambodivahibe) have also been documented (Ratsimbazafy et al 2016).

Somalia is reported as having historical mangroves on its northern coast of Indian ocean (Spalding et al 2010). Fewer mangrove stands exists in the Somalia south coast, near the border with Kenya and may be already threatened therefore some form of protection and reinforcement might be needed.

Mangroves in South Africa have been lost from 10 temporarily closed estuaries, these represented small areas of mangroves, with losses due to mouth closure and increasing water levels. In Kwazulu-Natal; agriculture (sugar cane), mouth closure, and poorly place transport infrastructure are the main drivers for mangrove loss in small systems. In the Eastern Cape, unsustainable harvesting, cattle browsing and changes in mouth conditions are the main threats. Currently and into the future St Lucia/Mfolozi may experience mangrove losses due to freshwater inflow and siltation (Adams and Rajkaran 2020).

- **Existing Protection level**

Mangrove protection level in non-existent in Somalia

Kenya mangrove enjoys protection within Kiunga Marine National Reserve, Watamu Marine National Park, both UNESCO MAB ; Mombasa National Park, Mombasa national Reserve and Gazi Mokoko Pamoja communities area (Spalding et al 2010).

In Tanzania, from north to south, mangroves area protected within 10 protected areas (Spalding et al 2010)

- Forest Reserve # 10
- Forest Reserve # 11
- Pemba Channel Conservation area
- Saadani National Park
- Chumbe Island Coral Park (CHICOP)

- Marine Sanctuary and Forest Reserve
- Menai bay Conservation area
- Fundu Yasini Marine Reserve
- Dar Es Salaam marine Reserve
- Mbudya Marine Resreve
- Rufiji-Mafia-Kilwa Marine Park (Ramsar)
- Mnazi Bay-Ruvuma Estuary Marine Park

Mozambique possess the following protected areas with mangroves:

- Quirimbas National Park (also UNESCO MAB, declared in 2018)

- Area of Environmental Protection of the Archipelago of Primeiras e Segundas Islands

- Marromeu Reserve (Ramsar Site)

- Bazaruto Archipelago National Park

- Pomene Reserve

- Ponto do Douro Partial Marine Reserve

Details in terms of area coverage per PA, species and importance and threats comes in Table 11 below.

Tabela 11. Mangroves and conservation areas in Mozambique (source: Balidy et al. 2005; DNAC 2011, MITUR 2014, ANAC 2016a, ANAC 2016b, Diaz et al. 2016, Nicolau et al. 2017)

	Area (Km^2)	**%**	**Species diversity**	**Uses and threats**
Total protected area	318.1	100	8	-
Bazaruto Archipelago National Park	0.51	0.16	-	Sustainable local use is allowed. Threats: illegal cutting, extreme events

Area of Environmental Protection of the Archipelago of Primeiras e Segundas Islands	569.94		6 espécies	
Marromeu National Reserve	147.4	46.33	5	Mangroves appears intact here given also remoteness.
Pomene Reserve	1.57	0.49	7	The forests are quite intact here. Cyclone Eline (in 2000) impact, now mentioned recovered. Possibe current human use threat
Ponto do Douro Partial Marine Reserve (including Maputo E. Reserve)	45.16	14.20	5	Mangrove at Inhaca and Matutuine region are quit in good shape
Quirimbas National Park	123.48	38.82	6	Main threat is the local use (for house and boat construction), however tolerated/allowed in specific areas.
Area of Total Protection of San Sebastião	-	-		Mangrove mentioned being pristine

South Africa mangrove protected areas are:

- Kosi bay (Ramsar
- Great Saint Lucia Wetland Marine Park (Ramsar and World Heritage Site)
- Umlalazi Nature reserve
- Beachwood Mangroves Nature Reserve
- Umtamvuma Nature Reserve
- Mkambati Wildlife Reserve
- Hluleka Marine Sanctuary
- Dwesa-Cwebe Nature Reserve

Madagascar conservation areas with mangroves forests are:

- Baaie de Baly National Park
- Kirindy Mitea National Park

Seychelles enjoys considerable protection specially the occurring in Aldabra region (2000 Ha). Mahé island mangroves appears in good condition despite past report of some impacts.

The planted mangroves forests in Rodrigues Island appears protected

- **Priority areas for conservation**

In Somalia, we believe a priority area for intervention in mangrove conservation is to undertake detailed evaluation of mangrove coverage and status. If possible would be desired to carry out a historical evaluation of mangrove status. Somalia mangrove may require approaches for restoration and management especially given reports of past intensive deforestation.

In Kenya, a vibrant mangrove management action plan was recently approved and, having also a Mikoko Pamoja program and a research outputs portfolio for this region (Gazi Bay). These has turned Kenya as an African, also a global model of mangrove endeavour; setting a stage for ensure replication of this elsewhere. Yet listed as priority for Kenya is a desired need to sustain wider community participation and ecosystem based management of mangroves.

Reviving a management action plan comes as a priority for Tanzania. As stated by Mangora *et al*. (2016). Such action plan would need to update the country mangrove area, strengthening reinforcement, involve a wide community's participation in mangrove best practices and increment wider mangrove rehabilitation. Tanzania, also Mozambique has pointed out the need to stablish permanent mangrove areas as treatise for applied research.

Mozambique has recently (in 2020) approved a mangrove management action plan. And, already there is an ongoing restoration activities targets as to follow SDG14.2. Priority is to be given to appropriate techniques for restoration such as in high tide amplitude abandoned shrimp ponds (such as around Zambezi Delta), integration of community based wider approaches in mangrove management and restoration. Integration of blue carbon in management initiatives as part of solution both anthropogenic and natural or climate related impacts. Come to terms with the NDC for Mozambique, as integrated in a climate adaptation portfolio. Issues of reinforcement and wider environmental awareness and education about mangroves are very relevant too. Specifically we list, in Table 12 below a priority activities that can be implemented in specific locations in Mozambique.

Table 12. Priority activity fort selected mangrove locations in Mozambique.

Area	**Province**	**Suggested type of intervention**
Palma (Quionga)	Cabo Delgado	Mapping ad mangrove condition
Olumbi	Cabo Delgado	Restoration, sensitization and environmental education, and good sustainable practices

Mecufi	Cabo Delgado	Restoration of abandoned salt pans (as initiated few years ago)
Angoche	Nampula	Options for possible restoration, sensitization and environmental education, and good sustainable practices
Moma	Nampula	Restoration, sensitization and environmental education, and best sustainable practices
Quelimane	Zambezia	Mangrove mapping and studies of its condition. Continuation of restoration activities, sensitization and environmental education
Inhassungue	Zambezia	Restoration of abandoned aquaculture ponds
Micaune	Zambezia	Mangrove condition and mapping studies
Nhangau	Sofala	Sensitization and good practices
Buzi and Pungue estuaries		Mapping and forest condition
Baía de Inhambane	Inhambane	sensitization and environmental education, and best practices
Distrito de Xai Xai (Fóz do Limpopo)	Gaza	Continuous environmental sensitization and mangrove restoration
Norte da cidade de Maputo	Maputo	Environmental sensitization
Matola	Maputo	Restoration of abandoned salt pans

In South Africa, mangrove forests at Kosi Bay, uMhlathuze Estuary and Mngazana Estuary should be prioritised for protection. Kosi Bay is the only site with all six mangrove species as well mangrove associates. uMhlathuze represents the largest area in the country and mangroves are continuing to increase in that estuary. Mngazana Estuary is the largest forest in the Eastern Cape and is one of the most important estuaries in that province.

Important priority set for Madagascar is to establish a mangrove regulatory and management framework for mangrove management and conservation. Madagascar highlight the need to control current, also future, anthropogenic and natural pressures on mangroves. Highlighted the need to implement community-based mangrove management, ecosystem based management and increment technical capacities in mangrove research and management. Madagascar has also commit themselves to increment MPA incorporating more mangroves forests in the network of MPAs (Ratsimbazafy *et al.* 2018)

- **Recomentations**

National agendas on mangroves has to be re-visited so that is mainstreamed with global platforms such as SDGs its main targets. Mangrove mapping, their socio-economic role and research on impacts and socio-economic role is also an avenue to pursue in WIO. WIO countries assessments and known gaps in knowledge and management and integration of wider society both at local and country level steering discussing tackle wider mangrove management. Regional network such as WIO Mangrove Network and other platform with already integrated analysis about mangrove conservation and management, such as “Save our mangroves now” forms an appropriate avenue for wider discussion on mangrove management and conservation.

Given wider deforestation history in many WIO countries, WIO region needs better to strategize implementation of mangrove restoration strategy together appropriate social adaptation strategies. The region would need to strategize towards mangrove

management following existing assessment and models of vulnerability related to climate events and sea level rise (e.g. Cinco-Castro and Herrera-Silveira 2020; Charrua *et al.* 2020)

In Somalia, basic studies are needed on mangrove condition, occurrence and utilization. This can be linked with the need to design mangrove management for regions in this country. For Tanzania more is needed in terms on updating information on mangrove distribution and restart the previous approved mangrove management plan. Focus to Mozambique is to further document role and impact of climate change on mangrove forests especially in the recent cyclones and; undertake implementation of a recently approved Mangrove Management plan. In South Africa, priority for protection is suggested to mangrove forests at Kosi Bay, uMhlathuze Estuary and Mngazana Estuary. Madagascar might find itself prioritizing reduction of intense mangrove deforestation as reported; further channelled in the 2015 inter-sectorial national committee on integrated mangrove management (Ratsimbazafy *et al.* 2018). An update of mangrove mapping is needed in Mauritius as to strengthen monitoring mangrove stands in several sites in the Island as well as the planted mangroves in Rodrigues island

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