

## Eastern African Dugongs

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The eastern coast of Africa marks the westernmost boundary of the dugongs' global range. They are known to occur in the waters off Somalia, Kenya, Tanzania, and Mozambique (map 9.1). Their range also extends farther east off the islands of the Seychelles, Comoros, Mayotte, and Madagascar<sup>1</sup>. In Mauritius and Rodrigues dugongs were historically present, and in some places abundant, but declined during the eighteenth century due to hunting. Dugongs are now extinct in Mauritius<sup>2</sup>. The Western Indian Ocean (WIO) region is an important feeding and calving ground for dugongs as well as other endangered marine species such as sea turtles<sup>3</sup>.

The region has a coastal population of more than 30 million people, who are among the poorest in the world and whose livelihoods are largely dependent on marine and coastal resources such as inshore fisheries and mangroves<sup>4</sup>. The population is increasing at a rate of 5–6% per year and is expected to exceed 40 million by 2020. This rapid human expansion is having a significant negative impact on marine and coastal environments<sup>5</sup>.

As in many areas of their range, dugongs here are severely depleted. Their future survival is threatened by incidental catch in fishing nets, habitat loss/degradation, fishing pressure, hunting, and pollution. Vessel strikes, acoustic pollution, and ecotourism pose lesser threats. Sharp population declines in recent decades have led to escalating concern about their future survival in a region where dugongs are considered to be critically endangered<sup>6</sup>.

This chapter explores the issues that influence dugong conservation in eastern Africa and presents a suite of possible conservation strategies in a region of rapid development.

### Dugong Status and Distribution

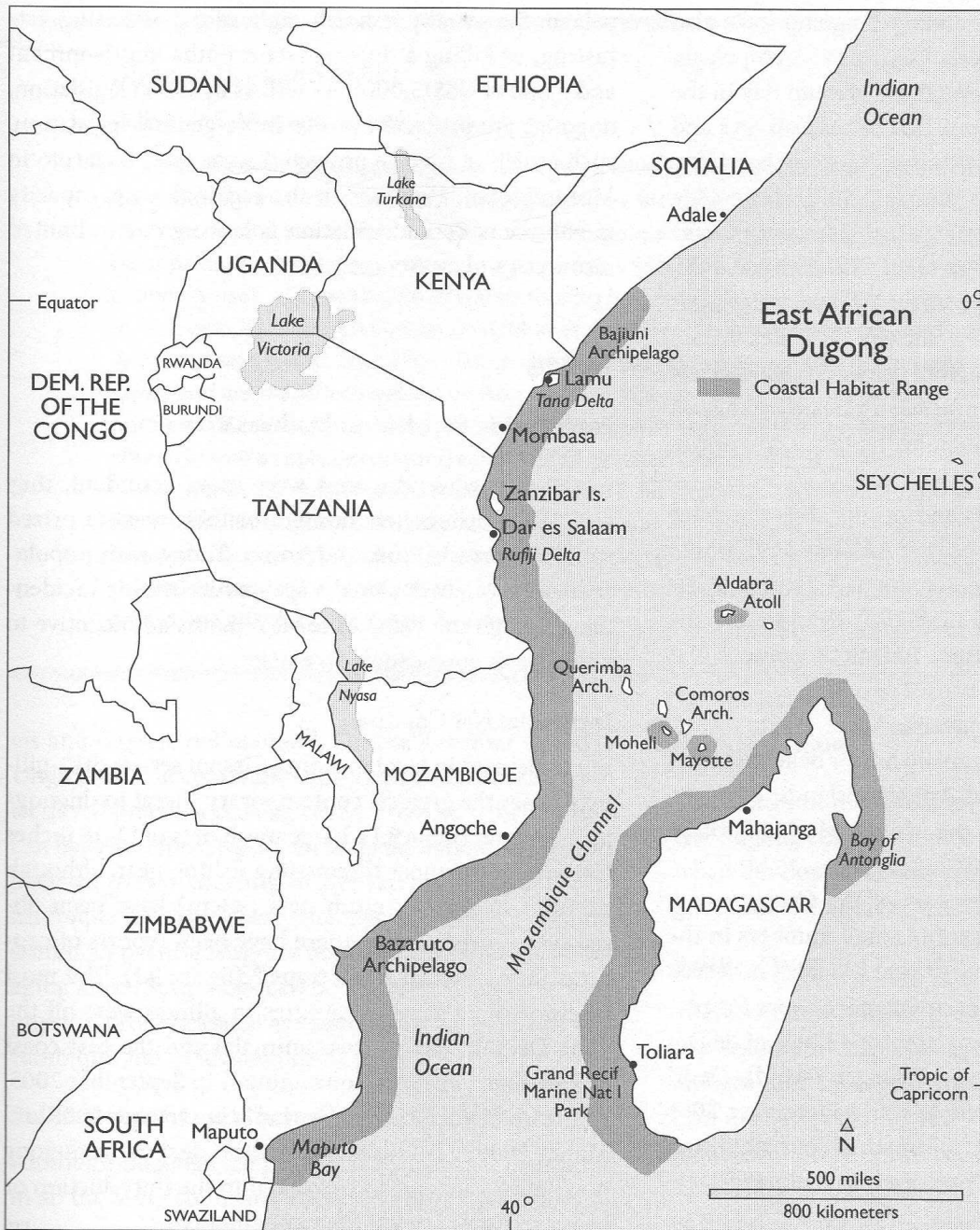
The critical status of dugongs in eastern Africa and the lack of knowledge concerning their abundance and ecol-

ogy are prompting immediate and effective conservation measures to ensure their future survival. This prompted an initiative to develop a regional WIO dugong conservation strategy<sup>8</sup>. As part of this study, in 2003, scientists from the seven countries in the region gathered data on dugong status, distribution, and threats, working mainly from historical data (literature reviews) and qualitative surveys (questionnaire surveys and opportunistic sightings). Since then, dugong studies and conservation programs have been set up in some countries, including Tanzania, Madagascar, the Comoros archipelago (Mayotte and Moheli), and Mozambique, to collect more data on dugong abundance, biology, and ecology as well as to raise awareness among local people.

These studies indicate that populations are very small, isolated from one another, and threatened by gill-nets and habitat disturbance. The mortality levels and the discrete nature of these populations underscore their critical conservation status. Mitigating the threats poses a major challenge for conservation managers, particularly as there are extensive gaps in knowledge of dugong biology, movements, population dynamics, and feeding, mating, and calving habitats. The summaries that follow for each country reflect the results from both the regional assessment and these national initiatives.

Historical records and anecdotal reports indicate that dugongs were relatively abundant off the eastern African coast in the 1950s and 1960s, with herds ranging in size from 30 to over 500 individuals<sup>9</sup>. However, current information suggests that dugong populations have been declining sharply since the 1960s and 1970s in Kenya and Tanzania and more recently, since the late 1980s and early 1990s, in the Comoros, Mozambique, Madagascar, and Mayotte. In the Seychelles the historical status of dugongs is not clear. In southern Somalia dugongs are reported to occur around the Bajuni archipelago, but their current status is unknown<sup>10</sup> (map 9.1).

Kenya's dugong population has dropped precipitously



Map 9.1. East African dugong distribution. (Map by Ellen McElhinny.)

ported, the largest a group of 500 seen in 1967<sup>11</sup>. In 1994, ten dugongs were observed during an aerial survey<sup>12</sup>. During the last national aerial survey conducted in 1996, only nine dugongs were counted: six within the Lamu Archipelago in the north and three in the south near the border with Tanzania<sup>13</sup>. The most recent verified records are from the Tana Delta area, where two dugongs died in gillnets in September 2005<sup>14</sup>. Based on recent research on the possible movement patterns of dugongs<sup>15</sup>, the extreme northerly and southerly populations may interact between southern Somalia and northern Tanzania.

In Tanzania the most important dugong habitat is off the Rufiji Delta east to Mafia Island and south to Kilwa, an area characterized by extensive shallow seagrass beds

and sheltered bays and channels. Dugongs have also been reported to occur at Moa, near the border with Kenya. From January 2004 to December 2008, there have been confirmed reports of eleven animals caught in drift gillnets: ten off the Rufiji Delta<sup>16</sup> and one off the east coast of the Zanzibar island of Unguja<sup>17</sup>. The exact size and range of the population in Tanzania are unknown, but anecdotal reports and infrequent captures indicate that numbers are very small.

The largest remaining population in the WIO region is believed to be in the Bazaruto Archipelago in Mozambique, where recent aerial surveys conducted between April 2006 and December 2007 estimate 250 animals<sup>18</sup>. In 2005 four animals were caught in nets: three in a gill-



net and one in a beach seine net<sup>19</sup>. Dugongs have also been sighted in the northern Quirimba Archipelago, but they may have disappeared from Maputo Bay in the south. At this writing, seagrass bed habitat surveys and bycatch monitoring are under way in Bazaruto Bay (map 9.1).

The current status of dugongs in Madagascar is unclear, but they are thought by local fishers to have declined over the past 10–15 years due to heavy exploitation for their meat. Interview surveys (116 sites visited and 195 respondents, mostly from the west coast and few from the northeast and southeast) indicate or suggest that potential dugong sites include the northeast, north, and northwest coasts<sup>20</sup>.

Within the Seychelles Island group, dugongs have been reported as occurring only at Aldabra Atoll, where they have been observed by members of the Seychelles Island Foundation regularly since 2001. Prior to this, the last sightings were in the early twentieth century. The largest group, seen in 2005, consisted of four animals: an adult, two subadults, and a juvenile<sup>21</sup>.

In the Comoros dugongs are no longer believed to occur off Grande Comore and Anjouan islands; however, low numbers still occur in the Moheli Marine Park, in the south of the island<sup>22</sup>.

In Mayotte, which forms part of the Comoros Archipelago, dugongs are present in small numbers in the lagoons. The largest aggregation that has been observed consisted of three animals seen during surveys for marine turtle nesting assessment (Centre d'Etude et de Découverte des Tortues Marines, Réunion Island). Dedicated aerial surveys between July and December 2005 (21.4 hours of visual effort) resulted in four sightings: three of single animals and one of a cow-calf pair<sup>23</sup>.

### Legal Status

The dugong is protected throughout East Africa, from Mozambique to Kenya, including all islands of the western Indian Ocean. In addition, these countries have ratified a number of conventions, such as CITES. In Kenya, for example, all marine mammals are protected from hunting and harassment. The national law is galvanized by Islamic beliefs, prohibiting the consumption of certain food items<sup>24</sup>. In Tanzania dugongs have been protected since 1970 under the Fisheries Act no. 6. Under this law anyone found guilty of a first offence is liable to a fine of around US\$300. In Mozambique the fine is as much as US\$2,000, and fishing gear and licenses are confiscated.

In Mayotte, a French territory of the Comoros archi-

pelago, the penalty is much higher for purchasing, harassing, or killing a dugong (six months imprisonment and a fine of US\$13,000). As well as by direct legislation, dugongs are protected under more generic legislation, such as within marine protected areas (e.g., Bazaruto in Mozambique). However, at the regional scale, capacity to enforce national legislation is lacking due to limited resources and awareness.

## Threats

### Exploitation for Meat and Other Parts

In the past when dugongs were more abundant, they were often deliberately hunted for their meat (a prized source of protein), oil, and bones. Today, with populations so severely depleted, captures are mostly incidental, although the value of meat remains an incentive to kill a live dugong caught in a net<sup>25</sup>.

### Incidental Net Captures

Entanglement in legal inshore artisanal set- or drift-gillnets poses the greatest contemporary threat to dugongs in the region (table 9.1). Large mesh nets of 12–18 inches (*jarife*) are the most threatening fishing gear, although captures in smaller mesh nets (<3cm) have been observed in Mayotte, and there have been reports of captures in traditional fence traps<sup>26</sup> (figure 9.1). The most recent verified dugong captures in gillnets were off the Tana Delta in Kenya (two animals) and the east coast of Zanzibar, Tanzania, (one animal) in September 2005, and from Mafia Island in Tanzania in October 2005 and March 2009<sup>27</sup>. In all countries, the decline in dugong populations appears to be related to the introduction or increased use of nylon filament gillnets<sup>28</sup>.

### Population Pressure

The shallow, nearshore habitat requirements of dugongs and their slow rate of reproduction render them particularly vulnerable to human activities, including artisanal inshore fishing, habitat disturbance, and hunting, and to general pressures from a rapidly growing coastal population<sup>29</sup>. Even low rates of dugong mortality can have a devastating impact on the reproduction and future survival of the population<sup>30</sup>.

### Habitat Destruction and Disturbance

Seagrasses, the main diet of dugongs, are very sensitive to human influence, both directly (trawling, mining) and indirectly (inland and coastal clearing inducing erosion and sedimentation, and pollution by heavy met-

## BOX 9.1

## Dugong Uses and Myths

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While the primary use of dugongs is for meat, which is highly valued and has already compromised dugong survival in most countries in the region, there are other uses for dugong parts. Coastal Kenyan communities use the meat, oil, bones and tusks of dugongs as a cure for a variety of ailments including arthritis, labor pains, tonsillitis, and protection against evil spirits (N. T. Marshall 1998). In Tanzania, dugong oil is occasionally used as a cooking fat or waterproofing for boats (*sifa*) and as a cure for asthma, burns, skin ulcers, muscle pain, ear ache, and breast pain (Muir et al. 2003). The dense bones are used as a cure for skin rashes or rubbed on the legs of young children to help them walk. They are also believed by some to ward off evil spirits and are made into necklaces. According to legend, eating dugong meat perpetuates eternal life. In northern Mozambique, owing to the dugongs' similarity to humans, a prayer must be said at the mosque or church before a captured dugong can be butchered (Whittington et al. 1998).

The mermaid myth remains robust throughout the region. In southern Mozambique, for example, the local name for dugong translates as "human fish" and in Tanzania, local fishers often refer to dugongs as *binadamu* or persons. Other myths and beliefs tend to be localized. In Kenya dugongs play an important cultural role and in Lamu are referred to as the "queen of the sea." In Madagascar, sighting a dugong is interpreted as a gift or a good omen for fishing (Rafomanana and Rasolojantovo 2004).

als and organic pollutants)<sup>31</sup>. On the Zanzibar Island of Unguja in Tanzania, rapid and unplanned coastal tourist development is causing severe erosion, which in turn can have a serious impact on seagrass habitat. Nearshore licensed prawn trawling in Kenya, Tanzania, and Mozambique in areas where dugongs are most commonly seen is impacting seagrass beds and therefore their foraging areas. Seagrasses can be also destroyed by natural physical processes such as cyclones, which occur in Mozambique and Madagascar.

**Political Apathy and Lack of Law Enforcement**

Although dugongs are protected by national legislation in all the WIO countries, these laws are rarely enforced. The capacity of government departments responsible for enforcement of such laws is often lacking, with efforts hampered by limited personnel and lack of resources.

**Regional Issues**

There are a number of common regional issues that affect dugong conservation and that need to be addressed when developing conservation and management strategies. Table 9.1 summarizes these.

**Political Will and Law Enforcement**

There is often limited political will to invest finances and resources in species and habitat conservation or to enforce laws in developing countries. With the exception of the Seychelles and Mayotte, laws to protect dugongs are rarely enforced, despite appropriate legislation. The areas that need to be covered or regulated are vast and remote, infrastructure and training are inadequate, and there are insufficient people and equipment (boats, vehicles, radios, etc.) to implement regulations

Table 9.1. Summary of current threats to dugongs in the WIO region.

Threats	Fishing			Habitat loss/disturbance				Others	
	Gill/shark nets	Explosives	Other	Pollution	Coastal development	Boat traffic	Cyclones	Hunting	Lack of political will
Kenya	√		√	√	√			√	√
Tanzania	√	√	√	√	√	√		√	√
Mozambique	√		√	√	√		√	√	√
Madagascar	√		√	√	√		√		√
Seychelles	√								
Comoros	√				√			√	√
Mayotte	√			√	√	√		√	

Source: WWF EAME 2004.





Figure 9.1. A dugong that was accidentally caught in a net being sold on the beach of Kani-Be, south of Mayotte. (Courtesy of Franck Charlier/ONCFS.)

and raise awareness. This situation is unlikely to change in the immediate future. Private sector and civil society involvement in dugong protection and monitoring is an effective way of resolving this issue. In Tanzania, for instance, a local NGO, Sea Sense, is employing local fishers to assist with community monitoring and educational activities<sup>32</sup>. In northern Mozambique tourist hotels and operators are employing local fishers as game scouts to support dugong conservation activities<sup>33</sup>.

#### Lack of Environmental Concern

Many coastal communities in the region live a hand-to-mouth existence and are concerned primarily with daily survival. The regional dugong assessment exercise highlighted the fact that although local coastal communities are aware that hunting or killing dugongs is illegal, the animals are still killed for meat if caught in a net<sup>34</sup>. Local villagers are often highly suspicious of conservation intervention, especially when it may mean compromising their income (e.g., banning certain types of fishing gear) or restricting access (marine protected areas). Thus local sightings and captures often go unreported, which hinders research and conservation efforts. Without incentives, alternatives, and long-term commitment, it will be difficult to gain the confidence of local communities, and conservation is unlikely to be effective. Private sector employment of local villagers in conservation activities is one way of providing incentives. Others include leasing key seagrass habitats from local communities, which they could then patrol and manage, and establishing local dugong societies or trusts, which could become

self-sustaining through membership fees and donations. The dugong could act as a flagship for marine conservation, including seagrass habitats.

#### Local Culture and Beliefs

Although coastal communities are aware that hunting or killing dugongs is illegal, there is a cultural demand for dugong parts. The meat is highly valued and a dugong is typically killed if caught in a net<sup>35</sup>. The use of other parts for medicinal purposes still occurs and cultural beliefs persist, but these are eroding as the dugong becomes less common and increasingly unfamiliar to younger generations (see text box 9.1).

#### Funding

Scientific research (such as aerial surveys, genetic studies, and tagging) and conservation efforts require considerable resources and long-term commitment. It may not be possible to implement effective research projects and management efforts in developing countries due to lack of funding or limited institutional capacity or continuity. Funding opportunities and successes would be greatly improved if countries in the region came together and pooled knowledge and expertise in areas like proposal writing. The development of regional projects may also considerably improve funding success. An example of such an initiative is a regional proposal currently being finalized, led by Réunion (IFREMER, via the South-Western Indian Ocean Fisheries Project or SWIOFP, funded by the World Bank), to study the movements of green turtles in the southwest Indian Ocean through satellite tagging.

## Conservation Recommendations and Strategies

### Existing Research and Conservation Activities

In Mozambique, aerial dugong surveys are carried out regularly in Bazaruto Bay, but additional surveys are needed in the Quirimba Archipelago and Maputo Bay. Gillnets have been banned in Bazaruto Bay. In Mayotte, regular aerial surveys were conducted between 2004 and 2007 to assess the distribution and abundance of dugongs and other marine mammals. The establishment of a marine park (covering most of the lagoon where there is seagrass) and stricter marine protected areas are planned. In Tanzania, an education campaign targeting gillnet fishers has been in effect since 2001, and aerial surveys in the Rufiji Delta area have been conducted in 2006 and 2008 by Sea Sense to assess dugong abundance and distribution<sup>36</sup>. In the Seychelles, regular aerial surveys in Aldabra, protected as a World Heritage Site, are being conducted to determine dugong site fidelity, movements, population size and spatio-temporal distribution<sup>37</sup>.

Very little information is available from Madagascar. The western and northeastern coasts are probably inhabited by dugongs, but their status in the area has not been assessed despite the presence of large areas of seagrass habitat. This region may be highly significant as a potential dugong foraging area. As such, Madagascar should be prioritized for aerial and further questionnaire surveys in the near future.

### Priorities for Dugong Research

In areas where no data exist, immediate questionnaire surveys are needed to help define potential dugong hotspots and assess the status of the species (especially related to bycatch and exploitation). Interviews can also help to underline key interactions between dugongs and human activities<sup>38</sup>. Second, if interviews reveal regular sightings, aerial surveys can then be conducted. Aerial surveys should be performed first in areas where dugong hotspots are known or suspected<sup>39</sup>. These surveys should be carried out often and regularly if a comprehensive picture of population trends, habitat, and distribution is to be obtained<sup>40</sup>.

A realistic estimate of dugong mortality in gillnets and other fishing gear is needed to define population vulnerability. Experiments to investigate ways to reduce the threat from bycatch are also important; for example, reducing the soak time of the net and establishing marine protected areas where the use of certain nets is banned (such as in Bazaruto National Park, Mozambique, and in Mayotte).

Furthermore, raising awareness among coastal communities, especially fishers, should also be a priority. This will help improve the level of reporting of dugong captures and encourage better relations between local communities and research or conservation groups. In Tanzania, regular contact between NGOs and fishers has helped to quantify the impact of human activities on dugong populations<sup>41</sup>.

Ecological studies include assessment of habitat distribution and status, feeding ecology, and habitat preference and use. Identifying seagrass distribution and species consumed by dugongs can help prioritize areas for conservation. The collection of samples from strandings or animals taken as bycatch will allow analysis of stomach content, seagrass species use, and possibly cause of death<sup>42</sup>. Currently only a few dugong specimens are available for biological and ecological investigation.

Research on the large, medium and fine-scale movement patterns of dugongs is needed to assess migration patterns and the degree of isolation between populations (in conjunction with genetic analyses). It is also critical to identify small-scale home range, habitat use, and preferences in sites where potential habitats, particularly seagrass beds, have already been surveyed<sup>43</sup>.

Studies of habitat use and preferences can be done through dugong tagging. However, tagging may be risky, particularly with so few animals<sup>44</sup>.

Using existing material in museums and biopsy surveys, genetic studies are needed to determine the genetic structure of dugong populations throughout the region and for comparison with populations elsewhere, such as Australia and the Gulf of Arabia. Such data will help determine levels of isolation and assess the mobility of individuals<sup>45</sup>.

### Priority Conservation Actions

It is clear that conservation actions—such as banning the use of threatening fishing gear in key seagrass areas, providing local fishers with alternative livelihoods, and raising public awareness about dugong conservation—should have the highest priority.

To develop effective national and regional dugong conservation and management strategies, several key steps are required. These include working with local communities and government to protect dugongs and develop conservation strategies that are appropriate, mutually beneficial, practical, and effective; raising awareness through education campaigns; improving capacity; and bringing relevant parties in the region together to develop a regional program and raise much-needed funds.



To protect the habitats where dugongs feed and breed, measures need to be put in place quickly by engaging with local communities, enforcing existing regulations, and banning threatening fishing gear. The most effective way will be to restrict or ban the use of gill and mesh nets in key dugong habitats. Other options include the establishment of marine protected areas or community-managed sanctuaries in key habitat areas where human activities such as trawling, gillnet use, and marine traffic have been identified<sup>46</sup>. Any management interventions should consider the needs and culture of local communities so that measures are fitting, mutually beneficial, practical, and effective.

Environmental awareness and concern are generally poor in the region. Conservation education, promotion of sustainable resource use, and provision of alternative livelihoods are critical. The use of radio as a medium for delivering messages about marine conservation and specifically dugong biology, threats, issues, and solutions is often highly effective in countries where illiteracy is high and other media are either unavailable or too expensive. Education efforts should target fishers, users of coastal areas, and school children.

Adopting the dugong as a flagship species for marine and coastal biodiversity conservation is recommended. In Mayotte children have played an important role in delivering dugong conservation messages to their families and to elders, and the dugong is regularly used as an educational symbol<sup>47</sup>.

In countries with limited government capacity and resources, community monitors should be trained. Local villagers often have greater knowledge and cultural sensitivity and can play effective roles in raising awareness and obtaining local information. Training of relevant government authorities should also go hand in hand with capacity building at the village level. Regular communication with local communities will ensure more efficient feedback of information and understanding of conservation. In Tanzania members of the network of local fishers established by Sea Sense act as an interface between the NGO and local communities, and frequent contact is maintained to ensure strong working partnerships.

There are common issues and threats relating to dugong conservation and management, so many solutions will be similar throughout the region. A regional gathering of practitioners (scientists, conservationists, managers, etc.) is recommended to address these common

themes and to find affordable, practical, and culturally sensitive ways to implement research and conservation strategies using expertise from across the region and from elsewhere in the dugongs' range.

Fund-raising success may also be more effective when international and/or regional funds are targeted through a regional initiative. Potential funding sources include the Western Indian Ocean Marine Science Association (WIOMSA) and SWIOFP. Moreover, some countries in the region that have greater financial support and resources (e.g., Mayotte is a colony of France) can help to mobilize other less affluent countries to develop regional projects and cooperation.

## Summary

The dugong is a critically endangered species in eastern Africa and adjacent island states. Basic scientific knowledge remains sparse in most countries, and conservation measures are mostly inadequate due to limited funding, education, and political will.

Historical data indicate that dugongs occurred in the coastal waters throughout the region and were relatively common. Recent investigations show that dugongs have declined dramatically in recent decades, especially during the 1970s and 1980s. The reasons for this decline are still unclear, but deliberate killings, incidental catches in fishing nets, and habitat destruction are probably the most significant threats. Dugongs are still found in Mozambique, Tanzania, Kenya, the Comoros, Mayotte, the Seychelles, and Madagascar but in very low numbers, which may not be viable. However, observations of mother-calf pairs in certain areas gives reason for optimism.

Reducing mortality levels needs to be addressed immediately. The most effective short-term conservation measure will be reducing the threat from incidental net capture through restriction or banning of threatening fishing gear and the provision of alternative gear or livelihoods. In the medium to long term, education, training of local communities and relevant government bodies, and the establishment of community-managed dugong sanctuaries will also play a valuable role. Regional cooperation is imperative to coordinate efforts, target resources, and encourage the development of a more robust scientific approach. Further scientific investigations are needed to provide accurate data on the status, distribution, abundance, and ecology of the region's dugongs.