

Chapter 2: EAST AFRICA

Helene Marsh¹, Asma Hadi Awadh², Lea Bernagou³, David Blair¹, Vic Cockcroft⁴, Damboia Cossa⁵, Almeida Guissamulo⁶, Anna Koester⁷, Len McKenzie⁸, Mohamed Omar Mohamed⁹, Ben Anthony Moussa¹⁰, Evan Trotsuk¹¹

¹ College of Science and Engineering, James Cook University, Townsville, Queensland, Australia.

² School of Environmental and Earth Sciences, Pwani University, Kilifi, Kenya.

³ Plan National d'Actions en Faveur du Dugong à Mayotte, Association des Naturalistes de Mayotte.

⁴ Institute for Coastal and Marine Research, Nelson Mandela University, Gqeberha, South Africa.

⁵ Department of Biological Sciences, Eduardo Mondlane University, 257 Maputo, Mozambique.

⁶ Museu de História Natural, Universidade Eduardo Mondlane, Maputo, Mozambique.

⁷ Seychelles Islands Foundation, Victoria, Mahé, Seychelles.

⁸ Centre for Tropical Water and Aquatic Research TropWATER, Cairns, Queensland, Australia.

⁹ Marine and Coastal Research Centre, Kenya Wildlife Service, Mombasa.

¹⁰ Mohéli National Park, Union of Comoros.

¹¹ Bazaruto Archipelago National Park, African Parks, Vilankulo, Mozambique.

Correspondence to: Helene Marsh helene.marsh@jcu.edu.au.

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Regional Findings

East Africa: Kenya, Madagascar, Mayotte, Mozambique, Republic of Mauritius, Republic of Seychelles, Union of the Comoros, United Republic of Tanzania, Somalia

- Hunting and bycatch in fishing nets have caused very serious declines in the dugong populations in East Africa.
- Dugongs are probably extinct in the waters of both Mauritius and Rodrigues and apparently no longer occur in the Comoros outside Mohéli, and in the Seychelles outside Aldabra.
- IUCN listed the East African Coastal ‘subpopulation’ of dugongs as Critically Endangered in 2022.
- Dugongs in East Africa are likely to have limited resilience to extreme events as the genetic differences between individual animals appear to be very low.
- The only location in East Africa where a globally-significant number of dugongs is known to occur is the Bazaruto Seascape in Mozambique. This location has been recognised internationally as an Important Marine Mammal Area and a Key Biodiversity Area.
- Bazaruto dugongs are actively monitored and the threats to them are managed. There is significant community engagement. These programs are very important.
- Scientifically-designed local-scale surveys informed by local knowledge have the potential to provide important new information about dugongs in Zeyla Archipelago in Somaliland, Mohéli, Mayotte and Aldabra Atoll.
- In Madagascar, Nosy Hara Marine Park, Ampobofofo, Bay of Rigny complex and Ambodivahibe are important habitats for dugongs.
- The ‘Northwest Madagascar and Northeast Mozambique Channel’ Important Marine Mammal Area, which spans the waters of Comoros, Mayotte and Northwest Madagascar includes the dugong as one of 22 supporting species.
- Outside the locations named in these Key Findings, dugong numbers are apparently so low that management interventions focussed solely on dugongs are unlikely to attract much support. Interventions designed to protect all marine megafauna are likely to be more successful and groups with an interest in the conservation of marine turtles and small cetaceans should be invited to incorporate dugong conservation in their management actions.
- The areas of seagrass habitat in the region are likely to be underestimated. It will be important to undertake further mapping using modern techniques.
- An updated comprehensive ‘Dugong Conservation Strategy in East Africa’ would be a timely initiative, especially if it included a regional spatial risk assessment of the threats to dugong in areas of local importance.

2.1 Regional Setting

2.1.1 Geographic overview

This chapter considers the status of the dugong along the ~ 13,476 km coast of East Africa from the Djibouti-Somalian border in the Gulf of Aden (11.46° N, 43.26° E) to the Mozambique-South African Border (26.86° S, 32.89° E) and the offshore islands along the East African coast. The region comprises the coastal waters of the following countries, which are ordered here from north to south: Somalia, Kenya, the United Republic of Tanzania (henceforth Tanzania), Mozambique, and the offshore islands of Madagascar, the Union of the Comoros, Mayotte (overseas department and region of France), the Republic of Seychelles (henceforth Seychelles), the Republic of Mauritius (Mauritius and Rodrigues) and Réunion (overseas department and region of France) (Figures 2.1, 2.3, 2.4). Réunion is not considered further in this chapter as it is believed the dugong never occurred there due to the lack of suitable habitat (Kiszka et al. 2004).

This region is the western boundary of the dugong's range in the Indian Ocean and is part of the Tropical Indo-Pacific seagrass bioregion (Short et al. 2007). Estimates of the total areas of seagrass within the region (Figure 2.2), which are likely to be underestimates, are as follows: Somalia (including Somaliland) 10 km² (Allen Coral Atlas 2020); Kenya 680 km² (Traganos et al. 2022); Tanzania 548 km² (Traganos et al. 2022); Mozambique 1,779 km² (Traganos et al. 2022; Bandeira et al. 2014); Madagascar 1,309 km² (Traganos et al. 2022); Comoros 25 km² including Mohéli with 4 km² (Allen Coral Atlas 2020; Poonian et al. 2016; Mayotte 35 km² (Allen Coral Atlas 2020); Seychelles 799 km² (Lee et al. 2023) and Mauritius 30 km² (Turner et al. 2000; Turner and Klaus 2005). The estimate for Mauritius includes Rodrigues with 5 km² (Allen Coral Atlas 2020; Chapman and Turner 2004) (all areas rounded to nearest km², confidence intervals are not available, all estimates with moderate to high confidence).

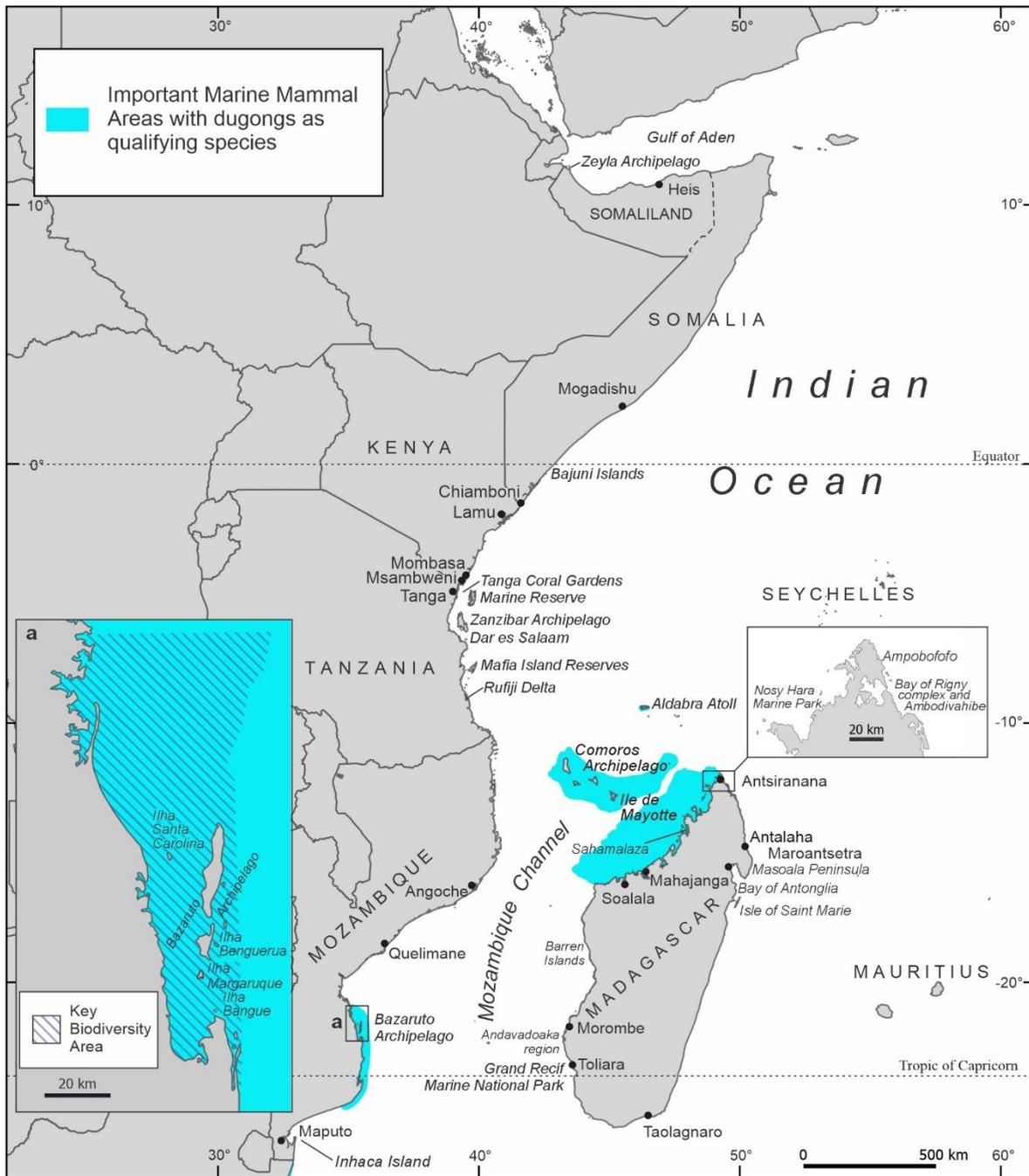


Figure 2.1. Geographic context of East Africa showing placenames mentioned in the text. Dugong Range States are (ordered counterclockwise around the region starting with Somalia): Somalia, Kenya, Tanzania, Mozambique, Madagascar, Comoros, Mayotte, Seychelles, Mauritius and Reunion. Important Marine Mammal Areas with the dugong as a qualifying species are shown in blue. The Key Biodiversity Area is shaded in blue lines. Inset left: Bazaruto Archipelago. Inset right: Nosy Hara Marine Park. Note: Dugongs are unlikely to occur on the open, high energy coast of Somalia between the Gulf of Aden and the Bajuni Islands. Figure created by Adella Edwards; reproduced with permission.

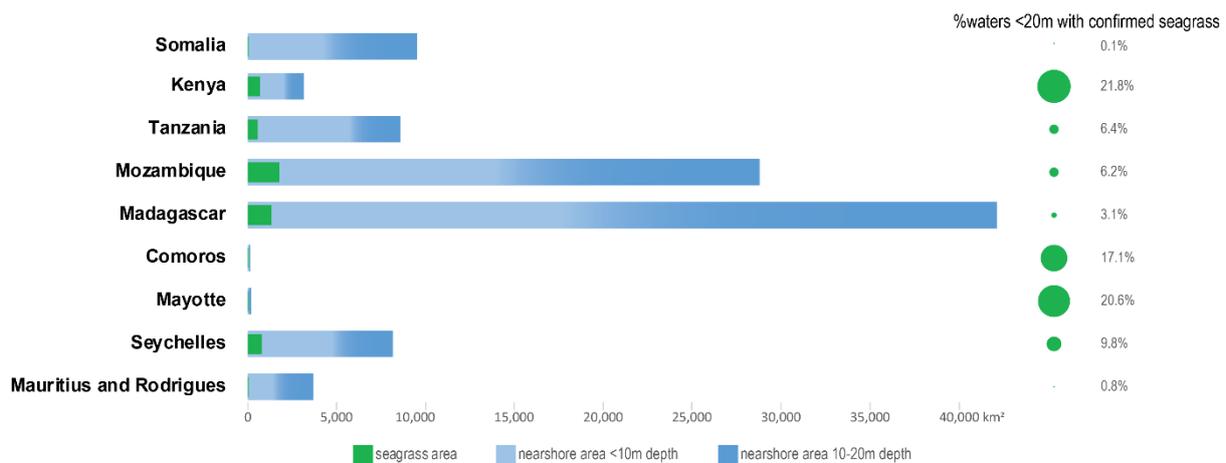


Figure 2.2. Histogram showing the known areas of seagrass and coastal waters < 10m and < 20 m deep for each dugong Range State in the East African region. The areas of seagrass are almost certainly underestimates and do not include reef associated seagrasses. The value for Somalia includes Somaliland; the value for Mauritius includes Rodrigues. The very small areas of water < 20 m deep indicate that Comoros and Mayotte could never support a large dugong population. Figure created by Len McKenzie; reproduced with permission.

Given that the dugong is a seagrass community specialist that eats most available seagrass species (Chapter 1), seagrass area is a crude index of dugong carrying capacity. Thus, this information on seagrass area indicates that it is not surprising that Mozambique currently supports a sizable dugong population (with estimates in the Bazaruto Archipelago of $406 \pm \text{SD } 146$) (Trotzok et al. 2022a) and suggests that the dugong population(s) around Comoros, Madagascar and Mayotte merit further investigation. Dugongs have not been observed in the central or northern regions of the Seychelles. The island groups are separated from the southern region by deep oceanic waters and ~ 1000 km. The dugong population in East Africa is fragmented. The distance along the coast from the Bajuni Islands in Somalia, the northern-most record along the east coast of Africa, to the Zeyla Archipelago near the border with Djibouti is almost 3,000 km (Figure 2.1), further than documented large-scale movements of dugongs of up to 625 km (Deutsch et al. 2022), apart from occasional vagrant animals (Hobbs et al. 2007; Hill-Lewenilovo et al. 2018). While it may be possible for dugongs to move along this coast between Somalia and the Gulf of Aden, dugong abundance appears to be very low in southern Somalia, and it is likely that such movements, if they occur, are rare (Deutsch et al. 2022). Similarly, although it is theoretically possible for dugongs to move between the coastal populations of dugongs in Mozambique and the offshore islands of Aldabra (Seychelles), Comoros and Madagascar, the genetic evidence, albeit limited and excluding Aldabra, suggests that this may be a rare event (see Section 2.2.6).

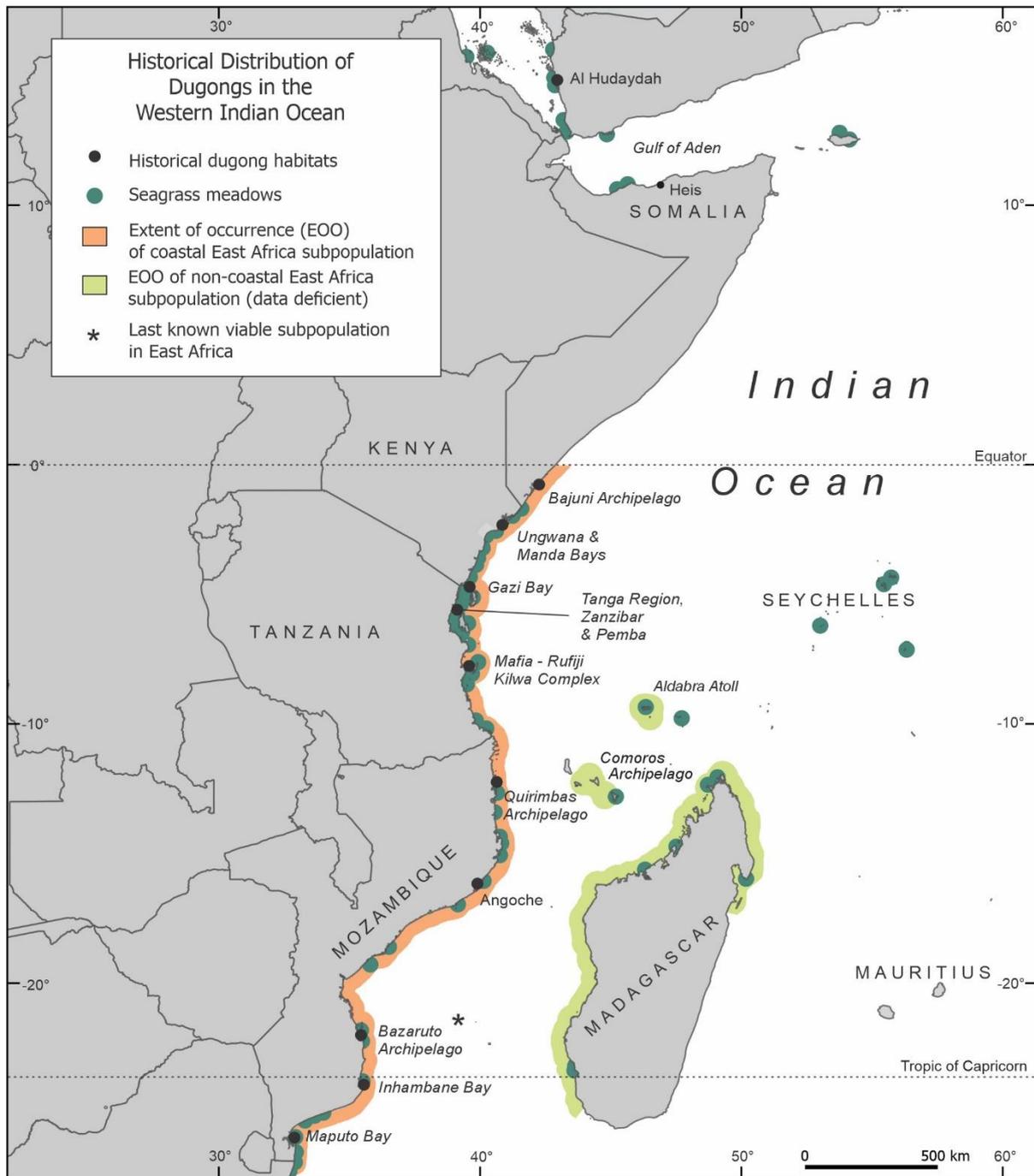


Figure 2.3. Historical distribution of the dugongs and seagrass in the Western Indian Ocean. Modified from Figure 1 Supplementary Information in Trotzuk et al. 2022a and BANP 2022; reproduced with permission. Figure created by Adella Edwards; reproduced with permission.

2.1.2 Geo-political and socio-economic context

This information is provided as an indication of the challenge for each of the various Range States in the region to consider the conservation of dugongs and their habitats in the context of their socioeconomic development needs. The East African region has a population of some 200 million people, increasing at an average of 2.2% p.a. (United Nations 2022). Approximately 35% of the

population (70 million) live within 50km of the coastline; 23% (46 million) within 10 km (Figure 1.x, Chapter 1; Schiavina et al. 2023). These peoples are amongst the world’s poorest (World Population Review 2023). Comoros, Madagascar, Mozambique, Somalia and Tanzania are all classified as Least Developed Countries (United Nations 2022); low-income countries that face significant challenges in developing a sustainable and self-supporting economy. At the time of writing (March 2024), such challenges are particularly acute because of the food crisis in Somalia and Kenya caused by drought in the Horn of Africa (Somali Peninsula) (Bedasa and Bedemo 2023). The livelihoods of coastal inhabitants of the region are largely dependent on coastal and marine resources, such as artisanal fisheries and mangroves (East Africa Marine Ecoregion [EAME] 2004).¹

Table 2.1. Human Development Index (HDI) status and rank and Gross Domestic Product (GDP) per capita rank of the Dugong Range States in East Africa. The countries in this table are ordered north to south, left to right around the region starting with Somalia. The ranks are ordered so that countries with the highest HDI or GDP have the lowest ranks. 189 countries were ranked for both indices.

Range State	HDI	HDI Rank 2023 ¹	GDP per capita rank ²
Somalia	-	-	178
Kenya	Medium	152	137
Tanzania	Low	160	157
Mozambique	Low	185	185
Madagascar	Low	173	180
Union of the Comoros	Medium	156	158
Seychelles	High	72	48
Mauritius	Very High	63	61

¹ 2023 HDI data from <https://hdr.undp.org/data-center/country-insights#/ranks> (downloaded from the internet January 2024);

² 2023 per capita GDP from [https://en.wikipedia.org/wiki/List_of_countries_by_GDP_\(PPP\)_per_capita](https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita) (downloaded from the internet January 2024).

2.1.3 Genetics of dugong sub-populations

For an overview of techniques, relevant genetic studies and general findings, refer to Chapter 1.

There is limited genetic data for East Africa. No data is available from nuclear genetic markers. The available mitochondrial control-region sequence data indicates very little diversity along the coast of East Africa. Two previously unpublished sequences (410 bp) from Tanzania (now GenBank

PP317827-PP317828) are identical and also consistent with all the sequences (n=17) from the coast of East Africa reported in Plön et al. (2019) and with most of those from the Red Sea in the same paper. The same haplotype also occurs in the Arabian Gulf. This haplotype, and the related ones reported in Plön et al. (2019) belong to the Western Indian Ocean (WIO) haplogroup. Only one short sequence from Plön et al. (2019) (MH704426; 156 bp), labelled as from Mozambique, is anomalous; it matches several haplotypes in the Australasian widespread lineage (Chapters 9 and 10). It is unclear whether this should be taken at face value. Although deposited in GenBank, this sequence was not included in the analyses reported in Plön et al. (2019).

Five sequences from Madagascar and the Comoros, reported by Plön et al. (2019) form a distinct subclade within the WIO haplogroup. This indicates a separate evolutionary history for these populations which should be accorded special conservation status.

A further two sequences from a refuse dump (17th–18th Century) in Mauritius (EU826002-03) are identical and differ from the common East African haplotype at only a single site. The sequences were derived from adjacent rib bones that may have belonged to the same individual (Haile 2008).

The low variation in mitochondrial sequences across East Africa, the Red Sea (Chapter 3) and the Arabian Gulf (Chapter 4), suggest relatively recent colonisation of the region from further east or recovery and expansion from a genetic bottleneck. Only additional data, including from nuclear genomes will help to clarify this.

- The only genetic data available for dugongs from East Africa is from the mitochondrial control region.
- These DNA sequences are all very similar and belong to the Western Indian Ocean (WIO) haplogroup.
- A subclade within the WIO haplogroup occurs in Madagascar and the Comoros.
- The limited mitochondrial diversity implies relatively recent colonisation of the region or recovery and expansion from a genetic bottleneck.

2.2 Distribution, abundance and trends in Range States

2.2.1 Somalia

William Travis journeyed to Somalia in the early 1920s to establish a turtle cannery. In his book 'Voice of the turtle' written in 1924 (Travis 1967), he convincingly describes herds of dugongs:

'off the open coast, with the nearest swamp 300 miles to the south, I found huge herds, sometimes as many as 500 strong, swimming freely within and without the reef'

This account is presumably from the waters of the Bajuni Islands about 120 km north of the Kenyan border. Cockcroft and Young (1998) reported anecdotal accounts of large groups of dugongs moving between Lamu in northern Kenya and southern Somalia (Figure 2.1). No contemporary accounts of such behaviour have been found, although it is plausible, because fringing reefs and barrier islands provide sheltered waters along this coast (Carbonne and Accordi 2000). Outside the Gulf of Aden (Figure 2.1), the exposed, high-energy coastline of central and northern Somalia is unlikely to be suitable dugong habitat due to lack of seagrass (UNEP-WCMC and Short 2021).

Somalia is one of the least developed countries of the world (United Nations 2022). The country has been wracked by armed conflicts (linked to piracy, militant groups and war) and political instability for decades and the southern coast has largely been inaccessible to scientists for security reasons for many years. The situation is more stable in Somaliland, an autonomous region in northern Somalia on the southern coast of the Gulf of Aden (Filho and Oliveira da Motta 2021) (Figure 2.1). Braulik et al. (2022) undertook a scoping trip to Somaliland in January 2022 to evaluate the potential for collaborative marine science and conservation work. Fishers reported that dugongs were seen near Hiis (or Heis) in the past and there were contemporary sightings in the Zeyla archipelago near the border with Djibouti (Figure 2.1). These reports included recent sightings plus very regular sightings over a long period suggesting a resident population of dugongs (Braulik et al. 2022).

The International Union for Conservation of Nature (IUCN) Marine Mammal Protected Area Task Force (MMPATF) is in the process of identifying Important Marine Mammal Areas (IMMAs) in many parts of the world including East Africa. IMMAs are discrete portions of habitat, which are important to marine mammal species and have the potential to be delineated and managed for conservation. The MMPATF has identified the Gulf of Aden and Socotra Archipelago as an Area of Interest (Aoi) for potential designation as an IMMA (IUCN-MMPATF).

- Although the fringing reefs and barrier islands between the border of Kenya and the Bajuni Islands used to support significant numbers of dugongs, there is no contemporary information regarding dugongs in this region.
- North of the Bajuni Islands, the open coastline is unlikely to provide habitat for dugongs.
- There is anecdotal evidence that dugongs occur in the Zeyla archipelago near the border with Djibouti.

2.2.2 Kenya

Herds of dugongs were reported in the Gazi-Funzi area in the 1950s (Pertet and Thorsell 1980, Figure 2.4). However, the literature suggests that dugongs have been declining along much of the Kenyan coast since at least the middle of the 20th century (Jarman 1966), despite reports of 'relatively

recent' but undated anecdotal sightings of large herds at Mombasa and Malindi (Jarman 1966) (Figure 2.4). Low numbers of dugongs were sighted during aerial surveys along the Kenyan coast conducted in 1993 through 1998 (Cockcroft et al. 1994; Cockcroft 1995; Cockcroft and Young 1998; Wamukoya et al. 1997). In 2016 and 2017, transect aerial surveys were performed at historical areas of local importance (Kiunga to Kipini and Gazi to Vanga), plus shoreline surveys along the remaining Kenyan coast (Cockcroft et al. 2018). Only two 'possible dugongs' were sighted, one in the south (Gazi to Vanga) and one in the north (Kiunga to Kipini).



Figure 2.4. Geographic context of Kenya showing placenames mentioned in the text. Inset: Manda Bay. Figure created by Adella Edwards; reproduced with permission.

Awadh et al. (2021) used a literature review and semi-structured questionnaires, guided interviews, and focus group discussions with a total of 378 fishers in six fishing villages (Vanga, Shimoni, Msambweni, Matondoni, Kizingitini and Kiunga) (Figure 2.4), to obtain information on the status and distribution of dugongs in Kenya. Their results suggested that the Kenyan dugong population is currently very small and scattered. Fishers in the northern areas, especially within Kiunga Marine National Reserve, consistently reported higher numbers than in the southern region. Anecdotal information suggests a small population exists from just south of Msambweni to Funzi creeks and

north from the Siyu channel through Kiwayuu to Kiunga (Figure 2.4). Awadh et al. (2021) estimated there are about 20 dugongs in Kenyan waters with at least ten in Kiunga, making Kiunga the most significant dugong conservation site with the rest scattered in the other locations (Shimoni, Msambweni, Matondoni and Kizingitini). This conclusion is consistent with Jarman (1966), who considered the Lamu region to be the major stronghold of the dugong on the Kenyan coast.

The IUCN MMPATF identified the Lamu to Kiunga Archipelago as an Area of Interest (Aoi) for potential designation as an IMMA (IUCN-MMPATF). The dugong is the only supporting species listed as of March 2024.

- The Kenyan dugong population is currently very small and scattered.
- Anecdotal information suggests that a small population exists just from south of Msambweni to Funzi creeks and north from the Siyu channel through Kiwayuu to Kiunga.

2.2.3 Tanzania

Information on dugong distribution and abundance in Tanzania is mostly derived from anecdotal reports and incidental sightings. Kingdon (1971) reported two centres for dugongs in Tanzanian waters: the coastal waters of the Pemba-Zanzibar Channel and the Rufiji-Mafia area (Figure 2.1). Interviews with fishers between 2000 and 2003 yielded 38 reports of sightings (31 incidental captures and 7 live) (EAME 2004). The general level of awareness of dugongs amongst interviewees was high with nearly 70% recognising the dugong on an identification card. Seventy-nine percent of respondents reported a dramatic decline in dugong numbers since the mid to late 1970s.

The most likely place for any remaining dugongs in Tanzania is off the Rufiji Delta (EAME 2004), where two animals were caught in gillnets in January and March 2004, providing the first concrete evidence of the existence of dugongs in this area for 74 years. Infrequent sightings have also been reported from Moa in the north; these animals may be connected with those in southern Kenya (Figure 2.1). No dugongs were sighted during: (1) two transect aerial surveys of the Rufiji Delta-Mafia area between 2006 and 2008 (Muir 2006; Mbugani 2008), or (2) transect aerial surveys in the region between Somanga (Kilwa district) and the northern Rufiji Delta and across the Mafia Channel to western Mafia Island, or (3) inside the 30 m isobath in 2016 and 2017 (Cockcroft et al. 2018). Braulik et al. (2017) sighted two dugongs north of Mafia Island in 2014. There was a dead dugong photographed in Pemba Island in 2023 reported to the Tanzania Whale Network, another in May 2017 as well as a live sighting in 2018. Cockcroft et al. (2018) also found feeding trails around Pemba Island providing further evidence of their presence in this area.

The ecology of the Rufiji Delta–Mafia area depends on its seasonal nature and is influenced by the wet season inflow of water and sediment from the Rufiji River, which is being altered by the large Julius Nyerere Hydropower Project and its associated dam. The dam has a storage capacity of 34 billion cubic meters. How this will affect the seagrass habitat in the Delta or the livelihoods of the people living there is not yet known (IUCN 2019).

The IUCN MMPATF identified the Rufiji to Mafia-Kilwa coast as an Area of Interest (Aoi) for potential designation as an IMMA (IUCN MMPATF). The dugong is the only supporting species listed as of March 2024.

- The dugong population in the waters of Tanzania is currently very small and scattered. The most likely place for any remaining dugongs is the coastal waters off the Rufiji Delta.

2.2.4 Mozambique

Dugongs have been reported from: Maputo, Inhambane, and Bazaruto Bays, as well as the Primeiras and Segundas (Angoche) and Quirimbas Archipelagos (Hughes and Oxley-Oxland, 1971; Cockcroft et al. 1994; Cockcroft and Young 1998; Findlay et al. 2011). Cockcroft et al. (1994, 2018) concluded that observations and strandings of dugongs were very rare outside of the Bazaruto Seascape (~ 21° S to 22° S; Figures 2.1, 2.3). Dugongs have usually been sighted in shallow, near-shore waters or sheltered areas such as within Bazaruto Bay or in mangrove-fringed estuaries along the mainland coast (Trotzok et al. 2022b). Most individuals have been observed in shallow (< 20 m) waters, less than ~ 10 km offshore; individuals (including calves) have been occasionally detected over 20 km offshore or in water deeper than 30 m. Groups as large as 70 individuals have been observed as recently as 2021, and large groups of 10 – 20 individuals are regularly encountered during aerial surveys and by boats.

Robust estimates of dugong abundance in the Bazaruto Seascape have been obtained using aerial transect surveys and distance sampling since 2006-2007 (Findlay et al. 2011; Cockcroft et al. 2018; Trotzok et al. 2022b; Bazaruto Archipelago National Park [BANP] 2022). The most recent visibility-bias-corrected estimate from strip transect aerial surveys in 2022 was $406 \pm \text{SD } 146$ individuals. Dugongs were seen throughout the entire survey area but were clustered into two areas of importance: (1) the north of Bazaruto Bay and (2) the mangrove-fringed estuaries near the Save River. The percentage of calves was a healthy 14%. The relatively large confidence intervals around all the survey estimates make it very difficult to detect significant trends in the population. Thus it cannot be confirmed whether the size of the Bazaruto population has increased, decreased or

remained stable since the population was surveyed by Findlay et al. (2011) in 2006-2007 (Trotzuk et al. 2022b).



Figure 2.5. Part of a large, scattered group of dugongs in the northern Bazaruto Seascape in December 2021. Evan Trotsuk photograph; reproduced with permission.

Trotzuk et al. (2022b) conducted Population Viability Analyses using a range of parameters. The most liberal analyses estimated that the population could endure the removal of up to six adult dugongs per year before a decline would begin, while the most conservative estimates were that the removal of more than one single adult was unsustainable.

The Bazaruto Archipelago and Inhambane Bay region (Figure 2.1) was declared an IMMA in 2020 (IUCN-MMPATF 2020) and Great Bazaruto has been established as a Key Biodiversity Area (KBA) due, in part, to the presence of dugongs (Key Biodiversity Areas [KBA] Partnership 2024).

- The Bazaruto Seascape is the only location in East Africa where a globally significant dugong population is known to occur.
- This location has been recognized internationally as an Important Marine Mammal Area and a Key Biodiversity Area.
- Bazaruto dugongs are actively monitored and the threats to them are managed. These programs are very important.

2.2.5 Madagascar

Petit (1927) cited by Davis et al. (2022) reported that dugongs were common and present in herds and large groups around Madagascar's vast coastline. However, over the past half century they are believed to have suffered a precipitous decline, with sightings now very rare. Cockcroft (1993) reports anecdotal data suggesting that dugongs may have occurred on the south-west coast of the island at that time; six dugongs were allegedly caught at Morombe in 1992. Socio-ecological interview surveys from 2008-2013 at 15 locations along the west coast from Nosy Mitsio to Ifaty (Figure 2.1), and on the north-east coast at Masoala Peninsula (Cerchio et al. 2012 in Davis et al. 2022) suggest a severe decline in dugong populations in recent decades, especially during and after the 1980s and 1990s.

Fisher interviews and anecdotal communications including photographed kills provide the most recent information available on dugongs in the coastal waters of Madagascar (Davis et al. 2022). Dugongs have been infrequently observed in recent years in the extreme northern region between the Sahamalaza Peninsula in the west and Vohémar in the east (Figure 2.1).

Intensive interview surveys have been conducted with fishers since 2009 across northern Madagascar by various researchers. Davis et al. (2022) concluded that methodological differences preclude meaningful comparisons. Community Centred Conservation's (C3) studies between 2009 and 2017, across the regions of Nosy Hara Marine Park, Ampobofofo, Bay of Rigny complex and Ambodivahibe, confirm that these areas are still important habitats for dugongs, with cow-calf pairs consistently sighted in the bays and around the islets of Nosy Hara Marine Park (C3 2010a).

The most recent recorded dugong mortality occurred in 2018 when a fisher opportunistically encountered and killed a dugong at Andovokonko near the village of Ivovona in the Ambodivahibe region (Davis et al. 2022). Anecdotal evidence indicates that dugongs were encountered and targeted by fishers in the southwest region around Andavadoaka as recently as 2010 (Davis et al. 2022).

Aerial surveys also suggest that dugongs may occur over a wide area in Madagascar at very low densities. Dugongs were sighted on seven occasions during an aerial survey of northern and western Madagascar for cetaceans in 2009 (Laran et al. 2012). The transect design was not a fine-scale assessment of coastal or shallow-water dugong habitat and there were no corrections for detection bias. Thus, this survey will likely have underestimated dugong numbers. One dugong was seen in the Ampasindava region of the northwest within Nosy Hara Marine Park, supporting anecdotal evidence of an extant population in this region (Cooke et al. 2003; C3 2010a). Six sightings occurred on an approximately 150 km stretch of coast in the northwest between Mahajanga and Sahamalaza.

Dugongs were not sighted in other survey areas including the central west coast and the Barren Islands; the southwest coast, including the Andavadoake region; and the northeast coast, including Antongil Bay and the Masoala Peninsula.

The waters of the Mozambique Channel of the northwest coast of Madagascar support numerous marine mammal species including the dugong and have been declared the Northwest Madagascar and Northeast Mozambique Channel IMMA with the dugongs as one of 22 supporting species (IUCN-MMPATF 20201, Figure 2.1).

- Dugongs are believed to have suffered a precipitous decline in the waters of Madagascar in recent decades. Aerial surveys and fisher interviews suggest that they still occur over a wide area at very low densities.
- Nosy Hara Marine Park, Ampobofofo, Bay of Rigny complex and Ambodivahibe are still important habitats for dugongs.
- The Northwest Madagascar and Northeast Mozambique Channel IMMA, which spans the waters of Comoros, Mayotte and Northwest Madagascar includes the dugong as one of 22 supporting species.
- Preliminary genetic information suggests that dugongs from Madagascar and the Comoros form a distinct group indicating a separate evolutionary history for these populations, which could be accorded special conservation status.

2.2.6 Union of the Comoros, Mayotte, Seychelles, Mauritius and Rodrigues

2.2.6.1 Union of the Comoros

The Union of the Comoros comprises three volcanic islands (Grande Comore (with capital Moroni), Anjouan, and Mohéli), located north of the Mozambique Channel (Figure 2.1). Prior to 1970, dugongs were recorded around all three islands; Muir and Kiszka (2012) concluded they were limited to the waters of Mohéli. In 2022, 182 people were interviewed in 17 Mohéli villages by Mohéli National Park and the Naturalistes de Mayotte association (Bernagou et al. 2023). The majority (~45%) of respondents were aged between 36-55, 31% were aged 18-35, 23% were > 56, 1% were < 18. No data on age were recorded for < 1% of respondents. Sixty-one percent of respondents were familiar with the dugong and could recognize one from a photograph. Most believed that numbers had declined during their lifetime. People familiar with the dugong were asked to estimate numbers around the island. About half considered that the population would be of less than 10 individuals; ~30% believed there would be > 21.

- In the Comoros Archipelago, dugongs apparently now occur only in the waters of Mohéli, where villagers are familiar with dugongs and most believe the population is declining.

2.2.6.2 Mayotte

Mayotte forms part of the Comoros Archipelago but it is ~100km from the nearest Comorian Island and is administered by France (Figure 2.1). Kiszka et al. (2007) collated opportunistic sightings from 1999 to 2005 (n=53), surveyed 35 local fishermen from six villages, and undertook aerial surveys between July and November 2005. They sighted five dugongs including one cow-calf pair, despite sub-optimal aerial survey conditions in some parts of the lagoon. They concluded that dugongs were common in the lagoon before the 1980s, and then declined significantly due to hunting pressure and bycatch in fishing nets. Nonetheless, recreational dive operators and microlight aircraft pilots still make opportunistic sightings in many places in the lagoon including several observations of cow-calf pairs. For example, 360 opportunistic observations were recorded between 2006 and 2023, and a cow-calf pair was observed in July 2023 (Lea Bermagou pers comm. 2023.).

Bernagou and Beudard (2022) used the same questionnaire as in the Comoros above to survey 557 people (426 fishermen) from 55 villages around the coast of Mayotte. Forty six percent of respondents were > 56 years of age, 38% were aged 36-55, 13% were 18-35 and 3% were under the age of 18. No age data were recorded for 1% of respondents. Respondents reported recent sightings including cow-calf pairs. A very high percentage of respondents (91%) knew the dugong and could recognize one from a photograph. Most perceived that dugong numbers had declined during their lifetime. People familiar with the dugong were asked to estimate numbers in the Mayotte lagoon. More than 70% considered that the population would be of less than ten individuals, ~ 10% between 10 and 21 individuals; only seven respondents thought there would be > 21 dugongs in the region.

- Dugongs including cow-calf pairs are regularly sighted in Mayotte lagoon, where recreational dive operators and microlight aircraft pilots make opportunistic sightings of them.

2.2.6.3 Seychelles

The Republic of Seychelles comprises 115 islands off the coast of East Africa. Although historically, dugongs are thought to have occurred around the granitic islands of the Seychelles (McAteer 1991; EAME 2004), sightings over the past 50 years are restricted to the World Heritage listed Aldabra group of islands (EAME 2004). This remote island group is located more than 1,000 km from Seychelles' populated main islands, ~ 780 km off the Rufiji delta in Tanzania and 300-400 km from the Comoros, Mayotte and Madagascar, suggesting that the dugong population is isolated. Aldabra Atoll is the only location where dugong sightings have been recorded since the 1970s (Hermans and Pistorius 2008; Hamylton et al. 2012; Appoo et al. 2019). Mapping over the last decade reported 75.4 km² of seagrass habitat within Aldabra lagoon (including 4.3 km² dominated by seagrass and the remainder sparsely mixed with macroalgae) (Hamylton et al. 2018) and 15.5 km² of seagrass habitat

at Aldabra's outer reefs (including 14 km² dominated by seagrass and the remainder dominated by macroalgae with interspersed seagrass) (Haupt et al. 2015).

Records of dugong sightings are available from Aldabra Atoll since 1970. Muir et al. (2004), Hermans and Pistorius (2008), Hamylton et al. (2012) and Appoo et al. (2019) reported 31 and 42 opportunistic shore and vessel sightings during 1970-2009 and 2010-2018, respectively, by researchers and staff of the Aldabra research station. Small groups of dugongs including cow-calf pairs have been seen at irregular intervals inside Aldabra Atoll's shallow 200 km² lagoon and on the seaward reefs. The largest group of dugongs seen at Aldabra comprised at least ten individuals in 2021 (A. Koester, personal observation).

Dugongs have been recorded in all months suggesting a resident population. A partial aerial survey of the Aldabra Atoll lagoon conducted in February 2013 using a gyrocopter and helicopter recorded 14 dugongs including two calves (Seychelles Island Foundation [SIF], unpublished data in Appoo et al. 2019). In 2022, SIF launched the first systematic aerial surveys using Unoccupied Aerial Vehicles (UAVs) with the aim of obtaining a population estimate of dugongs at Aldabra. Preliminary analysis of survey images collected in 2023 indicate records of 19 individual dugongs, including calves (SIF, unpublished data).

- A resident population of dugongs occurs in the Aldabra Atoll lagoon, a World Heritage site.
- The lagoon contains ~ 75 km² of seagrass habitat.
- Dugongs no longer occur in the granitic islands of Seychelles.

2.2.6.4 Mauritius and Rodrigues

The C3 Madagascar and Indian Ocean Islands Programme (C3 2010b) undertook a comprehensive, systematic study to determine whether the dugong still existed in Mauritius and Rodrigues (Figure 2.1). Their literature review found convincing accounts of dugongs from the 1600s until the end of the 18th century, written by Dutch captains, colonial governors and early French explorers and naturalists. Seventeenth century Portuguese sailors allegedly referred to Mauritius as the 'Island of the Siren' or *Ilha do Cirne* (from Sirene) on account of the abundance of dugongs in its coastal waters.

From 1638 to 1710, Dutch colonists at Fort Frederik in the southeast of Mauritius relied on dugong meat as a major component of their diet, as evidenced by large quantities of dugong remains found in archaeological excavations of the site (Cheke and Hume 2008, Gill 2009, Peters et al. 2009).

Nonetheless, C3 (2010b) found no accounts of dugongs around Mauritius after 1800, although they were still described from Rodrigues in the mid-1800s (Pridham 1849).

Herds of 300-400 dugongs were reported from Rodrigues in the early 1700s (Leguat 1708). These animals provided large quantities of salted meat to Mauritius (d'Heguerty in de Lozoya 2004). Although Abbey de Pingré (1766, in Dupon 1969) noted that dugongs had become rare, small numbers were still observed at the end of the 18th century (Marragon 1795 in Dupon 1969). Stoddart (1972) claimed that sightings of single animals or small groups were reported from all around Mauritius in the 17th and 18th centuries, although it is possible that some of these sightings were of seals.

C3 (2010b) interviewed 105 fishers at six landing sites in Mauritius in 2008, and 97 fishers at five landing sites in Rodrigues in 2009. Three Mauritian fishers recognized the dugong from a photo and stated that they had seen the animal between the years of 1935 and 2008. Rodrigues' fishers recognized a photo of the dugong. Some were familiar with the French name for dugong (*Lamentin*); however, it became apparent upon further questioning that they were referring to seals.

- Dugongs are probably extinct in the waters of both Mauritius and Rodrigues.

2.3 Cultural values

Dugongs occupy an important cultural role in East Africa. In Tanzania, Comoros and northern Mozambique, they are called *nguva* (mermaid) or sometimes even *binamana* (human) (Muir and Kiszka 2012), suggesting an intimate likeness between humans and dugongs. In Shimaore (a regional language of Mayotte), elders call dugongs *Doutzi*, though the most common name is now *lambohara*, as in Madagascar (L. Bernagou, personal communication 2024). Kingdon (1971) claimed: 'to this day fishermen in Zanzibar who have caught a female dugong have to swear they have no interfered with it' (p. 398). It is a similar story in Mayotte and the Union of the Comoros where fishers had to swear on the Koran not to have interfered with captured female dugongs (L. Bernagou, personal communication 2024). In Kenya, dugongs are known as *nguva* but are differentiated from mermaids/mermen, which are known as *kitunusi*. Muir and Kiszka (2012) report that consuming dugong meat is commonly believed to improve longevity, and some East African fishers believe that their bones ward off evil spirits. Rich folklore, beliefs, and taboos defined Malagasy peoples' traditional interactions. Davis et al. (2022) report that members or descendants of the Anjoaty tribe in north Madagascar (known as mystics), were the only people apart from the chief fisherman of the village with the right to preside over ceremonial slaughter. Iyengar (2018) conducted a cultural study in the southwestern, northeastern, and northwestern regions of Madagascar and concluded that dugong hunting was neither frequent nor indiscriminate in the past. In Kenya, dugongs were hunted for their meat and oil, used as food and medicine (Awadh 2021;

Awadh et al. 2021). In Mayotte and Comoros dugong bones were crushed and mixed with water to form a paste and were believed to have aphroditic and medicinal properties (L. Bernagou, personal communication 2024).

The dugong is now used as a symbol for the Bazaruto Seascape, featuring on the logo of the National Park, the names of local lodges, and as the mascot for various regional events and initiatives (BANP 2022).

2.4 Threatening processes

The root causes of the threats to dugongs in East Africa are limited capacity and political will, corruption, human migration to coastal areas, armed conflict and high human population growth rates. These circumstances put severe pressure on marine ecosystems to support food provisioning. Climate change is likely to exacerbate the situation as it is a threat multiplier (Marsh et al. 2022).

The list of threats to dugongs and their habitats below is modified from Trotzuk et al. (2022a), who considered the risks to the dugongs in the coastal waters of East Africa from southern Somalia south. Davis et al. (2022) list similar threats to dugongs in Madagascar.

2.4.1 Threats to dugong survivorship

- Incidental capture in fishing gear (e.g., gill nets and seine nets); illegal, unreported, and unregulated (IUU) fishing, particularly if incidental captures are 'targeted' for later consumption; entanglement in marine debris including discarded fishing gear and plastic litter (see Burt et al. 2020; Vogt-Vincent et al 2023).
- Hunting and direct fishing: historically legal, currently illegal.
- Vessel strikes.
- Extreme natural events (e.g., storm surges and tsunamis).

2.4.2 Threats to dugong fecundity due to habitat loss, fragmentation, and modification

- Habitat damage caused by human settlements and infrastructure development on coasts and associated riverine systems, oil and gas exploration and production, shipping, destructive fishing (netting and trawling).
- Degradation of seagrass habitat, including from untreated sewage disposal, coastal dredging and reclamation, inshore commercial trawling, declining water quality due to land clearing and resultant erosion.

- Extreme weather and climate change impacts on seagrass communities (e.g., extreme tropical storms, marine heatwaves).
- Chemical pollution (e.g., oil spills and heavy metal loads).

Another possible threat of unknown impact is the seismic testing proposed seaward of Bazaruto Bay. Dugongs mostly occur in shallow water, where the propagation of sound is limited (Rob McCauley, personal communication 2023). The proposed seismic survey is off the continental shelf edge in waters > 200 m deep. Thus, it is unlikely that the animals to the west of the Bazaruto Archipelago would be impacted by the seismic survey. However, problems may arise for dugongs on the eastern (towards Mozambique Channel) side of the Bazaruto Archipelago, or dugongs making deep water crossings (Rob McCauley, personal communication 2023).

The only confirmed dugong population known to be in the hundreds of animals in East Africa is in the Bazaruto Seascape (Section 2.2.4), a situation which exacerbates these risks to the regional population. The seagrasses that support the Bazaruto population could be severely damaged by disease, an extreme weather event or a series of extreme events. Unlike the situation in eastern Australia (Preen and Marsh 1995; Marsh et al. 2022; Cleguer et al. 2023), Bazaruto dugongs have limited opportunities to move to well-protected, alternative seagrass communities, while seagrass recovers. There is no evidence that the historical dugong strongholds in East Africa have been recolonised (see Sections 2.2.1. Somalia, 2.2.2. Kenya and 2.2.5. Madagascar above), suggesting limited capacity for range extension in the region in human timeframes.

With the exception of Aldabra atoll, a UNESCO World Heritage site, tensions between biodiversity conservation and the imperative for resource extraction, infrastructure and other forms of development are acute throughout East Africa, especially in areas where dugongs are already rare and unlikely to be a conservation priority. For example, large-scale infrastructure development such as the proposed port expansions for Lamu and Maputo (Figure 2.1), the construction of the East Africa Crude Oil Pipeline in northern Tanzania, offshore gas extraction in Mozambique's Rovuma Basin and mining for sand, oil, and gas around the Bazaruto Archipelago could all lead to dugong mortality and habitat loss as explained by Trotzuk et al. (2022a).

Climate change, which is predicted to increase the intensity (but not the frequency) of tropical storms is likely to adversely affect the demography of the East Africa dugong subpopulation in the future (see Marsh et al. 2022). A series of floods and storms caused the loss of roughly 1,000 km² of seagrass in Hervey Bay, Queensland, and the mortality of at least 99 dugongs (Preen and Marsh 1995). A similar series of events in the Bazaruto Seascape must be a significant extinction risk to dugongs in East Africa, especially given the low genetic diversity of dugongs in this region.

2.5 Conservation initiatives

2.5.1 International conventions

All East African Dugong Range States are parties to the Convention on Biological Diversity, Convention on Migratory Species and its associated Dugong Memorandum of Understanding and the United Nations Framework Convention on Climate Change. All but Somalia are signatories to the Convention on International Trade in Endangered Species (CITES).

2.5.2 National laws

Muir and Kiszka (2012) claimed that dugongs were protected under fisheries and/or wildlife laws throughout East Africa but noted with concern that these laws are rarely adequately enforced. The current situation may be even less satisfactory than they thought. Davis et al. (2022) noted that although dugongs had been protected in Malagasy waters since the 1920s, dugongs (and other marine mammals) have technically fallen out of national legal protection, a fact confirmed by a 2018 government report (France, Ministry of Environment, Ecology and Forests 2018). In France, a ministerial decree protects all marine mammals and sets out the conditions for their protection, including the dugong (Decree of 1 July 2011, amended in 2020). There are no specific legal texts on the protection of dugongs in the Union of the Comoros, however, the species appears on the list of taxa protected by a decree (Order No. 01/031/MPE/CAB) on the protection of species of wild fauna and flora of the Comoros. In addition, the Mohéli National Park has defined the dugong as a priority conservation target. In the Seychelles, dugongs are protected under the Fisheries Act but are not specifically listed under the Wild Animals and Birds Protection Act (A. Koester, personal communication 2024).

As explained in Section 2.2, dugongs are also protected in several parks and reserves including: Kiunga Marine National Reserve (Kenya), Bazaruto Archipelago National Park (Mozambique) and Nosy Hara Marine Protected Area (Madagascar), Parc Naturel Marin de Mayotte (Mayotte's entire EEZ). Aldabra Atoll has been managed by the Seychelles Islands Foundation (SIF) since 1979 and was designated a Special Reserve in 1981 under the National Parks and Nature Conservancy Act. In 1982, Aldabra Atoll was inscribed as a UNESCO World Heritage Site. In most locations in East Africa, there is a severe lack of funding and resources to adequately enforce the preservation of dugongs, even when they are legally protected.

2.5.3 Conservation status

Although its assessments of conservation status are usually conducted at a global scale, the IUCN allows assessments of isolated regional population (which IUCN refers to as 'subpopulations') for

species with heterogeneous regional status such as the dugong. The IUCN declared the East African coastal 'subpopulation' from southern Somalia through Mozambique to be Critically Endangered in 2022 (Trotzük et al. 2022a). Even though the designation of Critically Endangered is based on Criterion C, the full range of Red List categories, under which this 'subpopulation' qualifies for listing, has been included below as evidence of the rationale for the IUCN assessment:

Criterion B: Vulnerable (VU B2ab(v))

- Criterion C: Critically Endangered (CR C2a(ii))
- Criterion D: Endangered (EN D)

The justification for this assessment was:

- the number of mature individuals in the geographically isolated East African coastal dugong subpopulation was estimated to be fewer than 250 in 2022,
- more than 90% of all mature individuals occur at only one location- the Bazaruto Seascape,
- pressures, including habitat loss and unsustainable fishing techniques, continue to threaten the entire subpopulation, and
- participatory appraisals in coastal communities throughout the region over the past 30 years indicate continuing decline.

The status of the dugong in coastal the waters of the Gulf of Aden or around the offshore islands of East Africa has not been formally assessed by IUCN.

2.5.4 Other conservation initiatives

NGOs have developed education and awareness programs in several dugong hotspots in the region. C3 Madagascar has focused intense efforts on outreach to remote communities of Nosy Hara Marine Park, which includes incidental monitoring by members of the marine park committees, school awareness campaigns, theatre and events organized by the Junior Ecoguards Youth Network (Davis et al. 2022). In Sahamalaza Marine Park, Madagascar, ranger capacity building and monitoring were initiated in 2016 under the Global Environment Facility (GEF) Dugong and Seagrass Conservation Project. Outreach campaigns include the production of communication materials on dugongs (signboards, posters, brochures, children's storybooks, and touring theatre) training in seagrass and dugong ecology, conservation, and monitoring (Rakotoarimino and Davis 2017).

In a project funded by CMS through the Dugong MOU, the NGO Sea Sense implemented the 'Thamani wa Nguva' project in the Kibiti and Kilwa districts of Tanzania. The project raised public awareness of the dugong as a flagship species through hosting events to celebrate 'World Seagrass Day' in March 2023; engaging with national and local decision makers, implementing a school education program, and building capacity of community fisheries managers to appreciate the importance of protecting dugongs and conserving seagrass meadows.

Numerous Mozambique government and NGO initiatives aimed at conserving dugongs have been developed in the Bazaruto Seascape. Some examples of these initiatives are outlined below.

- In Mayotte, a second National Action Plan for the dugong (2021-2025) has been established by the French government to acquire knowledge about the species and its habitat. Scientific studies and community awareness campaigns are currently underway.
- In Comoros, the Mohéli National Park has conducted an environmental education program of conservation target species which include the Dugong over the past 23 years across 20 villages of the Island of Mohéli (B. Moussa, personal communication 2024). This program aims to support local communities as well as encourage political and judicial authorities to join the Mohéli National Park Team in conservation and protection efforts for its target species (B. Moussa, personal communication 2024).
- **Alternative livelihoods including eco-tourism:** The potential for eco-tourism and other alternative livelihoods was investigated in the Bazaruto Archipelago between 2010 and 2015 using questionnaires and focus groups targeting local fishers, tourist operators and tourists (Cockcroft et al. 2018). Fishers, tourism operators and tourists were all sympathetic to dugong and seagrass conservation. Fishers were open to alternate sources of income and tourists seemed to want to support the local community through an ‘African experience’. However, tourist operators were generally reluctant to mentor and invest in fisher-run business opportunities to serve the needs of tourists for locally grown produce or curios or to reduce the carbon footprint of their operations. Tourism alone is unlikely to employ a sufficient number of people to sustainably reduce the detrimental impacts on dugongs without any additional alternatives, such as the promotion of aquaculture or the co-managing of new and existing fisheries, and effective law enforcement.
- **Reducing the impact of gill and seine-netting on dugongs and their habitats:** Effective law enforcement and community education by Bazaruto Archipelago National Park (BANP)’s administration and local authorities have mostly eliminated gill nets within BANP and the broader Bazaruto Bay area. Gill nets are illegal inside the National Park, and it is illegal to leave any type of fishing gear unattended in Mozambique (BANP 2022). The Mozambican government has approved a regulation for maritime fishing (2020), banning the use of beach seine nets to enable the recovery of seagrass communities. The regulation is being implemented currently, and there are regular consultations with fishers to find alternate materials, potentially gill nets, with obvious negative implications for marine megafauna.

2.6 Research and monitoring initiatives

2.6.1. Techniques used to date

2.6.1.1 Distribution and abundance of dugongs and their habitats

As outlined in Section 2.2 above, extensive shoreline and transect aerial surveys have been carried out for dugongs in many parts of their East African range. Outside of the Bazaruto Seascape, most of these surveys have been exploratory snapshots that have detected too few dugongs to make population estimates, even in historical areas of higher density.

The Bazaruto Seascape is the only place where a time series of population estimates has been attempted and these surveys had largely occurred on an opportunity basis between 2006–2016. Since entering into a co-management agreement with the Mozambican government in 2017, African Parks has started flying surveys on an annual basis. However, the relatively large confidence intervals around the survey estimates mean that the power of the time series to detect significant trends in the population is weak using frequentist statistics but may be improved using Bayesian methodologies (Marsh et al. 2020 Appendices 8-11; Cleguer et al. 2023). These surveys are critical and should continue with high priority. The optimum survey interval should be informed by a power analysis.

Questionnaire surveys of fishers have provided valuable anecdotal information on dugong distribution, relative abundance and trends throughout much of the region outside Somalia as discussed in Section 2.2 (see C3 2010a; Cerchio et al. 2012 in Davis et al. 2022; Awadh et al. 2021; Bernagou and Beudard 2022; Bernagou et al. 2023). This approach should be extended to the Zeyla Archipelago (Somaliland) and Bajuni Islands (Somalia) as circumstances permit.

Information on the distribution, extent of and trends in seagrasses in the region is very limited as explained in Section 2.1. High resolution (25 cm) satellite images were used to search for seagrasses in Mozambique and to map seagrass meadows in the Bazaruto Archipelago (Cockcroft et al. 2018). This approach is likely to be of limited value in seagrass meadows with low above ground biomass often favoured by dugongs (see Chapter 1), especially subtidal meadows in turbid water and it may be fruitful to consider using a range of large-scale, seagrass mapping approaches and techniques as outlined in Chapter 1. At Aldabra Atoll, remote sensing and ground-truthing studies were conducted to map the lagoon (Hamyton et al. 2018) and seaward reefs (Haupt et al. 2015).

2.6.1.2 Dugong biology

Little is known as to how the biology of East African dugongs differs from that of better studied populations elsewhere as outlined in Chapter 1. Nonetheless, it is unlikely that their life history,

ethology and behavioural ecology are sufficiently different to preclude meaningful inferences from populations outside the regions.

2.6.1.3 Dugong genetics

As outlined in Section 2.1.3, the work to date has been hampered by small sample sizes. Cockcroft et al. (2018) identified a further 54 samples (mostly bone, teeth, and skin but some soft tissues) from East Africa with a view to better understanding the genetic discreteness and structure of East African subpopulations and this work is currently underway. Any connectivity between the areas of local importance (Table 2.1) will be very difficult to determine without very comprehensive genetic research unless accompanied by satellite tracking of a large number of dugongs, which could be unjustifiably expensive and potentially unethical when numbers are so low in the region other than the Bazaruto Archipelago (see Chapter 1).

Genetic threats may arise when effective population sizes have declined, and/or when historically connected populations become isolated. These threats may reduce population viability due to loss of genetic diversity or inbreeding depression. There is a need for genetic analysis of additional samples from East Africa. Whole-genome data, even from one or a few individuals, would greatly help clarify population and demographic histories in the area. Such research has the potential to provide insights into the susceptibility of the East Africa population of dugongs to threats such as climate change and disease, especially if there is further evidence that genetic diversity is low.

2.6.2 Additional research techniques that may be applicable.

2.6.2.1 Distribution and abundance of dugongs and their habitats

Unoccupied aerial vehicles (UAVs, or drones), some of which are relatively inexpensive and easy to use, are increasingly used to conduct local scale seagrass and dugong surveys in various parts of the dugong's range including Aldabra Atoll Lagoon (Section 2.2.6 Seychelles) and Maputo Bay, Mozambique (Cossa et al. 2023), Mayotte and Mohéli. This approach has potential to provide information on dugong distribution and abundance at the areas of local importance listed in Table 2.1, especially Mayotte, and inform understanding of the relationship between the dugong's fine-scale habitat use and their biophysical environment in the Bazaruto Seascape.

2.6.2.2 Spatial risk assessment of threats

A regional spatial risk assessment of the threats including climate vulnerability to dugong areas of local importance could form a framework for prioritising management interventions for localities outside the Bazaruto Seascape.

2.7 Regional co-operation

Regional cooperation is well-developed in East Africa, outside Somalia. The Eastern African Marine Ecoregion team (EAME) produced a comprehensive 'Dugong Conservation Strategy in East Africa' in 2004 (EAME 2004). A joint project was conducted to collate information on the identity, distribution, status, threats, and management of the dugong in the Western Indian Ocean (WIO) region involving scientists from Kenya, Mozambique, South Africa, and Tanzania under the aegis of the Association for the Conservation and Protection of Dugongs and Marine Mammal Species (Cockcroft et al. 2018). A special session on dugongs was held at the Western Indian Ocean 12th Scientific Symposium in 2022 (WIOMSA 2022).

A regional cooperation project, primarily involving Mayotte and Mohéli, was conducted with the aim of identifying target sites for dugong conservation, transferring expertise, and standardizing monitoring methods for seagrass beds and dugongs between the two islands (Mission Report, 2023 unpublished).

Outside the Bazaruto Seascape, dugong numbers are apparently so low that management interventions focussed solely on dugongs are unlikely to attract much support. Interventions designed to protect marine megafauna more generically are likely to be more successful and regional co-operation should be extended to groups with an interest in the conservation of marine turtles and small cetaceans.

2.8 Regional summary

In the East African region, dugongs have suffered very serious decline due to human-caused mortality from hunting pressure and bycatch in fishing nets. Dugongs persist in small populations in the areas of local importance listed in Table 2.2 below. The only place with a confirmed population of hundreds of dugongs is the Bazaruto Seascape, although other areas may also support larger populations than currently confirmed e.g., Zeyla Archipelago, Comoros Archipelago (Mohéli and Mayotte) and Aldabra Atoll. The ongoing persistence of the dugong in the region will depend on the successful conservation management of dugongs in as many of these areas as possible, particularly the Bazaruto Seascape.

It would be timely if the current regional co-operation led to an updated comprehensive 'Dugong Conservation Strategy in East Africa'.

Table 2.2: Summary of confirmed and possible dugong areas of local importance in the East African region from north to south (Figures 2.1, 2.3, 2.4).

Country	Region
Somalia	Zeyla archipelago, Somaliland
	Bajuni Islands
Kenya	Kiunga to Kipini coast
	Gazi to Vanga
Tanzania	Kilulu southwards through Tanga to Pangani
	Coastal waters of Unguja and Pemba Island
	Somanga northwards to the northern Rufiji Delta and across Mafia Channel to western Mafia Island
Mozambique	Ruvuma Bay southwards through the Quirimbas Archipelago to Ponta do Diabo
	Save River Mouth southwards through Bazaruto Archipelago to Cabo São Sebastião
	Morrumbene southwards through Inhambane Bay to Cabo da Barra
	Ponta da Macaneta southwards through Maputo Bay and Inhaca island to Cabo de Santa Maria
Madagascar	Extreme northern region between the Sahamalaza Peninsula and Vohémar, including Nosy Hara Marine Park, Ampobofobo, Bay of Rigny complex and Ambodivahibe
	Mahajanga coast
Comoros	Coastal waters of Mohéli
Mayotte	Coastal waters of Mayotte
Seychelles	Aldabra Atoll Lagoon

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