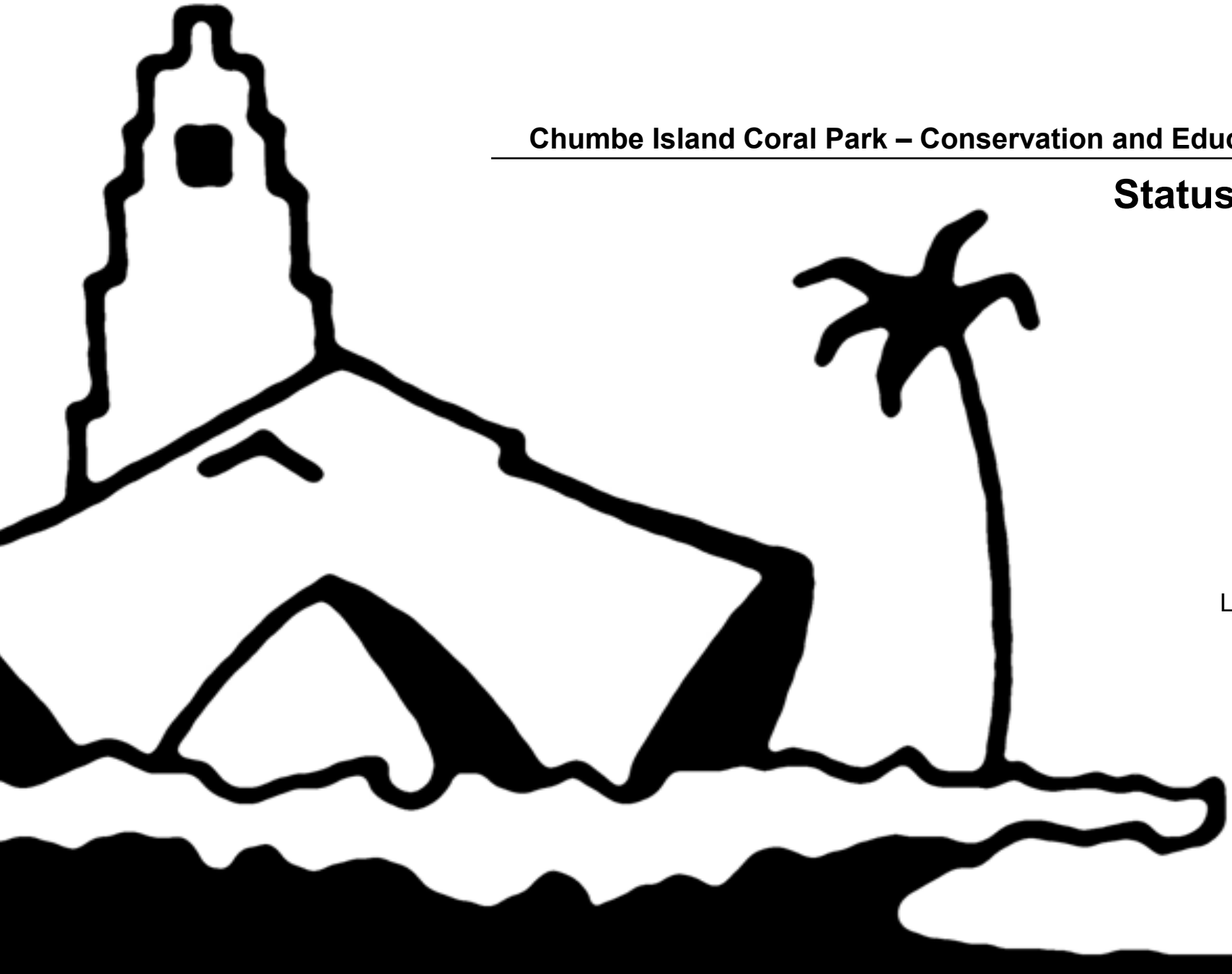
CHUMBE ISLAND
CORAL PARK
Zanzibar Tanzania

Chumbe Island Coral Park – Conservation and Education Programme

Status Report 2010



Prepared by
Lina Mtwana Nordlund
Anita Walther

Index

CHICOP Team 2010, Photo by Anita Walther

To be cited as:
Nordlund, L. & Walther, A. 2010. *Chumbe Island Coral Park - Conservation and Education programme, Status report 2010*. 1-36, Zanzibar

Foreword

Chumbe Island Coral Park is a small Marine Protected Area (MPA) just south of Zanzibar Island in Tanzania. Even though we are small, we have many interesting projects running within our conservation and education programme. The goal of the 2010 Conservation and Education Programme Status Report is to give an overview of the conservation and education work we are doing on Chumbe Island. Thanks you to all who have contributed to this report.

Chumbe Island Coral Park, Ltd. (CHICOP), established in 1991 as a private non-profit company, is a unique example of successful MPA management through income generation from eco-tourism. The visitors are supporting our conservation efforts for both the marine and terrestrial ecosystems, park management and the environmental education programme. I would like to thank all the guests that have visited Chumbe for their support as the guests make this conservation project possible!

2010 started with a 3 month power black out followed by a two-month maintenance season on Chumbe Island, in addition to governmental elections where tourists were recommended not to visit Zanzibar due to potential unrest. The election was very peaceful and we can already see positive changes; departments involved in fisheries and forestry are becoming more powerful and staff from the ministry of environment has moved up to vice presidents office. Arriving tourists are increasing and we look forward to a fruitful 2011. You are welcome to visit us!

Lina Mtwana Nordlund
Conservation and Education Manager

I started to work on Chumbe as a marine park ranger in September 1992. After spending years and years educating fishermen about the benefits of protecting a coral reef, I'm happy to say that the environment around Chumbe Island Coral Park has improved. Most of the local fishermen now agree with the protection of their environment and we can observe a measureable impact on the fishing industry. Results of the Coral reef monitoring programme on Chumbe Island show that the reef is developing extremely well, despite natural impacts like storms and increasing water temperatures. The Chumbe Island Coral Park has become unique system of conservation all over the world and we are proud to present our conservation efforts in the following status report.

Omari Nyange Ame
Chumbe Island Head Ranger

A major part of sustainable conservation of nature is the education of people that live in and next to it. In Zanzibar, there is a severe lack of understanding about the importance of environmental issues. Within the Chumbe Education Programme, we strongly support Education for Sustainable Development (ESD), which is a lifelong learning process. Through ESD, CHICOP helps students and community members to develop the knowledge, skills and action competence needed to create and sustain a viable future for human and all forms of life in Zanzibar and on the planet. Thus the Chumbe Education Programme contributes to the millennium development goals especially on resource management and strategies for addressing poverty. As Coordination and Education Ranger, I am happy to present you the proceedings we have achieved during the past years.

Khamis Khalfan Juma
Chumbe Coordination and Education Ranger

Introduction CHICOP

From left a hermit crab and the education centre, middle the sign at the boutique, right sunset over the education centre.
Photos by Oskar Henriksson

Chumbe Island is situated 12 km Southwest of Stonetown, Unguja, Zanzibar and 6 km from the nearest point on the Unguja coast (Chukwani). Latitude/Longitude: 6 16' S; 39 10' E (see figure 1). It is one amongst several MPA's in Tanzania, but one of only four in Zanzibar. The Chumbe MPA closely borders the Menai Bay Conservation Area.

Chumbe Island Coral Park Ltd (CHICOP) was registered in Zanzibar in 1992 for the sole purpose of establishing and managing the park. Company objectives are non-commercial, while operations follow commercial principles. CHICOP has been registered since 1995 as a MPA with the UNEP-World Conservation Monitoring Centre (WCMC) in Cambridge/UK and was, in 2000, also distinguished as Member of the UNEP Global500 Forum.

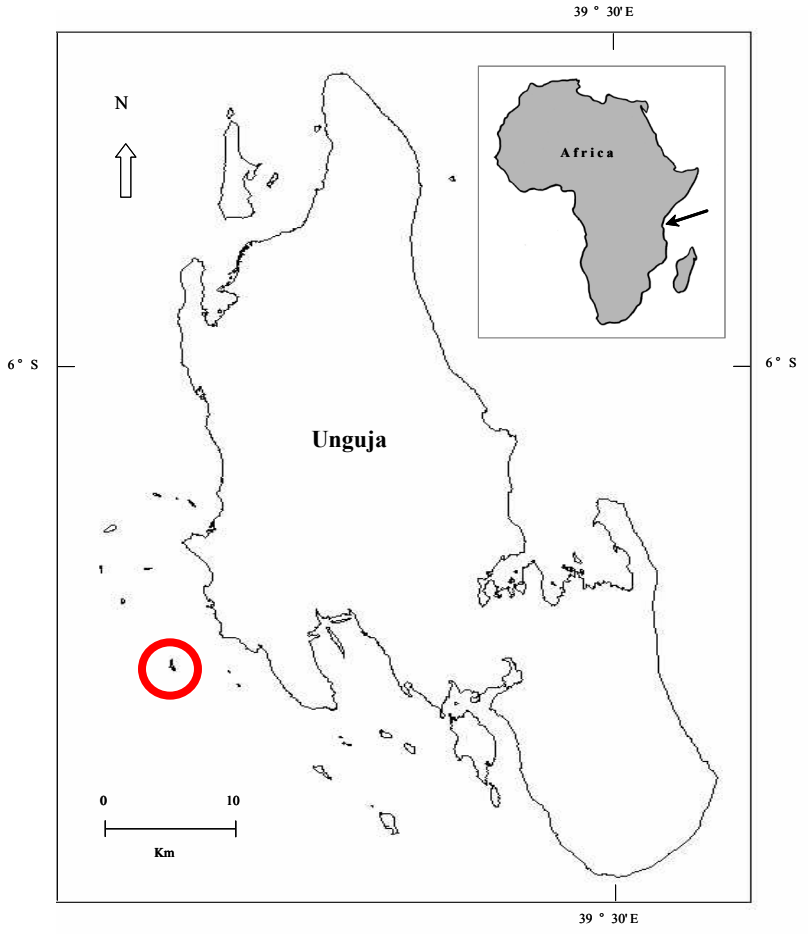
The MPA includes the Chumbe Reef Sanctuary (gazetted in 1994) and the Chumbe Forest Reserve (1995), a Visitors Centre and an Eco-Lodge on Chumbe Island. Management is based on consecutive Management Plans 1995-2005 and 2006-2016 (for project details see www.chumbeisland.com).

A key reason for CHICOP's early establishment, investment proposal and campaigning to gazette the Chumbe MPA was the recognition of Chumbe's high biodiversity value in both the reef and forest habitat.

Permitted uses of the marine park include recreation (swimming, snorkelling, underwater photography), education and research. Extractive and destructive activities, such as fishing, anchorage, collection of specimen (even for research) are not allowed. Research is co-ordinated with the Institute of Marine Sciences of the University of Dar es Salaam and regulated by the Chumbe Island Management Plans 1995-2005 and 2006-2016.

Mission statement for Chumbe Island Coral Park :

"To manage, for conservation and educational purposes, the Chumbe Island Reef Sanctuary and the Forest Reserve. This is also supported by eco-tourism activities which are directly related to the non-consumptive uses of the natural resources."



Unguja Island, Chumbe Island is marked with a red circle. Drawing by Anders Knudby

Part I:
The Conservation Programme

Chumbe Island Coral Park Ltd (CHICOP) was registered in Zanzibar in 1992 for the sole purpose of establishing and managing the park. On 3 January 1994, an agreement was signed between the Ministry of Agriculture, Livestock and Natural Resources (now known as the Ministry of Agriculture, Land & Environment – MALE) and CHICOP declaring the reef to the west of Chumbe as the **Chumbe Reef Sanctuary (CRS)** by virtue of section 6 (1) (e) of the 1988 Fisheries Act, Legal notice no. 99 of the 24th December, 1994. This made Chumbe Island Zanzibar's and Tanzania's first MPA (IUCN, 2001) and gave CHICOP responsibility for preserving, controlling and managing the Reef Sanctuary for an initial period of 10 years. This arrangement was reviewed and extended between MANREC & CHICOP on 3rd January 2004 for a further period of ten years. Under article 8 of this agreement, reference is made to the Chumbe Management Plan which will "be approved by the Advisory Committee, will be adhered to [in order to] ensure that the company is managing, controlling and preserving the CRS in a manner befitting a Marine Sanctuary."

On 22 July 1995 an agreement was signed between the Ministry of Agriculture, Livestock and Natural Resources and CHICOP which declared the land area of Chumbe Island, excluding the area leased to CHICOP, a **Closed Forest Habitat (CFH)** in accordance with the provisions of Wood Cutting Decree Ch. 121 and which entrusted management, including efficient control, conservation management and culturing of the natural resources, to CHICOP for a period of 33 years.

Chumbe is classified as a Class II protected area under IUCN's WDPA listings This is defined as a: *National Park / Protected Area managed mainly for ecosystem protection and recreation:* A natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible (Spalding *et al*, 2001).

The reef sanctuary has been declared one of the most diverse in the region and is believed to host 90% of the East Africa's hard coral species and 424 species of fish. As well as hosting the critically endangered Hawksbill Turtle (*Eretmochelys imbricata*) and the endangered Green Turtle (*Chelonia mydas*). The forest reserve possesses one of the last remaining healthy populations of the IUCN Red List of Threatened Species, the critically endangered Ader's duikers (*Cephalophus adersi*) and the data deficient Coconut crab (*Birgus latro*) along with various species of endangered birds. The tree *Uvariodendron kirkii* is listed as Vulnerable and there are indications of rare reptiles on the island.

Management Plan 2006-2016

A Management Plan is a fundamental tool to enable effective planning, development and management of a Marine Protected Area (MPA). It is designed to provide guidance to the MPA management team, through the identification of the key goals and objectives of the MPA in both time and space. Within these objectives, associated management actions provide recommendations for the setting of priorities, the identification of roles, responsibilities & stakeholder input, and the methodologies to be employed to ensure the sustainable development and management of the MPA. The Convention on Biological Diversity (CBD; to which the United Republic of Tanzania is a signatory) comments that management planning at individual MPA level is important for "..generating clear short and long term management objectives and associated programmes." (CBD, 2004).

A management plan should:

- provide a good decision-making framework
- be appropriate given the context of the MPA
- be adequate in terms of content
- be designed for effective implementation
  (Wells & Mangubhai, 2005:p.15)

The present management plan is following on from the earlier CHICOP management plan of 1995-2005. It is important to evaluate the MPA in terms of the effectiveness and relevance of the initial plan as well as review the status of the project in general in order to assign and priorities objectives and management actions for the next ten years.

The *first* step was to draw out the key 'values' (biodiversity, natural and socioeconomic values) of the project as it is today.

The *second* step was to review the original objectives in the management plan 1995-2005 and assess the adequacy of this initial plan.

Thirdly, there was an assessment of the management processes to date in implementing the original management plan, and the identification of areas where outputs have not met the expectations of the objectives (and where more management attention needs to be focused in the future), and – conversely - areas that have exceeded the original objectives.

Fourth, an up to date review of the existing policy and legal framework within which CHICOP operates was undertaken.

Finally the new objectives and management actions for this management plan 2006-2016 were developed.

Objectives of the Chumbe Island MPA: 2006 -2016
Conservation

I. To protect & manage the marine & forest ecosystems in the MPA
II. To promote research in the MPA in support of management
III. To develop and implement the biodiversity monitoring systems for both the marine & forest habitats in the MPA.
IV. To promote the conservation of rare & endemic species.Getting data to know how good we are doing

In the process of the above evaluations, in-situ stakeholder meetings were conducted in Unguja in order to gather input both into the assessment of CHICOP to date, and to encourage participation in the development of revised objectives and management actions.

During 2011 a recommended mid-point evaluation and review of this management plan should be conducted. This evaluation should explore the adequacy of the plan to date, and assess the achievements of the project against the management actions listed. Mechanisms for this evaluation should include a review of the yearly log-frame evaluations mentioned above, and an on-site evaluation of the project. Where necessary an addendum should be added to the plan outlining further management objectives (and associated actions) and / or any alterations / updating / augmenting in the organizations rules & regulations based upon the experiences of 2006-2011.

The eco-lodge on Chumbe, which income makes it possible to protect the environment and educate the local community in sustainability. Photos by Oskar Henriksson

The Key Values of the MPA

The key values in the MPA are outlined in the table. Structure & format adapted from Wells & Mangubhai, 2005

Biodiversity values:

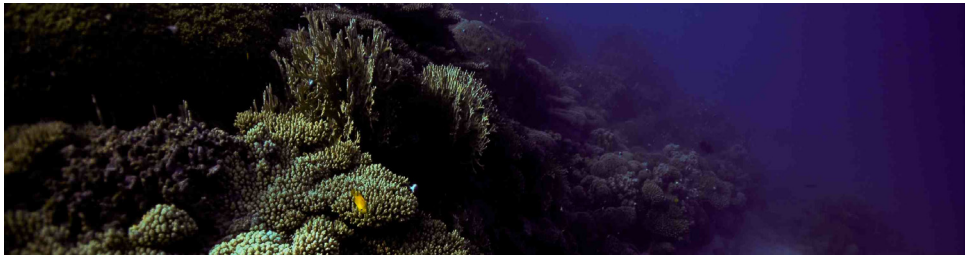
Value	Justification
Species-rich habitats & ecosystems	High species diversity in the CRS, including 55 Genera of coral & > 400 Spp fish. Healthy mangrove stand population and dense coral-rag forest of the CFH represent a remnant of the Coastal mosaic forest habitat.
Nationally representative habitats and ecosystems	The CRS is protected as a NTA and is therefore a rare example of non-impacted fringing reef representative of the region historically. And the CFH is a good example of an increasingly rare forest habitat in the region.
Globally threatened species on the IUCN red-list	The CFH is host to the Critically Endangered (IUCN-CR) Aders Duiker (*Cephalophus adersi*), and the CRS is a feeding ground for the Critically Endangered (IUCN-CR) Hawksbill Turtle (*Eretmochelys imbricata*) and the Endangered (IUCN-E) Green Turtle (*Chelonia mydas*)
Rare species nationally	The CFH is host to the data deficient (IUCN-DD) Coconut Crab (*Birgus latro*) considered to be increasingly rare in the region, and Uvariodendron kirkii, a species previously considered regionally extinct and with little research undertaken to date.

Other natural values:

Value	Justification
Specific fringing reef habitat formation	Shallow habitat with dramatic formations, high rugosity and diverse topography providing diverse habitat niches
Island ecosystem	Island ecosystems provide rich, isolated habitats relatively separate from external influences and pressures, allowing for a reduction in variables for research (control sites)
Source area for recruitment	Situated within a pivotal region in East Africa where cross-indian ocean current converge, an NTA at this site offers high potential as a source area for coral larvae.

Socio-economic/cultural values:

Value	Justification
Education	A variety of habitats and ecosystems provides education opportunities, combined with associated values from the ecotourism infrastructure in the education of future generations
Research	A 'natural laboratory' and control site for researchers able to examine comparative impacts / effects between non-protected and protected sites, as well as a site of rare and endangered species.
Sustainable fisheries	Through the full protection of the NTA and the associated spillover effect, combined with the connectivity to the adjacent Menai Bay Conservation Area.
Tourism & recreation	Regulated and controlled ecotourism and recreation activities enable revenue generation to sustain MPA operations.
Historical / archaeological sites	Presence of historical monuments, namely the mosque, lighthouse and lighthouse keepers house (converted into the education centre)



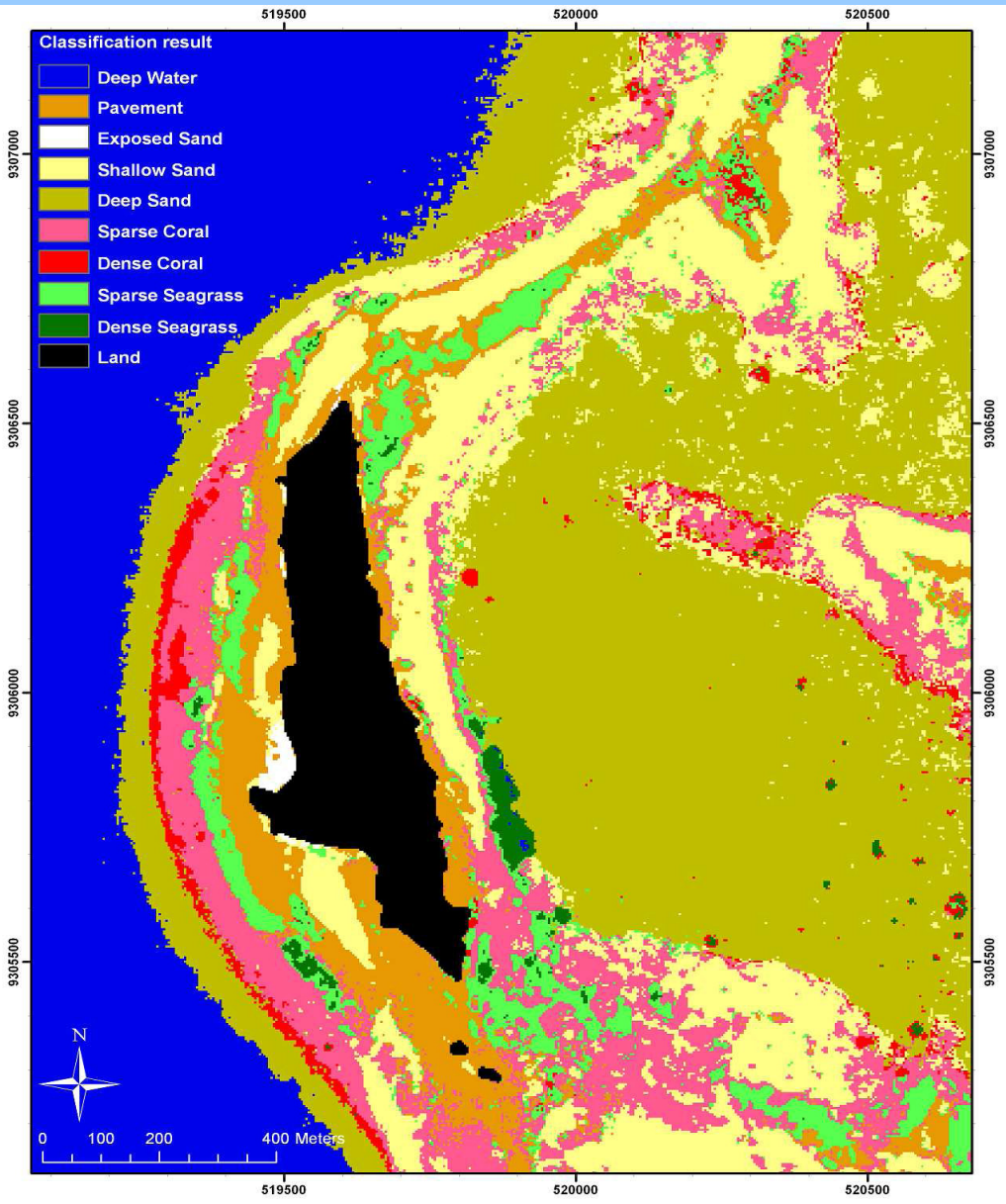
Top right mangrove kingfisher with its prey. Middle Excited tourists on their way to the reef for snorkeling. Bottom. The Chumbe reef. Photos by Oskar Henriksson

Remote Sensing

Chumbe contains a wide range of habitats; The map of Chumbe (opposite) displays the variety marine habitats that exist around the island. The western side of the island is protected and the eastern side is open for fishing. Only the western side of the island is protected because when the agreement was negotiated with the government, local fishermen wanted one side to be left open for the local fishing industry.

The figure to the right is taken from a study by Knudby & Nordlund (2011) were they classified a satellite image of Chumbe Island and its surroundings using supervised Maximum Likelihood Classification on the three depth-invariant indices using nine classes: deep water (negligible substrate reflectance), deep sand (>5 m), shallow sand (<5 m), exposed sand (above water), pavement (hard substrate with a low density of filamentous algae), sparse coral (<40% coral cover), dense coral (>40% coral cover), sparse seagrass (<250 g/m2) and dense seagrass (>250 g/m2).

The intertidal flat with sparse seagrass, exposed sand and pavement and a flock of terns. Photo by Lina Mtwana Nordlund



Monitoring Programmes

Monitoring provides early warnings of stress, e.g. to the reef, and allows appropriate management actions to be taken to mitigate these stresses. This allows an adaptive management scenario to be undertaken, defined by Wells and Mangubhai (2005) as 'adjusting management actions on the basis of lessons learned over time'. If monitoring is conducted by stakeholders, it can also increase environmental awareness and provide a sense of ownership and motivation to protect the monitored ecosystems (Wagner, 2005). However, using monitoring to assess the effectiveness and achievements of a terrestrial and marine reserve requires that the objectives of that terrestrial and marine reserve are clearly defined.

A long-term monitoring program should allow data to be collected over the timescales recommended by Russ (2002), providing stronger evidence of the effects of terrestrial and marine reserve protection than comparative studies. By providing increased evidence of the benefits of terrestrial and marine reserves, monitoring data will therefore increase support, both locally and internationally, for terrestrial and marine reserves.

As well as contributing to knowledge of terrestrial and marine reserve benefits, monitoring can benefit individual terrestrial and marine reserves. Monitoring data can be used to assess whether management objectives are being achieved, highlight issues for which that reserve needs support or funding and allow reserves to report their achievements (Wells & Mangubhai, 2005).

Chumbe island have several ongoing monitoring programmes.

Coral monitoring. The coral monitoring programme was set up by E.H.M Tyler in 2006. This programme monitors many different marine species including fish, sea urchins, Crown of thorn starfish, in addition to other threats such as coral disease.

Seagrass monitoring. The seagrass monitoring programme was set up in Sep 2006 by SeagrassNet.

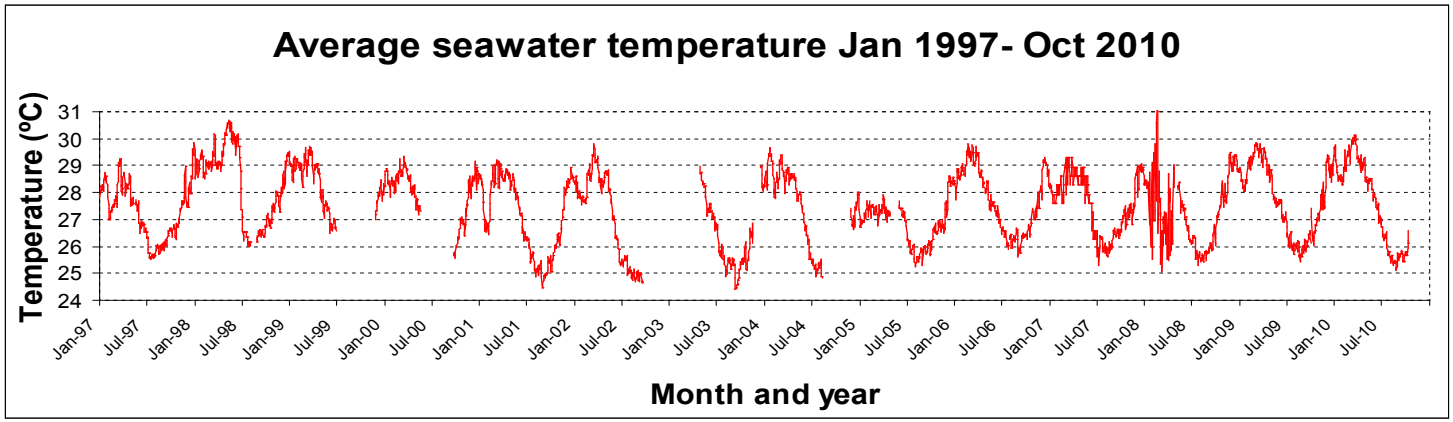
Seawater temperature monitoring. The temperature monitoring was initiated by Christopher Muhando at the Institute of Marine Science, University of Dar es Salaam in collaboration with Chumbe Island in 1997. See figures below for data.

Humpback whale monitoring. Sightings and whale behaviour are recorded and submitted to a large scale monitoring programme.

Forest monitoring. Our newest edition to the monitoring programmes, forest monitoring was set up by honors student Antony Gillingham in beginning of 2010. More can be read about this programme on page 20.

Ader's duiker monitoring. Every duiker sighting is recorded.

For more information please see respective chapter and below for results from the seawater temperature monitoring.



Seawater temperature monitoring showing the average seawater temperature from January 1997 until October 2010.

This is published with the kind permission of Dr Christopher Muhando, Institute of Marine Science.

The Chumbe Reef Sanctuary (CRS)

Pelagic: Open, relatively deep, oceanic habitat. Photo by Lina Mtwana Nordlund

After the discovery of Chumbe's incredibly biodiverse reef eco-system several years of campaigning by CHICOP succeeded in officially closing the fringing reef West of Chumbe Island in October 1992. With Chumbe being located upstream of the most important fishing grounds opposite Zanzibar's capital, Stonetown, the Chumbe reef provides a protected breeding ground for fish, corals and other species which can then spread out to recolonise nearby overfished and degraded areas. This makes Chumbe's protection of vital importance to both the preservation of bio-diversity and the fisheries economy in the region. On the 24th of December 1994 the Zanzibar Government officially gazetted the reef as the "Chumbe Reef Sanctuary" and with this Chumbe had become the first marine park in Tanzania. Following this Chumbe became registered as a UN recognised Protected Area. Chumbe is a rare example of a still pristine coral island ecosystem in an otherwise heavily overfished and over-exploited area.

There are four key habitat areas in the CRS:

Pelagic, Coral Reef, Coastal Shallows, Intertidal areas

Coral Reef: All live-coral dominated areas. Photo by Oskar Henriksson

Coastal Shallows: Shallow, rock and sand dominated areas (some vegetated by seaweeds and seagrasses) mainly on the landward site of the reef. Photo by Lina Mtwana Nordlund

Intertidal areas: All areas exposed between the tides into the eulittoral area. Photo by Lina Mtwana Nordlund

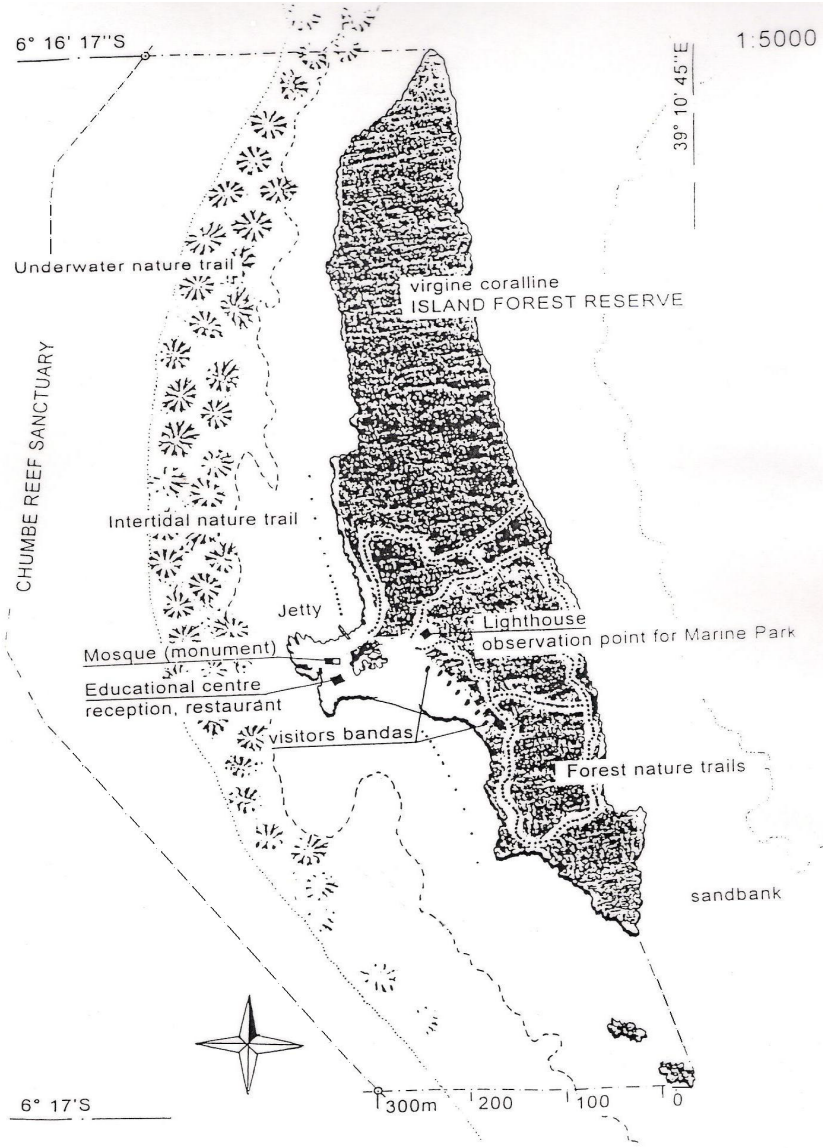
The Borders of the CRS

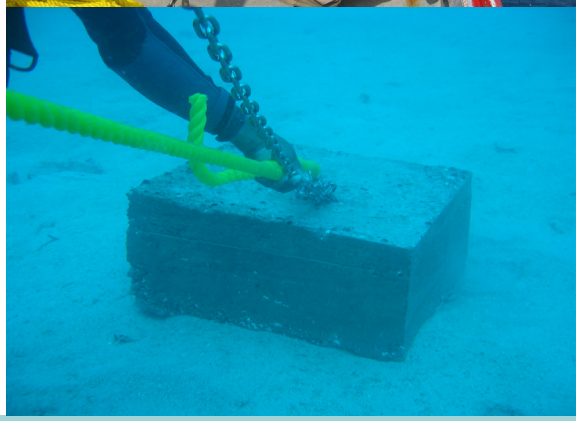
Chumbe has 3 marker buoys on the boundaries of the MPA to serve as a reminder of the no-fishing zone for local fisherman, in addition to alerting passing boats of the protected area.

In 2010 Chumbe experienced several problems maintaining the 3 marker buoys in the water. In 2009 stainless steel chains were purchased to secure the buoys to concrete block anchors. Unfortunately the chains started to accumulate rust after several months. As a result, two buoys were removed from the water as the chains had degraded close to the point of breaking. To temporarily fix the problem, nylon rope was used in place of the chains and the buoys were returned to the water in mid-March.

In end of August one marker buoy was lost (a painted SIM tank) from the southern boundaries of Chumbe's marine protected area. This SIM tank had replaced an official marker buoy that was lost in June that was never recovered. We were unable to identify whether the substitute marker buoy (SIM tank) drifted or sank. We are currently working with the Zanzibar Ports Corporation to identify a better method of securing the buoys to the concrete anchors.

Since August there have been 2 marker buoys marking the MPA boundaries on the west side of Chumbe Island. The temporary solution of using nylon rope to secure the buoys seems to be working well, however we are having issues with heavy on-growth of Oysters. Regular cleaning done by SCUBA diving is being carried out.





Photos from the top: The marker buoys when they were new (by Frida Lanshammar), placing the buoys in the water (by Lina Mtwana Nordlund)

Poaching

The rangers keep daily monitoring reports of activities in the CRS and these have been produced since rangers were first instated on the island in 1992. These provide key data on the scale of attempted infringements into the NTA.

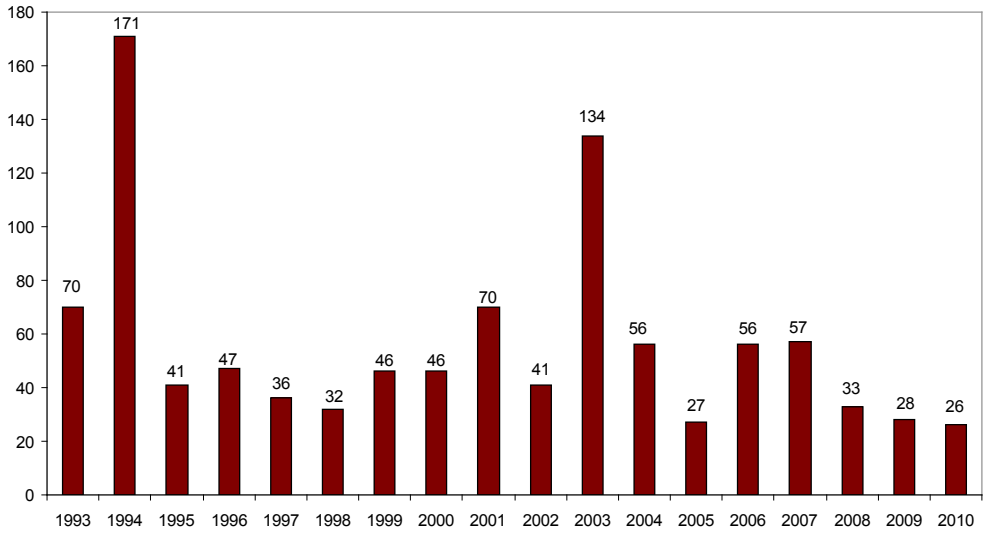
In the early years of the project, outreach meetings were conducted to generate awareness about the MPA NTA. The area of the Chumbe CRS had not been traditional fishing grounds as a military base on the adjacent coast used the area around Chumbe for shooting range exercises.

Additionally, since colonial times the area west of Chumbe was off-limits for traditional dugouts and outrigger boats, as they were considered to be hazardous obstructions for large vessels travelling in this Dar es Salaam / Zanzibar channel. Thus the area was little accessed previous to the MPA establishment. Therefore response was generally positive from the community representatives regarding Chumbe becoming an MPA, as expressed in village meetings held in 1991 prior to proposing the project (Riedmiller, 2003).

However, ranger patrols still met with some resistance on site in the early years, predominantly from fishers visiting from more distant areas in Unguja. Since 1998 it became apparent through the analysis of the ranger data that many infringements being documented coincided with political events, such as election campaigns (mid nineties) and the timing of the breakfast of Ramadhan, or stormy conditions when fishermen anchored temporarily and did not denote attempted fishing or poaching. After the analysis was conducted, buoys, especially for anchorage in these situations, were then established and infringement incidence has reportedly decreased (Omari Nyange pers comm).

Ngalawa. Photo by Lina Mtwana Nordlund

Total number of poaching incidents (1993-2010)



Chumbe Island. Photo by Lina Mtwana Nordlund

The Coral Reef

"…one of the most spectacular 'coral gardens' to be found anywhere in the world."

J.E.N Vernon Australian Institute of Marine Science

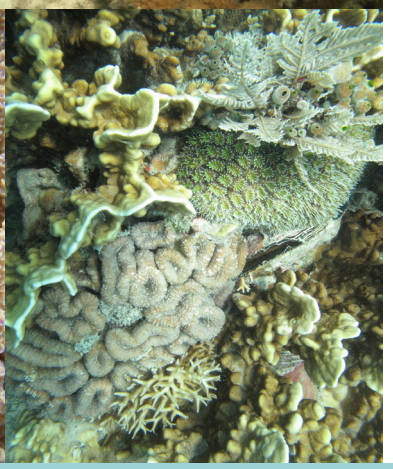
Chumbe Island has a wide variety of corals that represents at least 16 coral families. Furthermore it is believed that the CRS hosts 90% of the hard coral species in East Africa.

Since 1992 the different fish species have been recorded inside the borders of the CRS. 425 different fish species have been seen and the total list of species can be seen in the appendix.

The monitoring variables can be seen to the right and regarding the fish the key species and the size distribution within major fish families are monitored.

Zvuloni et al (2010) reports that in total, 2,829 individual coral colonies was sampled and categorized into 46 taxonomic units (TAUs; c diversity) at the following reefs around Zanzibar; Bawe, Mnemba, Chumbe and Changuu . Diversity across the three tested spatial scales was highest at Chumbe Islland, followed by Mnemba, Bawe Island and Changuu. Chumbe also supported the highest number of 'unique' TAUs (13; i.e., TAUs occurring only at that site) and the highest number of 'locally rare TAUs' (11; i.e., TAUs found only in one transect within a site.

Photos top: Omari Nyange conducting coral monitoring (photo by Karlyn Langjahr), middle left an orange striped trigger fish (*Balistapus undulatus;* photo by Martin Leyendecker), middle right Emperor angelfish (*Pomacanthus imperator;* photo from Chumbe archive), below Coral on Chumbe, e.g. *Porites sp, Acropora sp* (photos by Lina Mtwana Nordlund).



Coral monitoring programme variables

Fish:

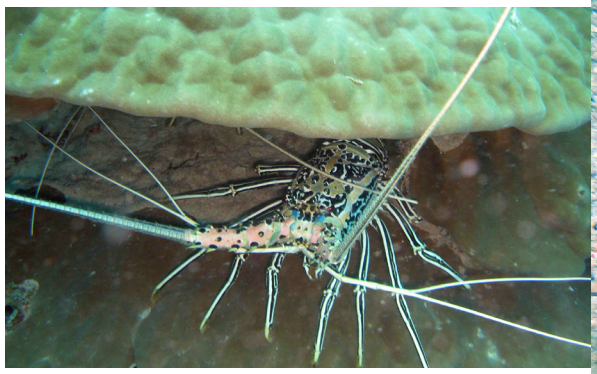
Balistidae
Haemulidae
Lutjanidae
Scaridae
Serranidae
Siganidae
Chaetodontidae

Habitat:

COTS
D. setosum
D. Savignyi
E. mathaei
E. Diadema
Coral colonies
COT predation
Colour bleach
Dead bleach
White Syndrome
Black Band Disease
Pigmentation
White splotch
Tumors
Brown Band Disease
PUWS
Other diseases
Natural damage
Human damage
Unsure damage

Fauna in the CRS

A variety of marine species are supported in four main marine habitats in the CRS, including seagress, coral reef, coastal shallows and the open pelagic. Species list for the fauna in the CRS can be found in the appendix. Chumbe would benefit from further inventories to identify species, especially for invertebrates.



A spiny lobster. Photo by Nell Hamilton

A seagrass ghost pipe fish in the coastal shallows of the CRS. Photo by Frida Lanshammar

The critically endangered Hawksbill turtle. Photo by Oskar Henriksson

Passing humpback whales are recorded and the data submitted to a large scale monitoring programme in the Western Indian Ocean. Photo by Lina Mtwana Nordlund

Coral Disease

The coral monitoring programme set up for Chumbe Island (Feb 2006) includes incidences of coral diseases; therefore any further knowledge in this field is very helpful in the success of the monitoring programme.

The reason we study coral disease is because disease outbreaks have occurred more frequently worldwide, there is a need to monitor these outbreaks as well as their potential causes. Very little research has been done on the prevalence of coral diseases in the Western Indian Ocean.

It is important to investigate correlations between disease outbreaks with other stressors, such as high temperatures. Dr Christopher Muhando at Institute of Marine Science is monitoring the water temperatures in the CRS in collaboration with Chumbe.

Interestingly, it has been found that the prevalence of disease is higher in MPAs, rather than in non-MPAs. This seems to be a complex situation, but one theory suggests that MPAs have higher coral diversity, therefore a wider range of hosts for different diseases.

A disease is defined as: “Any impairment of an organism’s vital organ, system or body function”. Some pathogens/parasites may induce bleaching. Infectious diseases can be caused by pathogens or parasites; micro parasites; viruses, bacteria, fungi, protozoa, ciliates macro parasites; nematodes Non-infectious diseases and be caused by; genetic mutations, malnutrition, exposition to abnormal conditions; chemical imbalance, UV, etc. But most diseases result from the interaction of more than 1 factor, it is therefore difficult to pinpoint the specific cause.

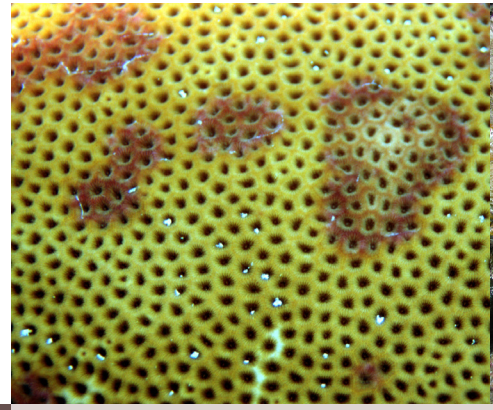
Outbreak events may result in drastic changes in the structure and composition of coral communities. Outbreaks can also affect the reproductive potential of coral species with potential evolutionary consequences.

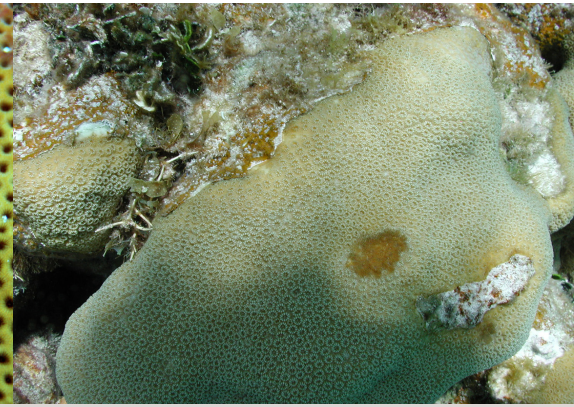
At Chumbe we are monitoring the following diseases:

- Pigmentation
- White syndrome
- Black band
- White splotch
- Tumors
- Brown band
- Porites Ulecerative White Spot
- Others

Above: Very healthy reef at Chumbe Island, photo by Oskar Henriksson,

Below: to the left brown band disease and to the right brown spot disease. Photos from the free photo library at www.reefrelief.org

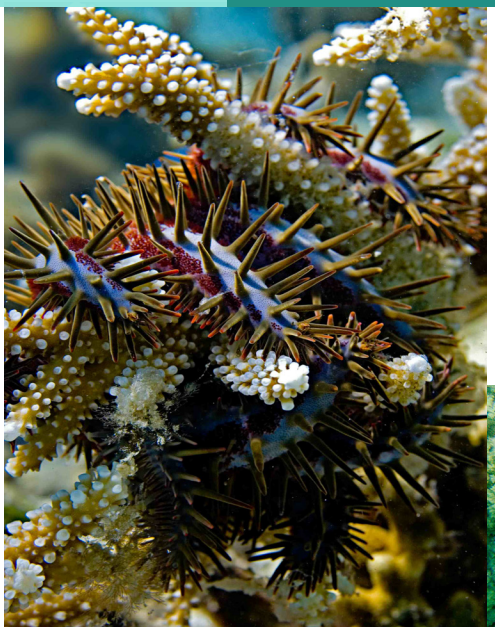




Crown of Thorns Starfish

Crown-of-thorns starfish (COTs), *Acanthaster planci*, is a coral predator causing great damage to coral reefs world wide. Their preferred prey is *Acropora* sp., and during the last 50 years temporary COTs population increases and outbreaks seem to occur more frequently, putting Acropora under great stress. Around Zanzibar, outbreaks of COTs seem to be detected more often.

An earlier study by Lanshammar & Muhando (2008) looked at coral mortality and recovery after the last major El Niño in 1998 related to COTs population densities in the Zanzibar archipelago. It also discusses COTs removal as a management tool for improving recovery of corals after large disturbances such as El Niño. Benthic data from three islands on the west coast of Zanzibar (Chumbe, Bawe, and Changuu) show that the % cover of Acropora dropped between 10-15% during the El Niño in 1998, after which a slow recovery could be seen on all reefs. Since a major COTs population outbreak in 2002/2003 however the levels have dropped dramatically down to only around 1% live Acropora on all reefs except for Chumbe where the level has increased to the same as before the bleaching.

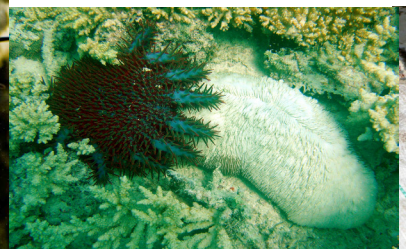


There are three common theories regarding COTs outbreaks:

- removal of predators
- human influence on water quality
- natural fluctuations

During an outbreak the COTs density increases, the competition for feed increases and the feeding preference broadens from tabular corals (preferably *Acropora* sp.) to other coral species.

From the left: COTs feeding on acropora coral, middle COTs feeding on mushroom coral. Right, collected COTs from the Chumbe reef. Photos: left by Oskar Henriksson, middle Lina Mtwana Nordlund, right left by Nell Hamilton



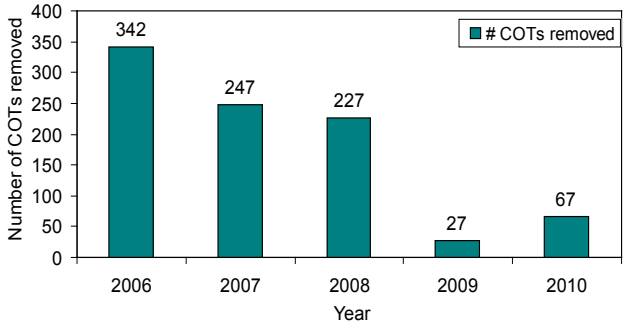
When increased densities of COTs were noticed inside the marine park on Chumbe, the management initiated a manual COTS control programme where park rangers would collect, count and measure all COTs seen inside the park in order to keep densities close to zero at all times. Since April 2004 a total of 3306 starfish have been collected inside the 0.4 km² marine park. All efforts have been recorded and each starfish has been measured and the area of the reef where it was collected recorded.

This study concludes that manual COTS removal programmes indeed can have an important positive effect on coral reef health, and that these efforts should be encouraged as a management tool for smaller marine parks with enough human resources for continuous collections.

 # COTs removed since 2006

	2006	2007	2008	2009	2010
MPA North	137	127	126	19	56
MPA South	205	108	53	8	11
MPA Middle	0	12	48	0	0
Total reef	342	247	227	27	67

 # COTs removed per year since 2006



Average size information per year since 2006

	2006	2007	2008	2009	2010
Min (cm)	16	15	15	20	16
Max (cm)	32	34	40	31	33
Av. Size (cm)	24.5	26.4	38.1	25.3	24.8

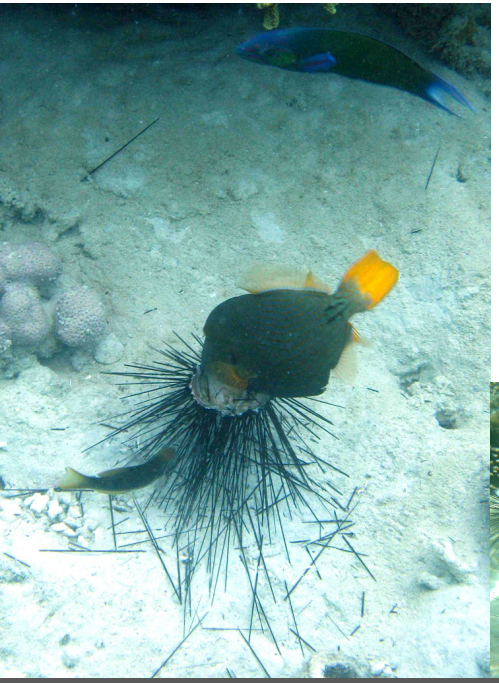
Sea Urchins

Population increases of the long-spined sea urchin *Diadema setosum* around Zanzibar are believed to have caused loss of seagrass beds and coral cover, and possibly competitive exclusion of herbivorous fishes. This has prompted both conservation organizations and local fishermen to call for management of the species. However, the population dynamics of *Diadema setosum* are poorly understood, and the effects of any management initiatives are difficult to predict.

On Chumbe we are monitoring the following sea urchin species:

- *Diadema setosum*
- *Diadema savignyi*
- *Echinothrix diadema*
- *Echinometra mathaei*

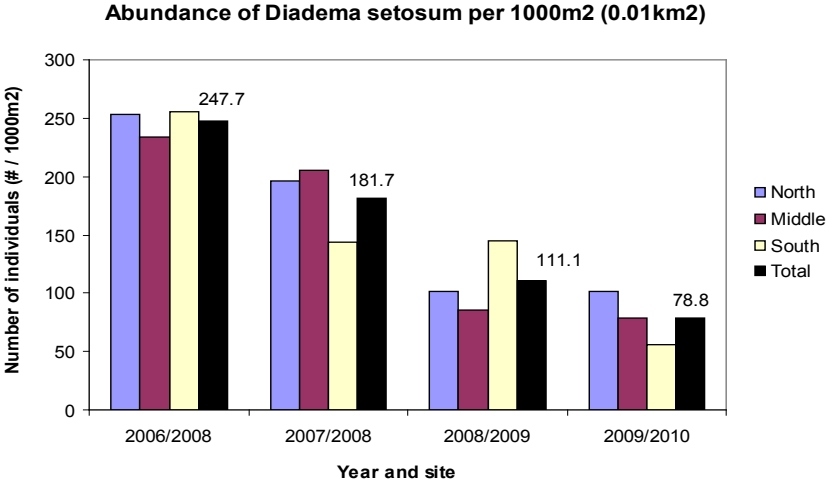
Survey studies show a decreasing abundance of *Diadema setosum* at several monitoring sites on the Chumbe reef (see diagram).

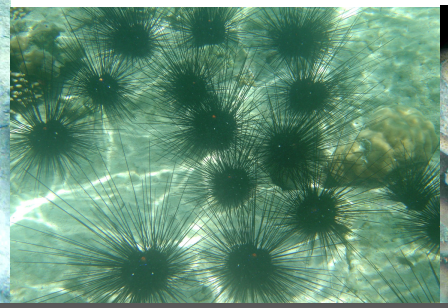


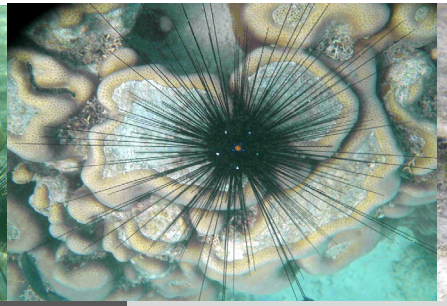
Above right: The long-spine sea urchin (*Diadema setosum)* Photo by Fam. Leyendecker
Left: An orange striped trigger fish (*Balistapus undulatus*) eating a sea urchin. Photo by Nell Hamilton

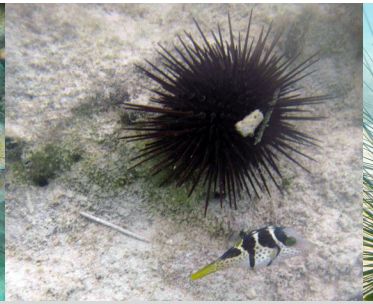
Below l-r: Many long-spine sea urchins (*Diadema setosum*) (Photo by Lina Mtwana Nordlund) long-spine sea urchin on coral (Photo by Anita Walther), *Echinothrix diadema* (Photo by Nell Hamilton), many long-spine sea urchins (Photo by Anders Knudby)

Right: A diagram showing the abundance of the common sea urchin (*Diadema setosum)* in the north, middle, south and the whole of the Chumbe reef.





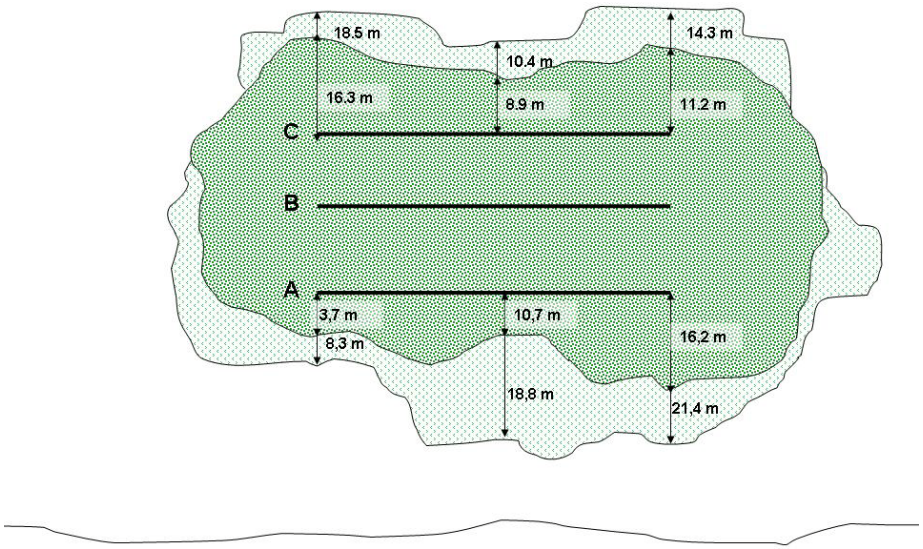




The Seagrass

Seagrass meadows are vital invertebrate harvesting grounds and are commonly distributed in tropical and subtropical coastal intertidal areas. Seagrasses are marine angiosperms that assist in stabilizing the seafloor with their root systems and filtering or trapping harmful pollutants or particles derived from land production (Howard et al. 1989; Duarte and Chiscano 1999). Fish and invertebrates use these habitats for foraging, protection against predators and as nursery grounds (Orth et al. 1984; Bell and Pollard 1989; Nagelkerken et al. 2000). A healthy seagrass meadow is important for the functionality of the whole seascape e.g. for coral reef ecosystems which are closely interlinked with seagrass systems (Dorenbosch 2006).

Our SeagrassNet monitoring site TZ19.2 - (S 6° 16.6596' E 39° 26.2626')



In the Coral Reef Sanctuary we have seagrass meadows**.** Of the 13 seagrass species known from the region (Bandeira and Björk 2001), seven are found around Chumbe Island: *Cymodocea rotundata* Ehrenb. & Hempr. ex Aschers, *Halodule* sp. (Forsk.) Aschers. in Bossier, *Thalassia hemprichii* (Ehrenberg) Asherson, *Thalassodendron ciliatum* (formerly *Cymodocea ciliata*) (Forskål) den Hartog, *Halophila ovalis* (R. Br.) Hook. *f.*, S*yringodium isoetifolium* (Ascherson) Dandy, and *Cymodocea serrulata* (R. Br.).
We monitor the seagrass and the programme is set up by SeagrassNet. We conduct the monitoring every 3 months and the results are sent to the SeagrassNET programme.

Information from the SeagrassNet website www.seagrassnet.org

"SeagrassNet is an expanding, worldwide ecological monitoring program that investigates and documents the status of seagrass resources and the threats to this important and imperilled marine ecosystem. The program started in 2001 in the Western Pacific and now includes 115 sites in 32 countries with a global monitoring protocol and web-based data reporting system. Our ultimate aim is to preserve the valuable seagrass ecosystem by increasing scientific knowledge and public awareness of this threatened coastal resource."

Photos: bottom, seagrass *Thalassodendron ciliatum* (by Nell Hamilton), top Omari Nyange and Rashid Hamad conducting seagrass monitoring (by Lina Mtwana Nordlund)

Chumbe Closed Forest Habitat (CFH)

Approximately 90% of Chumbe Island is covered by one of the last remaining pristine 'coral rag' forests in Zanzibar. The forest was declared a closed forest in 1994 by the Government of Zanzibar, and the management was entrusted to Chumbe Island Coral Park Ltd.(CHICOP). There is nature trails available for guests and students

There are three key habitat areas in the CFH:

The Mangrove pools area: Small saltwater-inundated pools with water levels varying with the tides and vegetation dominated by mangrove.

The Scrub: Relatively short scrub (3m), possibly wind/salt clipped, occurring on the periphery of the forest habitat.

The Forest: Relatively tall (6m) dense coastal thicket covering the majority of the island.

In the following text you will find information about this specialized forest habitat and some of its occupants, namely the rare Coconut Crab and the endangered Ader's Duiker.

View on the closed forest, northern part of the island. Photo by Oskar Henriksson

The Scrub, Photo by Antony Gillingham

The Mangrove pool area, Photo by Anita Walther

The Forest, Photo by Oskar Henriksson

The Tropical Dry Forest

Chumbe hosts a highly specialised plant community that has developed to survive without any groundwater, instead depending on capturing the moisture from the humid air and storing the rainfall during the rainy seasons. The bedrock of the island is made up of an impressive substrate of fossilized coral. You can still see the skeletal structures of corals and giant clams - a gentle reminder of the passage of time. More staggering still is the coral-rag forest. The density of the forest is spectacular, as adventitious roots thrust out in all directions and epiphytic species cling to life by wrapping themselves around all available surfaces. Researchers have taken up to four hours to transverse the 1 km stretch through the central forest reserve and the crags and caves hidden underfoot as remnant of the reef structure of this fossilized coral habitat, makes studying this environment both challenging and consistently rewarding as new discoveries are constantly uncovered. For guests the nature trails provided allow for an insight into this otherwise virtually impenetrable habitat.

In the management of this habitat, materials imported onto the island are carefully screened to avoid any non-indigenous elements intruding into this spectacularly preserved environment. Such practice was unfortunately not in place in the early 1900's when rats were accidentally introduced onto the island (probably by the British ships bringing materials when the lighthouse was established). However, after the successful conclusion of the rat eradication programme in May 1997, managed by CHICOP with support from specialists from Cork University in Ireland and the Zanzibari Plant Protection Division, the island was freed from this non-indigenous species and the island's flora (that had been under pressure from competition from the rats consuming the vital regenerating fruiting bodies) improved conditions further for the sanctuary.

In April 2010 the conservation team, together with the Honors student Mr. Antony Gillingham of the University of the West of England, has finalized a monitoring program for the coral rag forest on Chumbe Island. A monitoring manual for the rangers was developed and implementation will take place during the upcoming months. Additionally, an updated plant species list has resulted from his work where we now have 124 known plant species on Chumbe Island. An identification booklet with pictures has also been created.

Top: Uvariodendron kirkii Photo by Anthony Gillingham

Middle: Mr. Antony Gillingham monitoring the coral rag forest on Chumbe Island. Photo by Antony Gillingham.

Bottom: Department of Forestry visiting Chumbe photo by Lina Mtwana Nordlund

The Aders' Duiker

The Aders' Duiker (*Cephalophus adersi*) is an endangered species accepted to be extinct in its original range on the African mainland coastal thicket and forests of the Kenyan coast. Today, only a relict population survives on Zanzibar (Unguja) island and this small population continues to decrease as a result of habitat destruction and uncontrolled hunting despite being protected by Zanzibar law (Archer 1994). A long-term captive breeding programme is now proposed by the Department of Forestry of Zanzibar, but urgent attention is required if this species is to avoid extinction.

In order to improve the future for this threatened species, CHICOP began to work with the Department of Forestry towards the establishment of an Ader's duiker sanctuary in the Chumbe forest in 1995. Consultants of the Department and of CHICOP studied conditions there, and the Chumbe forest was found to be of exceptionally good quality to provide suitable habitat for these duikers (D. Aplin; A. Williams). Therefore, a small breeding population was introduced to the fully protected forest reserve on Chumbe Island. A total of 6 Ader's Duikers were translocated from the Mtende Region to Chumbe Island – in December 1998 one female, in February 2000, three males and two females (MacPherson et al., 2002).

Following the principles of re-introductions of endangered species, as outlined by IUCN, monitoring procedures are in place using remote camera sensors located in key areas in the forest, where they monitor the animals behaviour, territory and feeding patterns (personal comm. J. MacPherson & D. MacPherson).

Top right and bottom left An Ader's Duiker (*Cephalophus adersi*;; Photos by monitoring camera), middle, scent mark, right, monitoring camera (Photos by Lina Mtwana Nordlund)

Additionally, CHICOP records the direct sightings of non-tagged animals by rangers and guests. The numbers of sightings have been more frequent in the past 5 years. Even juveniles have been observed on two occasions.

In order to estimate the population size a so called "drive" was carried out in September 2007 and again in June 2009. This method is considered a reliable way to estimate population size of the Ader's Duikers on Chumbe Island. Unfortunately, the drive in 2007 showed at least 6 animals while the drive in 2009 resulted in only 4 animals. There might be several reasons for the difference in numbers of individuals concerning the monitoring technique. A far more sensitive technique to get information about the number of Aders' duikers on Chumbe Island is to conduct DNA analysis out of faeces samples. This monitoring technique will be examined in the near future.

The Project is managed in collaboration between Chumbe Island Coral Park (CHICOP) and The Wildlife Division of The Department of Commercial Crops, Fruits and Forestry (formally the Commission for Natural Resources) within the Ministry of Agriculture, Natural Resources, Environment and Co-operatives of Zanzibar. Munich-Hellabrunn Zoo and the Mammal Ecology Research Group (MERG), Royal Holloway University, London provided technical support. The Project was financed and supported by Chumbe Island Coral Park Ltd. (CHICOP), Chicago Zoological Society (CZS), Eco-tec (Zanzibar) Ltd., World Wide Fund for Nature (WWF), Fauna and Flora International (FFI), British Ecological Society (BES), British Airways, Munich-Hellabrunn Zoo, and Bavarian Television."

The Coconut Crab

The Coconut Crab (*Birgus latro)*, also called Robber Crab, is with a carapace diameter of up to 45cm the largest land-living arthropod in the world. It got its common name from its ability of climbing up to the top of coconut trees and of easily cracking coconuts with its powerful claws. The crabs have evolved to live on land but begin their life in the sea, later adopting shells as houses for protection until they grow large enough to manage with just their hardened carapace alone. This gives these crabs a lobster-like appearance with their curled-under abdomens.

Unfortunately, the coconut crabs are hunted for their tasty meat and have become locally extinct in areas typically close to human settlements, such as Zanzibar. A remaining number of *Birgus latro* is habited on Chumbe Island.
However, research into this species in the East African region is extremely limited and the disappearing species is unfortunately still listed as data deficient in the IUCN endangered species listing, as simply nobody knows how many are left. But fishermen regularly report decreasing sightings and CHICOP hopes to assist this plight in the establishment of a study base for comparing Chumbe's healthy population with neighbouring findings, so that at last the species may gain international support in its protection.

Kiran Singh an undergraduate student from School of International Training did a study on the coconut crab, *Birgus latro,* for 15 nights during October and November 2010. During her study she captured and marked 280 coconut crabs at the 9 study points. This can not be used as a population estimation for Chumbe, but it shows that we without any doubt have more than 280 adult coconut crabs on Chumbe. There were 170 female and 110 male crabs marked. The average thoracic length for males was 50.4mm and for females 39.5mm. The highest amount of coconut crabs was observed around 10 PM.

Coconut crab (*Birgus latro*), two morphs red/brown and purple/blue. Photos above and far left by Oskar Henriksson middle and bottom right by Lina Mtwana Nordlund

Birds

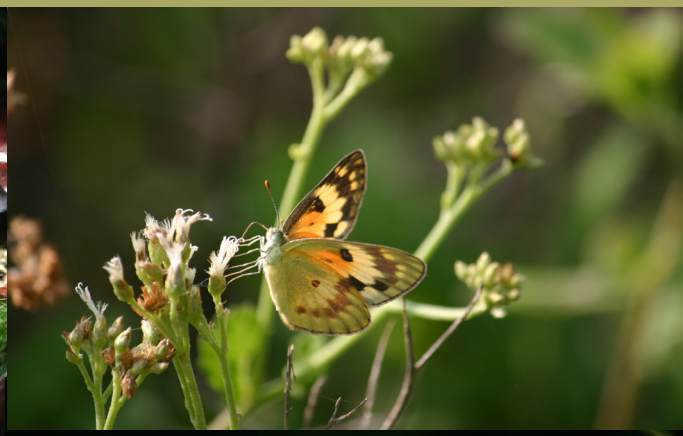
Chumbe Island is a breeding site for many birds. So far, a total of 93 birds species have been observed on the island. You can see different birds species in forest and on sea. Some birds are migrants and some are residents. Chumbe has a rich bird life; identified species can be seen in the species list in the appendix.

The most common birds that can be seen frequently on chumbe island are:

- Indian House crows
- Pied kingfisher
- Fish eagles
- Mouse colored sunbirds
- House sparrow
- Paradise flycatcher
- Eurasian golden oriole
- Ringed plover
- Little egret
- Little swifts
- Dimorphic heron
- Grey plover
- Somber greenbuls
- Ringed plover
- Purple banded sunbird
- Eurasian swallows
- Reed warblers
- Purple-banded sunbird
- Mangrove kingfisher
- Grey Heron
- Common sandpiper
- House sparrow
- Red eyed dove
- Pygmy kingfisher
- Ringed dove
- Red eyed dove

Photos, from left: flycatcher photo by Antony Gillingham, Roseate terns, photo by Mikala Peters, King fisher, photo by Antony Gillingham

Other Fauna in the Forest



Chumbe's coral rag forest is a unique ecosystem of species that subsist off the island's fossilized coral foundation. More research is needed to identify the true biodiversity of the forest, however a list of recorded species is contained in the appendix.

Top left (clockwise): Green Snake (photo from Chumbe archive), hermit crab, butterfly, snail (photos by Antony Gillingham), Red Hermit crab (*Dardanus megistos*; photo by Kai Spilker), insect (photo by Antony Gillingham), bats (photo by Antony Gillingham) and gecko (photo by J Sofie).

Conferences & Research

During 2010 the Chumbe team attended 4 different conferences to present our conservation and education efforts.

1) The 2nd Asia Pacific Coral Reef Symposium

- Collaboration for Coral Reef Conservation in a Changing Climate (20 - 24 June 2010) Phuket, Thailand
- "Environmental education & Conservation supported by sustainable eco-tourism at Chumbe Island Coral Park, Tanzania". Nordlund, L. and Langjahr, K.
- "Smashed reef, crime scene investigation and reef remediation in the Chumbe Island Reef Sanctuary". Nordlund, L., Lanshammar, F. and Langjahr, K.
- "Private MPA management & conservation based on sustainable eco-tourism at Chumbe Island Coral Park, Zanzibar, Tanzania". Langjahr, K. and Nordlund, L

During the 2nd APCRS, there were great opportunities to learn about problems and solutions in Asia as well as of other places in the world. Many great contacts were established.

2) The fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 14) - Biodiversity and Climate Change: Achieving the 2020 Targets (10-21 May 2010) UNEP Headquarters, Nairobi, Kenya.

-"Chumbe Island Coral Park Education Programme - Communicating Biodiversity and Climate Change". Nordlund, L. and Langjahr, K.

3) World Water Week (5-11 September 2010), Stockholm, Sweden. Poster presentation:

-"Environmentally friendly technology for water conservation, consumption and sanitation in Tanzania - what can we learn?" Lina Nordlund and Karlyn Langjahr

Ms. Lina Nordlund, the Conservation & Education Manger, had the honor to be invited to World Water Week. During the week Chumbe learned about the advancing problems with water, and we shared that rainwater harvesting is working even in tropical coastal countries.

4) 2nd Annual Agricultural Research Review Workshop (20-21 October, 2010) Zanzibar, Tanzania.

-"Chumbe Island Coral Park Education Programme - Communicating Biodiversity and Climate Change" Nordlund, L. and Langjahr, K.

-"Removing Fishing Nets from Coral Reefs around Zanzibar" Nordlund, L. and El Kharousy, Z.

This study was conducted together with Mr Zahor El Kharousy, Head of Marine Conservation Unit, Department of Fisheries. A scientific paper is also in preparation.

Ms Aurora and Ms Sanja visited the Island to conduct research within the reef sanctuary. Their thesis consists of a socio-ecologic study of fishing pressure on coral reefs. During their ecological study they have been sampling species abundance of fish at coral reefs that are exposed to different degrees of fishing pressure.

The students Elsie Thomson and Lindsay Dinsmore from the School of International Training made an inventory of invertebrates in the seagrass meadows around Chumbe Island. Their research resulted in a report called “Invertebrate Distribution in Seagrass Beds of Chumbe Island”. During mid-April SIT student Molly Moynihan also visited Chumbe to collect water samples. Molly wrote the report: Water Quality and Eutrophication: the effects of sewage outfalls on waters and reefs surrounding Stone Town, Zanzibar. During October Rachael Mallon conducted the project coral reef predation and population of coral predators; Kiran Singh - coconut crabs and their territory; Katie O'Reilly - producing a video working with ZanziBits to film the education program and look at students or schools who have already participated in the environmental education program; a ~5 minute video was the outcome and can be used in the future for selected audiences.

During Ramadan we invited 2 volunteers to relieve the Guiding Rangers from their in-water work to enable them to completely fast during the Holy Month. This year Ms. Lucy Marcus and Mr. Nicholas Duprey were our Ramadan Rangers who guided all of the snorkeling with guests. Lucy Marcus is a marine biologist and underwater videographer from the United States of America and Nicholas is a sea cucumber biologist working with the Canadian government.

Dr Narriman Jiddawi and Lina Mtwana Nordlund next to the 2 posters from Chumbe Island. Photo by Frida Lanshammar

Part II: The Education Programme

School education in Zanzibar, as elsewhere in the region, is based on rote-learning of an extremely academic syllabus having little relationship with the surrounding world. Extra-curricular activities, such as field excursions are rarely organised and very few children have a chance to visit their surrounding ecosystems. In 1999, CHICOP initiated an Environmental Education (EE) programme with the aim to provide hands-on environmental education for schoolchildren and at the same time give teachers ideas for how to conduct field-based environmental education in marine biology, forest ecology and environmental protection. It is the only regular and large-scale programme in Tanzania that fills the gap in school curricula and provides educational experiences and information for local schools on environmental issues and marine ecology.

On field excursions to Chumbe island, students get the chance to learn about nature within the appropriate environment. Experience shows that guided by park rangers on the coral reef and along nature trails created in the coral rag forest, the participating children benefit greatly from the insight they gained from lectures and practical experience in marine biology, forest ecology and environmental protection discussing climate change and biodiversity issues.

In addition to island excursions, CHICOP has also conducted outreach work within schools, which has proven to be extremely successful. Not only have schools fully participated in the field excursions but have also shown great enthusiasm to undertake more field based, hands-on, extra curricula learning in the ordinary school environment. Some of the topics for many environmental clubs are waste management, biodiversity loss and climate change mitigation projects such as tree and mangrove planting activities.

In 2007, the programme was expanded with an environmental education resource called the Chumbe Challenge Environment Award. This project provides teaching material for student groups and teachers to continue working with environmental issues in their local environment once they have returned from an educational trip to Chumbe Island. Extensive evaluation seminars are held regularly to monitor the quality and to continuously improve the education programme.

CHICOP is building a reputation for having great knowledge in marine environment and in recent years Chumbe has been involved in training of Local Government Officials, groups of fishermen from all over Zanzibar, local NGO's and other groups interested in marine and coastal environment and education. When the consequences of climate change is getting more obvious in the region through increased coastal erosion, more frequent coral bleaching events etc, the interest for learning how to mitigate these impacts increase.

Management Plan 2006-2016

The Management Plan was endorsed by the CHICOP Advisory Committee in 1995, and revised and updated in 2006 for another 10 years, again based on consultations with stakeholders.

The objectives of the plan regarding education are:

I. To promote environmental education issues regionally,

II. To provide environmental education through the Chumbe Education Programme,

III. To educate national and international visitors to the MPA.

In order to fulfil the education objectives of the Management Plan, CHICOP has operated its EE programme with a very adaptive management approach and is constantly trying to find new ways to evolve and improve the programme, such as through the inclusion of ESD.

Right: Two international visitors to the MPA on a guided coconut crab walk in the evening. Photo by Lina Mtwana Nordlund

Bottom: Khamis Khalfan is introducing snorkeling to Zanzibitz school in the shallow water, with the Chumbe lighthouse in the background, one of 3 historical monuments on the island. Photo by Lina Mtwana Nordlund

Chumbe Field Excursions

The excursions provide hands-on environmental education for schoolchildren, and at the same time give teachers ideas for how to conduct field-based environmental education in marine biology, forest ecology and environmental protection.

Interactive pre-visits in schools that are held up to one month before the actual excursion give the students a brief overview about the environmental issues that are further discussed on the island. Additionally, it gives the responsible CHICOP member the opportunity to find out more about the interests of the students and inform them about all details regarding their trip.

Snorkelling:
Although they have grown up near to coral reefs, many students have never received the opportunity to observe it. Many students experience snorkelling (and often swimming) for the first time at Chumbe Island.

Intertidal walk:
During low tide, the students get the chance to explore the ecosystems in the intertidal zone, together with a guiding ranger.

During their time on the island, the students are kept busy with well-guided activities providing hands-on environmental education.

Classroom:
An extensive educational centre has been built on Chumbe Island for the education of students and guests. During interactive classroom sessions, students learn about ecology, waste disposal and coral reef conservation on the island.

Eco-banda visit:
In one of Chumbes Eco-bandas, students are encouraged to think and discuss about different processes designed to minimize environmental impact, e.g. rain-water harvesting, composting toilets, solar energy, etc.

Forest walk:
Students are guided through the unique coral rag forest on Chumbe island where they learn about the flora and fauna that have adapted to live on the island.

Positive outcomes

•Inspired by our work with them, many secondary schools have started Environmental club, aiming to monitor their local area and educate their communities.

•In recognition of our efforts, the Zanzibar Ministry of Education and Vocational Training is working closely with CHICOP to develop Environmental Education in the school curriculum.

•CHICOP is often used as an example of good practice for other projects wishing to initiate and develop Environmental Education, e.g. Misali Island (Pemba, Tanzania) and Lamu Island (Kenya).

•Students are having a great time, which encourages their will to learn. They usually leave the island with a greater knowledge of their environment.

Photos: top left from Chumbe Achive, top right by Anita Walther, first in row left from Chumbe Archive, the remaining by Anita Walther

Education Trip Statistics

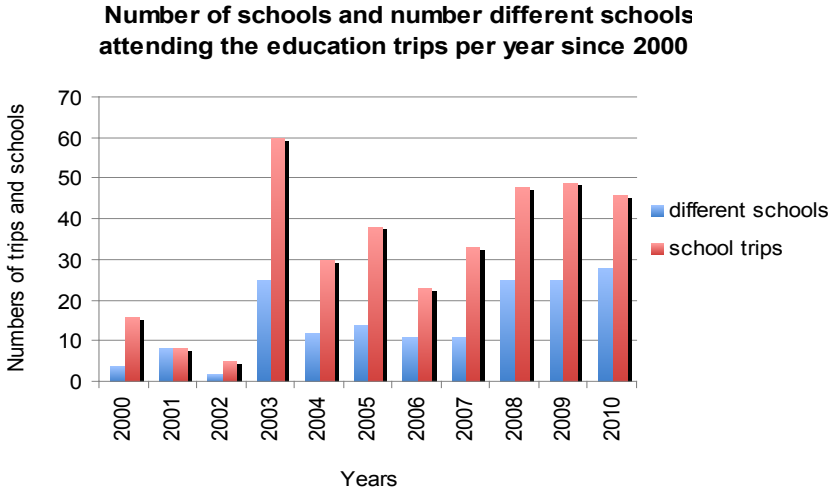
Since the establishment of the Chumbe Environmental Education Programme in 1999, CHICOP has offered one-day school excursions to Chumbe Island to more than 5000 students and community members as well as ca. 550 teachers. However, most of the participating students are in secondary school.

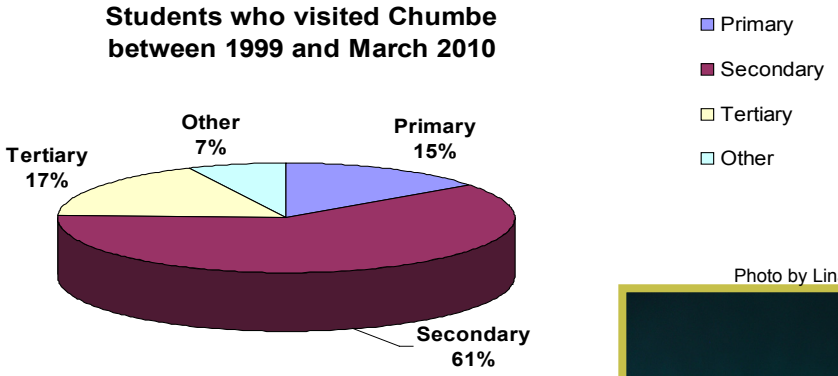
It is very important to us that not only boys but also girls get the opportunity to educate themselves. That is why the groups participating an education trip to Chumbe island are always mixed regarding the gender of the students. Between 2000 and 2010, 48% of the students have been girls. It is a unique opportunity for girls since many do not have the chance to learn how to swim nor the chance to see the coral reef.

Photo: introduction to snorkeling (Photo by Lina Mtwana Nordlund)

Diagram below: School and College students who visited Chumbe since 1999.

Diagram left: Number of school trips and number of different schools attending the the Education Trips per year since 2000.





Data year 2010

In year 2010, CHICOP has arranged 46 education trips, whereas 28 different schools were participating. A total number of 575 students and 81 teachers got the chance to visit Chumbe island. Although the number of education trips has been decreasing imperceptibly compared to 2008/2009, the number of different attending schools has been increasing slightly.

Success

- Many schools are coming back every year
- The number of different schools attending per year is increasing, meaning new schools are coming every year
- The number of total education trips per year has been increasing since the initiation in 2000. Though, it depends much on the yearly budget of CHICOP on how many education trips can be financed per year.

A girl snorkeling.
Photo by Lina Mtwana Nordlund

The Ranger Teaching Pack

The Chumbe Island Coral Park Ranger Teaching Pack aims to incorporate Education for Sustainable Development (ESD) into the Chumbe education programme. Further it is designed to function as a resource pack for the rangers (i.e. educator) especially to facilitate the teaching for the ranger (i.e. educator).

So, what is Education for Sustainable Development? The definition given by UNESCO is as follows "Education for Sustainable development is education that enables people to foresee, face up to, and solve the problems that threaten life on our planet". Another more extensive definition of ESD is given by Anna Maembe (NEMC, Tanzania). She refers ESD to "education that enables people to develop knowledge, values and skills to participate in decisions about the way we do things individually and collectively, both locally and globally, that will improve the quality of life now without damaging the planet for the future".

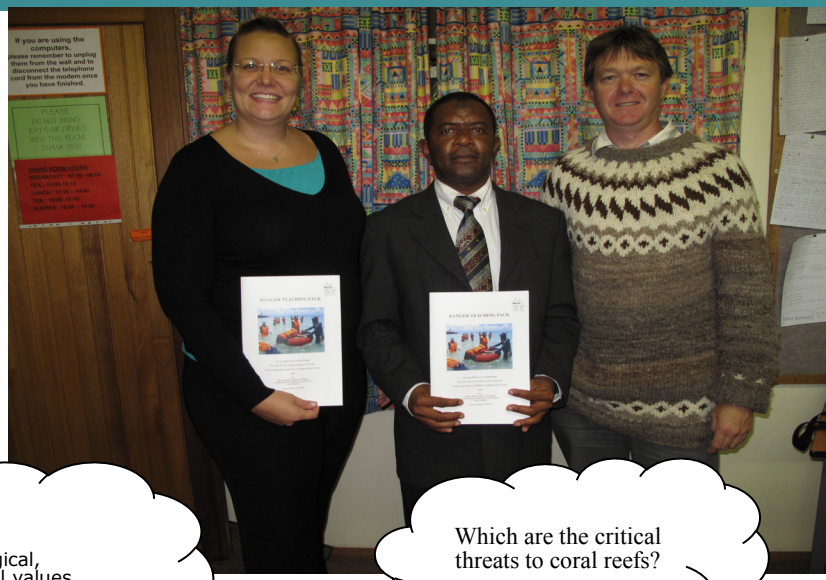
So instead of just having the educator showing and telling the learners what to do, ESD tries to involve more participatory education where the teacher sets an example, the educator is trying to enable change instead of just trying to cause change by conveying facts.

Finally, the Ranger Teaching Pack is about different methods of teaching, activities that attempt to stimulate ESD principles such as:

- Adopting participatory, active and learner centered methods
- Working with values, ethics and cultural diversity
- Creativity and critical thinking
- Using relevant local examples in teaching practices
- Enquiry based learning methods (two-way communication)
- Using indigenous and local knowledge in educational process
- Linkage with curriculum

The change project "Ranger Teaching Pack" was conducted during the Advanced International Training Programme (ITP) on Education for Sustainable Development (ESD) in Formal Education 2009/2010**.** The course is organized by Ramboll Natura AB in co-operation with SADC Regional Environmental Centre, South Africa, and Centre for Environment Education, India and financed by the Swedish Development Cooperation Agency (Sida).

The Education Program finalized their formal training in Education for Sustainble Development in Dar es Salaam from the 30th June to 2nd July 2010 and presented their final environmental education project called Ranger Teaching Pack. Representing Chumbe were Mr. Khamis Khalfan, Mr. Abdulrahman Abdalla and Ms. Lina Nordlund. Their project was successfully received and the networking that resulted was very positive.



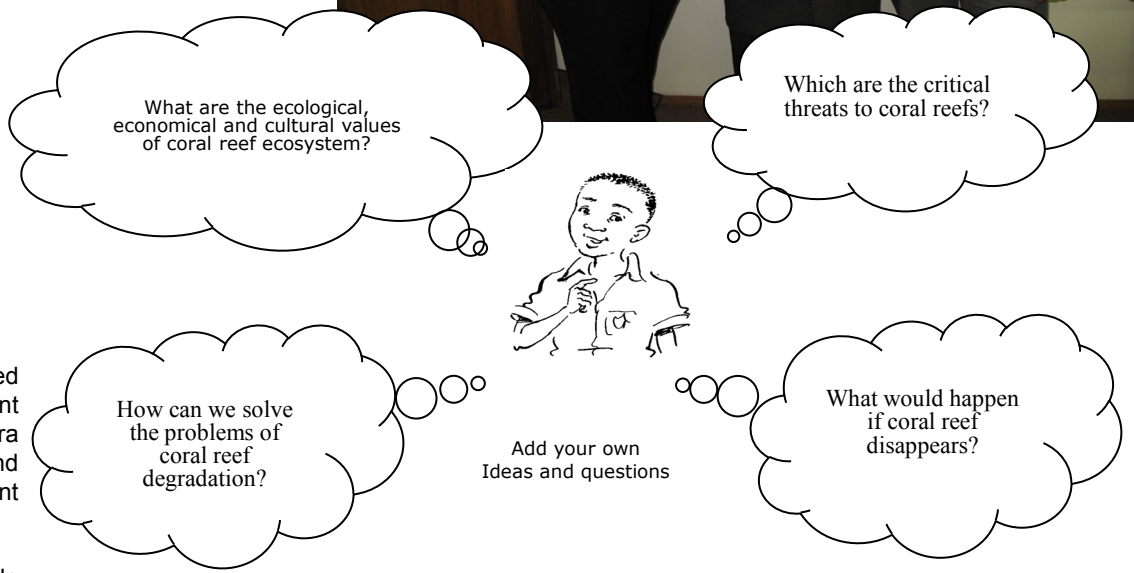


Photo: We are proud to have finalized our Ranger teaching pack, now it needs to be implemented and evaluated. In the photo are Lina Nordlund, Khamis Khalfan Juma and Wayne Peddie. Photo by Jim Taylor, WESSA.

The picture is from the Ranger Teaching Pack. In each chapter there is a deliberation of ideas section, this one is from the coral reef section. This activity is necessary because it helps the learners to be active in the learning process. Picture is adapted from ShareNets free resources. www.sharenet.org.za/

The Chumbe Challenge

Chumbe Challenge Environment Award was introduced by the CHICOP Environmental Education team in 2006. The project is the continuation of the Chumbe Challenge Environment Award Toolkit aimed to support students to find out more about environmental issues that affect them. It has been developed to help those who have been taking part on the Chumbe Island field excursion and who want to continue with their learning.

Every year, the Chumbe invites some school environmental clubs to join in competition. Schools are asked to establish two projects, one within their school compound and another outside of the school. At the end of year, the schools are asked to present their projects, so assessment can be done. Finally, the Chumbe education team awards the best projects.

The 7 Steps to achieve the Chumbe Challenge Awards

To participate in the Chumbe Challenge Award, the attenting school environmental clubs have to follow 7 steps of action:

1. Establish an Environment group
2. Carry out an Eco Audit
3. Develop an Environment Statement
4. Complete a Local Area Study
5. Choose at least one other focus area to investigate
6. Take Action
7. Review and complete the portfolio

Generally it was observed that, the Chumbe challenge environmental award activity has encouraged students to be more observant and taking positive actions on environmental issues in their surrounding communities.

Chumbe Challenge Awards 2010

Last year, a total number of 8 schools participated the challenge, but only 5 schools reached the finals. The majority of the projects focused on waste management and tree planting e.g. botanical garden with a very high creativity.

The Chumbe Challenge award ceremony was held on November 23rd at the Chumbe Island head office, attended by 25 students and 10 teachers. Each school presented its projects and assessment was done.

All attending schools were awarded a certificate of participation and a pair of Khanga for each student. The environmental club guardians were all awarded with Chumbe T-shirts for recognition of their hard work in supervising and coordinating the projects. The first winner of all five projects was Chukwani Secondary School who did a project on botanical garden, receiving a Chumbe environmental flag and a water pump. The second winner was Bembela high school who did a project on waste management and gardening. They were awarded a wheel barrow, a spade and a rake.

Outreach

On the 15th of June 2010, the Chumbe Education team delivered a half-day workshop for teachers involved in the Chumbe Education programme to discuss more about the annual "Chumbe Challenge" environmental award. Six teachers attended and also gave valuable feedback to the Education team members, which will help us to assess and monitor our ongoing efforts with schools.

Photos from the Chumbe archive

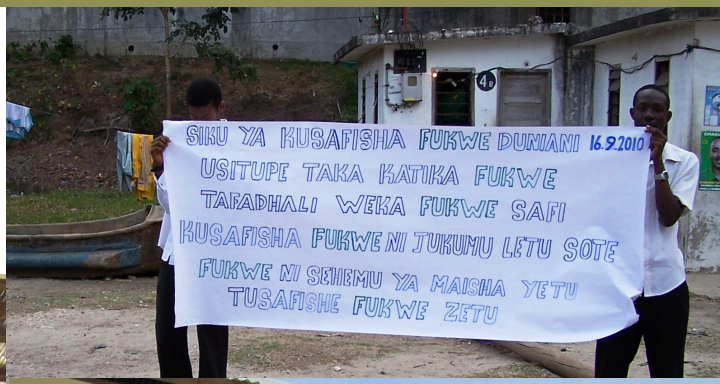
Community Outreach

Environmental Education and Conservation in Zanzibar

In January 2010, CHICOP started to support a 18-month project entitled “Environmental Education and Conservation Expansion in Zanzibar”, funded by ReCoMap. Project staff David Tanner, Nell Hamilton and Jokha Omar set about developing strong working relationships with the projects key implementing partner, the Jambiani-based NGO called JAMABECO (Jambiani Marine and Beach Conservation Organisation). The final Open Ceremony took place on the 31st of January in Jambiani to formally initiate the project with CHICOP and JAMABECO as partners.

In February, all members of JAMABECO were invited to educational day excursions to Chumbe Island. Nowadays, members are shadowing CHICOP’s education staff while conducting school pre-school visits and educational day trips to the island to observe the approach taken and activities implemented under Chumbe’s education programme. Additionally, meetings were held to discuss and explore possible collaboration with the Ministry of Education, Ministry of Agriculture, Land and Environment, Institute, Department of Environment, Department of Forestry, Department of Fisheries, Menai Bay Authority, Institute of Marine Sciences (IMS), National Teachers Resource Centre (NTRC) as well local NGOs working in environmental education namely, Community Development and Environmental Conservation in Zanzibar (CODE-COZ) and Mkokotoni Environmental Conservation Association (MECA).

Currently, the community outreach team is working on three environmental education resource guides specific for Zanzibar that finally will be utilised by teachers in local schools and community peer educators to conduct environmental education in 10 local communities in southern Zanzibar: Buyu, Bwejuu, Chukwani, Dimani, Jambiani, Makunduchi, Mazizini, Nyamanzi, Paje and Stone Town.



Photos by Nell Hamilton

Community Activities

The Menai Bay Conservation Area

Chumbe Island Coral Park has maintained its relationship with the Menai Bay Conservation Area (MBCA) in providing educational day excursions for community members residing in the south-western tip of Unguja. Along with sharing tourism in common with Chumbe, MBCA is also a marine protected area. By extending invites on environmental education trips to members from local communities around Menai Bay, we help to encourage protection of resources as well as to empower the community in decision making.

Outreach in neighboring communities

In early July CHICOP finished conducting its annual village visits to Nyamanzi & Kiovya (neighboring communities of Chumbe Island) to meet with each Sheha and fishers/community members. These meetings provide updates and information to the communities while allowing for community members to raise questions or concerns. Normally the village visits are scheduled in January/February but took place this year in June & July due to the schedule of Department of Fisheries and the West District Fisheries Officer.

World Environmental Day

The Chumbe Education team celebrated World Environment Day on 8th of June 2010 with several schools. CHICOP was invited by the organizers, International School of Zanzibar, to present on the topic of environmental education and CHICOP's unique environmental education programme. In June 2011, we expect to celebrate this years global event with different schools and NGOs by hosting environmental activities.

Beach and underwater Clean ups

On the 16th of September, the Community Outreach team coordinated 10 successful beach clean ups with the participation of over 3,000 volunteers collecting a total of over 16 tons of 'taka-taka' from the beaches of Stone Town. A large group of volunteers was also sent to Kendwa to do beach and underwater clean ups. They helped to remove 1,5 tons of trash from the waters and beaches along with a large abandoned fishing net from a healthy coral reef.

Photos by Nell Hamilton

Workshops and Training

Attended the Advanced International Training Programme (ITP) on Education for Sustainable Education in Formal Education July 2009-May 2010. Ramboll Natura AB is organizing the Training Programme in co-operation with SADC Regional Environmental Centre, South Africa, and Centre for Environment Education, India. The Programme is financed by the Swedish Development Cooperation Agency (Sida).

Mr. Abdul Abdalla, the Conservation & Education Assistant, joined the SIT (School for International Training) courses through the Institute of Marine Science, University of Dar es Salaam. CHICOP granted him 2 hours each day leave to further his knowledge and education from the 4th -18th September and he benefited from the networking and collaborative information-sharing as well.

Project "Environmental Education and Conservation Expansion in Zanzibar"
Both workshops were held at the "African Center of Research on Oral Traditional and National Language", Stonetown, Zanzibar

- **"**Environmental Education Materials for Zanzibar", a three day workshop to discuss the production of three environmental education resource guides specific for Zanzibar, March 29th to 31st 2010
- "Peer-Educator's Training Workshop in Environmental Education"; a three day workshop to discuss the correct handling of the three environmental education resource guides in production, August 6th to 8th 2010

Attended the IFS Science Outreach Workshop, in Zanzibar, Tanzania December 6th to 10th 2010. Held presentation about "Chumbe Island communicating science, conservation and environmental awareness"

Photos from the Environmental Education and Conservation Expansion Workshop in Zanzibar above the opening speech by Nell Hamilton, translated by Jokha Abdalla, middle, field work on how to teach on the beach, bottom, group photos of the participants.. Photos above by Lina Mtwana Nordlund, middle by Nell Hamilton bottom from the Chumbe archive.

Acknowledgements

There are many people that have contributed to this status report, with data, texts, research findings etc. In no specific order the contributers are:

Sibylle Riedmiller, Director of Chumbe Island Coral Park Ldt.

Khamis Khalfan, Coordinator and education ranger, island based since 2000

Kendra Collier, environmental educator

Frida Lanshammar, former conservation & education coordinator and project manager

Karlyn Langjahr, former project manager

Anders Knudby, former conservation & education coordinator

Mikala Peters, marine biologist, former conservation coordinator

Antony Gilingham, honors student volonteering at Chumbe

Elizabeth Taylor, founder of the coral monitoring programme

Eleanor Carter, former project manager in the early days

Helen Peeks, former project manager

Nell Hamilton, the community outreach coordinator

Omari Nyange, Head ranger on Chumbe Island since 1992

Christopher Muhando, Researcher at Institute of Marine Science

Jacob Tesoro Skaggs, volonteer at Chumbe

Caroline Karlsson, volonteer at Chumbe

Kiran Singh, SIT student

www.chumbeisland.org

We hope you enjoyed learning more about our conservation and education programme, if you have questions please do not hesitate to contact us at chumbe[a]zitec.org and we hope to see you in the near future!!

/ The Chumbe Ranger team!

Ranger team (Photo by Caroline Karlsson), the Chumbe guest beach (Photo by Lina Mtwana Nordlund)

References

Bell J.D., Pollard D.A., 1989. Ecology of fish assemblages and fisheries associated with seagrasses. In: Larkum A.W.D., McComb A.J., Shepherd S.A. (eds.) Biology of seagrasses - a treatise on the biology of seagrasses with special reference to the Australian region. Elsevier, Amsterdam, pp. 565–609.

CBD Technical Expert Group. 2004. Technical advice on the establishment and management of a national system of marine and coastal protected areas. CBD Technical Series no.13

Dorenbosch M., 2006, Connectivity between fish assemblages of seagrass beds, mangroves and coral reefs: evidence from the Caribbean and the western Indian Ocean. PhD Dissertation Radboud University Nijmegen.

Duarte C.M., Chiscano C.L., 1999. Seagrass biomass and production: a reassessment. Aquat. Bot. 65, 159–174.

Howard R.K., Edgar G.J. Hutchings P.A., 1989, Faunal assemblages of seagrass beds. In: Larkum A.W.D., McComb A.J., Sheperd S.A. (Eds.), Biology of seagrasses – a treatise on the biology of seagrasses with special reference to the Australian region. Elsevier, Amsterdam, pp. 536–564.

Knudby, A., Nordlund, L. 2011. Remote sensing of seagrasses in a patchy multi species environment. International Journal of Remote Sensing. (In press; DOI number: 10.1080/01431161003692057)

Lanshammar F & Muhando C., 2008. Ecological Effects of the Crown-of-Thorn Starfish Removal Programme on Chumbe Island Coral Park, Zanzibar, Tanzania. Proceedings of the 11th International Coral Reef Symposium, Ft Lauderdale, Florida 7-11 July 2008, pp 1134-1138.

MacPherson, J., MacPherson, D., Carter, E, 2002. A Study of the ecology and effects of a re-introduced population of Ader's duiker (Cephalophus adersi) on Chumbe Island, Zanzibar.

Nagelkerken I., Dorenbosch M., Verberk W.C.E.P., Chocheret de la Morinière E., van der Velde G., 2000. Importance of shallow water biotopes of a Caribbean bay for juvenile coral reef fishes: patterns in biotope association, community structure and spatial distribution. Mar. Ecol. Prog. Ser. 202, 175–192.

Orth R.J., Heck K.L. Jr., van Montfrans J., 1984. Faunal communities in seagrass beds: A review of the influence of plant structure and prey characteristics on predator-prey relationships. Estuaries 7, 339–350.

Riedmiller, S. 2003. Private Sector Investment in Marine Conservation: What Can Make it Happen? Experiences of Chumbe Island Coral Park Ltd. Paper presented at Second International Tropical Marine Ecosystems Management Symposium (ITMEMS2), April 24-29, Manila, Philippines

Russ, G.R. 2002. Marine reserves as fisheries management tools: yet another review. In: P.F. Sale (ed.) Coral reef fishes: dynamics and diversity in a complex ecosystem, Academic Press, London.

Spalding, M., Ravilious, C., Green, E. 2001. World Atlas of Coral Reefs. University of California Press, Berkeley.

Wagner, G.A. 2005. Participatory monitoring of changes in coastal and marine biodiversity. Indian Journal of Marine Sciences, 34(1), 136-46.

Wells, S. & Mangubhai, S. 2005. A Workbook for Assessing Management Effectiveness of Marine Protected Areas in the Western Indian Ocean. IUCN

Zvuloni, A., van Woesik, R, Loya, Y. 2010. Diversity Partitioning of Stony Corals Across Multiple Spatial Scales Around Zanzibar Island, Tanzania. PLoS ONE

Appendix species list

Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Acanthuridae	*Acanthurus auranticavus*	Orange socket surgeon
	Acanthurus bariene	Roundspot surgeon
	Acanthurus blochii	Ringtail surgeon
	Acanthurus dussumieri	Eyestriped surgeon
	Acanthurus leucosternon	Powderblue surgeon
	Acanthurus lineatus	Lined surgeon
	Acanthurus mata	Elongate surgeon
	Acanthurus nigricauda	Epaulette surgeon
	Acanthurus nigrofuscus	Dusky surgeon
	Acanthurus nubilus	Bluelined surgeon
	Acanthurus thompsoni	Black&White surgeon
	Acanthurus triostegus	Convict tang
	Acanthurus xanthopterus	Yellowfin surgeon
	Ctenochaetus binotatus	Yellowstripe surgeon
	Ctenochaetus striatus	Lined bristletooth
	Ctenochaetus strigosus	Goldring bristletooth
	Naso annulatus	White margin unicorn
	Naso brevirostris	Spotted unicorn
	Naso elegans	Elegant unicorn
	Naso fageni	Horseface unicorn
	Naso hexacanthus	Blacktongue unicorn
	Naso lituratus	Orangespine/ masked unicorn
	Naso unicornis	Bluespine unicorn
	Naso vlamingii	Bignose unicorn
	Zebrasoma desjardinii	Sailfin tang
	Zebrasoma scopas	Brushtail tang
Apogonidae	*Apogon apogonides*	Goldbelly cardinal
	Apogon aureus	Sun cardinal
	Apogon bifasciatus	Doubleband cardinal
	Apogon cooki	Cook's cardinal
	Apogon cyanosoma	Yellow-striped cardinal
	Apogon fragilis	White streak cardinal
	Apogon fucata	Orange-lined cardinal
	Apogon fuscus	Samoan cardinal
	Apogon kallopterus	Iridescent cardinal

FAMILY	GENUS/SPECIES	COMMON NAME
	Apogon nigrofasciatus	Blackstripe cardinal
	Archamia fucata	Orange-lined cardinal
	Archamia mozambiquensis	Mozambique cardinal
	Cheilodipterus arabicus	Arabian cardinal
	Cheilodipterus artus	Yellow-lined cardinal
	Cheilodipterus caninus	Dogtooth cardinal
	Cheilodipterus lineatus	Brown-lined cardinal
	Cheilodipterus macrodon	Largetoothed cardinal
	Cheilodipterus quinquelineatus	Five-lined cardinal
	Rhabdamia gracilis	Slender cardinal
Aulostomidae	*Aulostomus chinensis*	Trumpetfish
Balistidae	*Balistapus undulatus*	Orange-striped triggerfish
	Balistoides conspicillum	Clown Triggerfish
	Balistoides viridescens	Moustache triggerfish
	Melichthys indicus	Indian triggerfish
	Melichthys niger	Black triggerfish
	Sufflamen ablicaudatus	Bluethroat triggerfish
	Sufflamen chrysopterus	Halfmoon triggerfish
	Sufflamen fraenatus	Bridled triggerfish
Belonidae	*Strongylura leiura*	Banded needlefish
	Tylosurus crocodilus crocodilus	Reef Needlefish (Garfish)
Blenniidae	*Aspidontus taeniatus*	Cleaner wrasse mimic
	Cirripectes castaneus	Chestnut eyeblash-blenny
	Cirripectes stigmaticus	Redstreaked blenny
	Exallias brevis	Shortbodied (Leopard) blenny
	Istiblennius lineatus	Black-lined fangblenny
	Meicanthus mossambicus	Mozambique fangblenny
	Plagiotremus rhinorhyncus	Blue-stripe fangblenny
	Plagiotremus tapeinosoma	Scale-eating fangblenny
Caesionidae	*Caesio caerulaurea*	Scissortail fusilier
	Caesio lunaris	Lunar fusilier
	Caesio teres	Yellowback fusilier
	Caesio xanthonota	Yellowtop fusilier
	Pterocaesio pisang	Banana fusilier
Caracharhinidae	*Carcharhinus melanopterus*	Blacked-tipped Reef Shark

FAMILY	GENUS/SPECIES	COMMON NAME
Carangidae	*Carangoides ferdau*	Striped/blue trevally
	Carangoides orthogrammus	Gold-fleck trevally
	Carangoides plagiotaenia	Barcheek trevally
	Caranx melampygus	Bluefin trevally
	Caranx sexfasciatus	Elongate trevally
	Elagatis bipinnulata	Rainbow runner
	Gnathanodon speciosus	Golden kingfish
	Scomberoides lysan	Leatherback trevally
	Scomberoides tol	Needlescaled queenfish
	Selar boops	Oxeye scad
	Seriola dumerili	Greater amberjack
	Trachinotus blochii	Silver pampano
Chaetodontidae	*Chaetodon auriga*	Threadfin butterfly
	Chaetodon benetti	Bennet's butterfly
	Chaetodon falcula	Sickle butterfly
	Chaetodon guttatissimus	Spotted butterfly
	Chaetodon kleinii	White-spotted butterfly
	Chaetodon lineolatus	Lined butterfly
	Chaetodon lunula	Racoon butterfly
	Chaetodon madagaskariensis	Madagascar butterfly
	Chaetodon melannotus	Black-backed butterfly
	Chaetodon meyeri	Meyer's butterflyfish
	Chaetodon speculum	Ovalspot butterfly
	Chaetodon trifascialis	Chevronned butterfly
	Chaetodon trifasciatus	Redfin/melon butterfly
	Chaetodon unimaculatus	Tear-drop butterfly
	Chaetodon vagabundus	Vagabond butterflyfish
	Chaetodon xanthocephalus	Yellowhead butterfly
	Chaetodon zanzibariensis	Zanzibar butterfly
	Forcipiger longirostris	Longnose butterfly
	Heniochus acuminatus	Longfin/sailfin bannerfish
	Heniochus monoceros	Masked bannerfish
Cirrhitidae	*Cirrhitichthys oxycephalus*	Pixy hawkfish
	Paracirrhitis arcatus	Arc-eye hawkfish
	Paracirrhitis forsteri	Freckled/ blackside hawkfish

Appendix species list

Cont. Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Clupeidae	*Herklotsichthys quadrimaculatus*	Bluestripe herring
Congridae	*cf. Conger cinereus*	Longfin african conger
	cf. Gorgasia sillneri	Garden eel
Dasyatididae	*Dasyatis kuhlii*	Kuhl's blue-spotted stingray
	Himantura jenkinsii	Jenkin's whipray
	Himantura undulata	Leopard whipray
	Taeniura lymma	Blue-spotted ribbontail ray
	Taeniura melanospila	Black-bloched stingray
	Urogymnus africanus	Thorny stingray
Echeneidae	*Echeneis naucrates*	Striped remora
Engraulidae	*Stolephorus indicus*	Indian anchovy
Ephippidae	*Platax orbicularis*	Circular batfish
	Platax pinnatus	Dusky batfish
	Platax teira	Longfin batfish
Fistulariidae	*Fistularia commersonii*	Flutemouth
Gobiidae	*Amblyeleotris steinitzi*	Steinitz' prawn-goby
	Amblyeleotris sungami	Magnus' prawn-goby
	Amblyeleotris wheeleri	Burgundy partner goby
	Amblygobius hectori	Hectors' goby
	Cryptocentrus caeruleopunctatus	Harlequin prawn-goby
	Cryptocentrus lutheri	Luthers partner goby
	Cryptocentrus octafasciatus	Blue speckled prawn-goby
	Cryptocentrus strigilliceps	Target prawn-goby
	Exyrias bellissimus	Mud reef-goby
	Fusigobius neophytus	Fine spotted sand-goby
	Gnatholepis cauerensis	Gladiator goby
	Gnatholepis scapulostigma	Shoulderspot goby
	Gobiodon citrinus	Citron goby
	Istigobius decoratus	Decorator goby
	Lotilia graciliosa	Whitecap goby
	Valenciannea helsdingenii	Twostripe goby
	Valenciannea strigata	Blue-streak goby
Haemulidae	*Diagramma pictum*	Painted sweetlip
	Plectorhinchus flavomaculatus	Gold-spotted sweetlip
	Plectorhinchus gaterinus	Black-spotted sweetlip
	Plectorhinchus gibbosus	Brown sweetlip
	Plectorhinchus multivittatum	Many-lined sweetlip
	Plectorhinchus obscurus	Giant sweetlip
	Plectorhinchus orientalis	Oriental sweetlip
	Plectorhinchus picus	Spotted sweetlip
	Plectorhinchus playfairi	Whitebanded sweetlip
	Plectorhinchus schotaf	Sombre sweetlip
	Plectorhinchus vittatus	Indian ocean oriental sweetlip
Hemirhamphidae	*Hemiramphus far*	Spotted halfbeak
	Hyporhamphus affinis	Tropical half beak
Holocentridae	*Myripristis hexagona*	Doubletooth soldier
	Myripristis murdjan	Blotcheye soldier
	Myripristis violacea	Lattice soldier
	Myripristis vittata	White-tipped soldier
	Neoniphon opercularis	Clearfin/Blackfin squirrel
	Neoniphon sammara	Bloodspot/Spotfin squirrel
	Plectrypops lima	Rough scale soldier
	Sargocentrum caudimaculatum	Tailspot squirrel
	Sargocentrum diadema	Crown squirrel
	Sargocentrum spiniferum	Long-jawed squirrel
Kyphosidae	*Kyphosus vaigiensis*	Brassy chub
Labridae	*Anampses caeruleopunctatus*	Blue-spotted wrasse
	Anampses lineatus	Lined wrasse
	Anampses melanurus	White-spotted wrasse
	Anampses meleagrides	Chequered wrasse
	Anampses twistii	Yellow-breasted wrasse
	Aspidontus taeniatus tractus	Cleaner Mimic (Flange Blennie)
	Bodianus anthioides	Lyretail hogfish
	Bodianus axillaris	Axilspot hogfish
	Bodianus bilunulatus	Hogfish
	Bodianus diana	Dianaa's hogfish
	Cheilinus chlorourus	Floral wrasse
	Cheilinus fasciatus	Redbreasted wrasse
	Cheilinus oxycephalus	Snooty wrasse
	Cheilinus trilobatus	Tripletail maori wrasse
	Cheilinus undulatus	Humphead wrasse
	Cheilio inermis	Cigar wrasse
	Cirrhilabrus exquisitus	Exquisite wrasse
	Coris africana	African coris
	Coris aygula	Clown coris
	Coris batuensis	Batu coris
	Coris caudimacula	Spottail coris
	Coris cuvieri	African sand wrasse
	Coris formosa	Queen coris
	Coris gaimard	Yellowtail coris
	Epibulus insidiator	Slingjaw wrasse
	Gomphosus caeruleus	Indian ocean bird wrasse
	Haliochoeres hortulanus	Checkerboard wrasse
	Haliochoeres iridis	Rainbow wrasse
	Haliochoeres marginatus	Dusky wrasse
	Haliochoeres scapularis	Zigzag wrasse
	Hemigymnus fasciatus	Blackedge thicklip
	Hemigymnus melapterus	Thicklip wrasse
	Hologymnosus annulatus	Ring wrasse
	Hologymnosus doliatus	Longface wrasse
	Labrichthys unilineatus	Tubelip wrasse
	Labroides bicolor	Bicolor cleaner wrasse
	Labroides dimidiatus	Cleaner wrasse
	Lorabicus quadrilineatus	Four-line wrasse
	Macropharyngodon bipartitus	Vermiculate wrasse
	Novaculichthys taeniourus	Rockmover wrasse
	Oxycheilinus arenatus	Speckled maori wrasse
	Oxycheilinus diagramma	Bandcheek wrasse
	Oxycheilinus mentalis	Mental wrasse
	Pseudocheilinus evanidus	Striated wrasse
	Pseudocheilinus hexataenia	Six-line wrasse
	Pseudocheilinus octotaenia	Eightline dwarf wrasse
	Pteragogus flagellifer	Cocktail wrasse
	Pteragogus pelycus	Sideburn wrasse
	Stethojulis albovittata	Blue-lined wrasse

Appendix species list

Cont. Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Labridae	*Stethojulis bandanensis*	Red-shoulder wrasse
	Stethojulis interrupta	Cutribbon wrasse
	Stethojulis strigiventer	Three-ribbon wrasse
	Thalassoma amblycephalum	Twotone wrasse
	Thalassoma hardwicke	sixbar wrasse
	Thalassoma hebraicum	Goldbar wrasse
	Thalassoma lunare	Crescent wrasse
	Thalassoma purpureum	Surge wrasse
Lethrinidae	*Gnathodentex aurolineatus*	Glowfish, Yellowspot emperor
	Lethrinus amboinensis	Ambon emperor
	Lethrinus borbonicus	Snubnose emperor
	Lethrinus chrysostomus	Sweetlip emperor
	Lethrinus conchyliatus	Red lip/red axel emperor
	Lethrinus erythrancathus	Yellowspotted emperor
	Lethrinus harak	Blackspot emperor
	Lethrinus lentjan	Pink-ear emperor
	Lethrinus mahensa	Sky emperor
	Lethrinus microdon	Smalltooth emperor
	Lethrinus nebulosus	Spangled emperor
	Lethrinus obsoletus	Orange-stripe emperor
	Lethrinus olivaceus	Longface emperor
	Lethrinus rubrioperculatus	Redgill emperor
	Lethrinus variegatus	Slender emperor
	Lethrinus xanthochilus	Goldlip/Yellowtail emperor
	Monotaxis grandoculis	Bigeye emperor
Lutjanidae	*Aprion virescens*	Greater jobfish
	Lutjanus bohar	Twinspot snapper
	Lutjanus ehrenbergii	Ehrenbergs snapper
	Lutjanus fulviflamma	Blackspot snapper
	Lutjanus gibbus	Humpback snapper
	Lutjanus lutjanus	Bigeye snapper
	Lutjanus monostigma	Onespot snapper
	Lutjanus rivulatus	Maori seaperch
	Macolor niger	Blacksnapper/Black and white Seaperch
Monacanthidae	*Aluterus scriptus*	Scribbled filefish
	Amanses scopas	Black brush-sided/ broom filefish
	Cantherhines dumerilii	White-spotted filefish
	Cantherhines pardalis	Leopard (Honeycomb) filefish
	Oxymonacanthus longirostris	Longnose filefish
	Pervagor janthinosoma	Earspot filefish
Mullidae	*Mulloides flavolineatus*	Yellowstripe goatfish
	Mulloides vanicolensis	Yellofin goatfish
	Parupeneus barberinoides	Bicolor goatfish
	Parupeneus barberinus	Blackstripe (dot and dash) goatfish
	Parupeneus ciliatus	White-lined goatfish
	Parupeneus cyclostomus	Yellow saddle goatfish
	Parupeneus macronema	Longbarbel goatfish
	Parupenus forsskali	Red sea goatfish
	Parupenus macronema	long barbel goatfish
	Parupenus rubescens	Ruby goatfish
	Upeneus tragula	Blackstriped goatfish
Muraenidae	*Echidna nebulosa*	Snowflake moray
	Echidna polyzona	Ringed moray
	Gymnomuraena zebra	Zebra moray
	Gymnothorax javanicus	Giant moray
	Gymnothorax meleagris	Whitemouth moray
	Rhinomuraena quaesita	Ribbon eel
	Siderea grisea	Geometric moray
	Siderea picta	Peppered moray
Nemipteridae	*Scolopsis bimaculatus*	Thumbprint monocle spinecheek
	Scolopsis frenatus	Bridled spinecheek
	Scolopsis ghanam	Dotted spinecheek
Ostraciidae	*Ostracion cubicus*	Cube boxfish
	Ostracion meleagris	whitespotted boxfish
Pempheridae	*Parapriacanthus guenthery*	Slender sweeper/ glaassfish
	Parapriacanthus ransonneti	Yellow Sweeper
	Pempheris adusta	Dusky sweeper
	Pempheris oualensis	Copper Sweeper
	Pempheris schwenkii	Schwenk's sweeper
	Pempheris vanicolensis	Cave sweeper
Pinguipedidae	*Parapercis hexophtalma*	Speckled sandpearch
	Parapercis punctulata	Spotted Sandperch
Platycephalidae	*Papilloculiceps longiceps*	tentacled flathead
	Platycephalus indicus	Bartailed flathead
	Thysanophrys otaitensis	Fringelip flathead
Plotosidae	*Plotosus lineatus*	Striped catfish
Pomacanthidae	*Centropyge acanthops*	African dwarf-angelfish
	Centropyge bispinosus	Two-spined angel
	Centropyge flavicauda	Whitetail dwarf angelfish
	Centropyges multispines	Multispined angel
	Pomacanthus asfur	Yellowband angel
	Pomacanthus chrysurus	Earspot angel
	Pomacanthus imperator	Emperor angel
	Pomacanthus maculosus	Yellowbar angelfish
	Pomacanthus semicirculatus	Semicircle angel
	Pomacanthus xanthometopon	Blueface angel
	Pygoplites diacanthus	Regal angel
	Abudefduf notatus	Dusky damsel/ Yellowtail sergeant
	Abudefduf septemfasciatus	7-bar or banded sergeant
	Abudefduf sexfasciatus	Scissortail sergeant
	Abudefduf sordidus	Spot sergeant
	Abudefduf sparoides	False-eye sergeant
	Abudefduf vaigiensis	Sergeant major
	Amblyglyphidon leucogaster	White-belly damsel
	Amphiprion akallopisos	Skunk clown
	Amphiprion allardi	Anemone fish
	Amphiprion ocellaris	Western clownfish
	Chromis agilis	Bronze reef chromis
	Chromis atripectoralis	Black-axil chromis
	Chromis caerulea	Blue puller
	Chromis dimidiata	Chocolate dip chromis
	Chromis lepidolepsis	Scaly chromis
	Chromis leucura	White-tail chromis
	Chromis nigrura	Blacktail chromis

Appendix species list

Cont. Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Pomacanthidae	*Chromis opercularis*	Doublebar chromis
	Chromis pembae	Yellow edge chromis
	Chromis ternatensis	Golden chromis
	Chromis viridis	Blue-green chromis
	Chromis weberi	Weber's chromis
	Chromis xutha	Buff chromis
	Chrysiptera annulata	Footballer damsel
	Chrysiptera biocellata	Twinspot damsel
	Chrysiptera glauca	Blue damsel
	Chrysiptera leucopoma	Surge damsel
	Chrysiptera unimaculata	Onespot damsel
	Dascyllus aruanus	Zebra humbug
	Dascyllus carneus	Twobar humbug
	Dascyllus trimaculatus	Domino
	Neoglyphidodon melas	Black/zulu damsel
	Neopomacentris azysron	Yellowtail damsel
	Neopomacentris cyanomos	Regal damsel
	Plectroglyphidodon dickii	Narrowbar damsel
	Plectroglyphidodon imparipennis	Stop-start/bright-eye damsel
	Plectroglyphidodon johnstonianus	Johnston Island damsel
	Plectroglyphidodon lacrymatus	Jewel damsel
	Plectroglyphidodon leucozonus	Sash damsel
	Pomacentrus baenschi	East africa's damsel
	Pomacentrus caeruleus	Careulean damsel
	Pomacentrus grammorhynchus	Bluespot damsel
	Pomacentrus leptus	Slender damsel
	Pomacentrus pavo	Sapphire damsel
	Pomacentrus sulfureus	Sulfur damsel
	Pomacentrus trichourus	Yellowtail damsel
	Pomacentrus trilineatus	Three-line damsel
	Stegastes albifasciatus	Whitebanded gregory
	Stegastes fasciolatus	Dark damsel
	Stegastes nigricans	Black damsel/ Dusky gregory

FAMILY	*GENUS/SPECIES*	COMMON NAME
Priacanthidae	*Priacanthus blochii*	Bloch's bigeye
	Priacanthus hamur	Zaiaer's Bigeye
Ptereleotridae	*Ptereleotris evides*	Blackfin dartfish
Scaridae	*Calotomus carolinus*	Stareye parrotfish
	Cetoscarus bicolor	Bicolor parrotfish
	Chlorurus atrilunula	Bluemoon parrotfish
	Chlorurus sordidus	Bullethead parrotfish
	Chlorurus strongylocephalus	Indian Ocean steephead parrotfish
	Hipposcarus harid	Indian longnose parrotfish
	Leptoscarus vagiensis	Seagrass parrotfish
	Scarus atrinula	Black crescent parrotfish
	Scarus diminiatus	Turquoise capped parrotfish
	Scarus dubius	Regal parrotfish
	Scarus ferrugineus	Rusty parrotfish
	Scarus frenatus	Bridled parrotfish
	Scarus ghobban	Blue-barred parrotfish
	Scarus gibbus	Red sea parrotfish
	Scarus globiceps	Violet-lined parrotfish
	Scarus japanensis	Pale bullethead parrotfish
	Scarus niger	Swarthy parrotfish
	Scarus psittacus	Palenose parrotfish
	Scarus pyrrhurus	Redtail parrotfish
	Scarus rubiviolaceus	Redlip parrotfish
	Scarus russelli	Russel's parrotfish
	Scarus scaber	Dusky-capped parrotfish
	Scarus strongylocephalus	Indian ocean steephead parrotfish
	Scarus tricolor	Tricolor parrotfish
	Scarus viridifucatus	Greenlip parrotfish
Scorpaenidae	*Pterois antennata*	Antenna firefish
	Pterois miles	Devil firefish
	Pterois radiata	Radiating firefish
	Pterois volitans	Common lionfish
	Scorpaenodes guamensis	Guam scorpionfish
	Scorpaenodes minoa	Minor scorpion
	Scorpaenopsis oxtcephala	Tassled scorpion

FAMILY	*GENUS/SPECIES*	COMMON NAME
	Scorpaenopsis venosa	Raggy Scorpion
	Sebastapistes cyanostigma	Yellowspotted scorpionfish
	Sebastapistes strongia	Barchin scorpion
	Taenianotus triacanthus	Leaf scorpionfish
Serranidae	*Aethaloperca rogaa*	Redmouth grouper
	Anyperodon leucogrammicus	White-lined rockcod
	Belonoperca chabanaudi	Chabanaud's soapfish
	Cephalopholis argus	Peacock grouper
	Cephalopholis boenak	Chocolate hind or brown-barredrockcod
	Cephalopholis leopardus	Leopard hind
	Cephalopholis miniata	Coral grouper
	Cephalopholis sexmaculata	Sixspot grouper
	Ephinephelus tukula	Potato Grouper
	Epilephelus melanostigma	Blackspot grouper
	Epinephelus caeruleopuntatus	White Spotted grouper
	Epinephelus chlorostigma	Brownspotted grouper
	Epinephelus fuscoguttatus	Brown marbled grouper
	Epinephelus lanceolatus	Giant grouper
	Epinephelus malabaricus	Malabar grouper
	Epinephelus spilotoceps	Foursaddle grouper
	Grammistes sexlineatus	Six-stripe soapfish
	Plectropomus laevis	Saddleback coralgrouper
	Plectropomus pessuliferus	Leopard grouper
	Plectropomus punctatus	African trout grouper
	Pseudanthias Squamipinnis	Lyre-tail fairy basslet/Sea goldie
	Serranus tigrinus	Harlequin bass
	Variola albimarginata	Jewel grouper
	Variola louti	Lyre tail grouper

Appendix species list

Cont. Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Siganidae	*Siganus argenteus*	Fork-tailed rabbit
	Siganus stellatus	Stellate rabbit
	Siganus sutor	African white-spotted rabbit
Soleidae	*Pardachirus pavoninus*	Peacock sole
Solenostomidae	*Solenostomus cyanopterus*	seagrass ghost pipefish
Sphyraenidae	*Sphyraena barracuda*	Great barrcuda
	Sphyraena flavicauda	Yellowtail barracuda
	Sphyraena forsteri	Forsters barracuda
	Sphyraena qeine	Blackfin barracuda
Syngnathidae	*Corythoichthys flavofasciatus*	Network pipefish
	Trachyrhamphus bicoarctatus	Double-ended pipefish
Synodontidae	*Saurida gracilis*	Graceful lizardfish
	Synodus dermatogensis	Sand lizardfish
	Synodus indicus	Indian lizardfish
	Synodus variegatus	Variegated lizardfish
Terapontidae	*Terapon jarbua*	Cresent bass
Tetraodontidae	*Arothron hispidus*	Whitesptted pufferfish
	Arothron mappa	Map puffer
	Arothron nigropunktatus	Blackspotted puffer
	Arothron stellatus	Star pufferfish
	Canthigaster bennetti	Bennet's toby
	Canthigaster coronata	Crowned toby
	Canthigaster solandri	Solander's toby
	Canthigaster valentini	Black-saddled toby
	Diodon hystrix	Common porcupinefish
	Diodon liturosus	Masked porcupinefish
	Ablabys binotatus	Redskin waspfish
Torpedinidae	*Hypnos monopterygium*	Electric ray
	Myrichthys maculosus	Ocellated snake eel
Zanclidae	*Zanclus cornutus*	Moorish idol

Cnidaria - Cnidarians

FAMILY	GENUS/SPECIES
Acroporidae	*Acropora*
	Astreopora
	Montipora
Agariciidae	*Coeloseris*
	Gardineroseris
	Leptoseris
	Pachyseris
	Pavona
Anthoathecata	*Millepora*
Astrocoeniidae	*Stephanocoenia*
Caryophylliidae	*Gyrosmilia*
	Physogyra
	Plerogyra
Dendrophylliidae	*Dendrophyllia*
	Heteropsammia
	Tubastrea
	Turbinaria
Faviidae	*Caulastrea*
	Cyphastrea
	Diploastrea
	Echinopora
	Favia
	Favites
	Goniastrea
	Leptastrea
	Leptoria
	Montastrea
	Oulophyllia
	Platygyra

FAMILY	GENUS/SPECIES
Fungiidae	*Cycloseris*
	Fungia
	Halomitra
	Herpolitha
	Podabacia
Merulinidae	*Hydnophora*
	Merulina
Mussidae	*Acanthastrea*
	Blastomussa
	Lobophyllia
	Scolymia
	Symphyllia
Oculinidae	*Galaxea*
Pectiniidae	*Echinophyllia*
	Mycedium
	Oxypora
	Pectinia
Pocilloporidae	*Pocillopora*
	Seriatopora
	Stylophora
Poritidae	*Alveopora*
	Goniopora
	Porites
	Porites solida
Siderastreidae	*Coscinaria*
	Psammocora
Tubiporidae	*Tubipora*
Zoanthidea	*Protopalythoa nelliae*

Mollusca - Molluscs

FAMILY	*GENUS/SPECIES*
Arcidae	*Anadara spp.*
Buccindae	*Engina mendicaria*
Cerithiidae	*Clypeomorus bifasciatus*
Chitonidae	*Acanthopleura brevispinosa*
	Acanthopleura gemmata
Conidae	*Conus miles*
Cypraeidae	*Cypraea annulus*
	Cypraea tigris
	Cypraea vitellus
Fasciolaridae	*Fusinus colus*
Gryphaeidae	*Hyotissa hyotis*
Lottidae	*Patelloida profunda*
Mitridae	*Mitra spp.*
Muricidae	*Drupella rugosa*
	Morula granulata
Neritidae	*Nerita spp.*
Octopodidae	*Octopus cyanea*
Patellidae	*Cellana radiata*
Sepiidae	*Sepia pharaonis*
Strombidae	*Dolabella auricularia*
	Lambis lambis
Tridacnidae	*Tridacna maxima*
	Tridacna squamosa

Appendix species list

Plantae & Chlorophyta – Marine Plants & Macro algae

FAMILY	GENUS/SPECIES
Boodleaceae	*Boodlea composita*
	Cladophoropsis sundanensis
Caulerpaceae	*Caulerpa recemesa*
	Caulerpa spp.
Cladophoraceae	*Chaetomorpha crassa*
Codiaceae	*Codium geppii*
Cymodoceaceae	*Cymodocea rotundata*
	Cymodocea serrulata
	Halodule wrightii
	Syringodium isoetifolium
	Thalassodendron ciliatum
Dasyaceae	*Dasya elongata*
	Dictyurus purpurascens
Dictyotaceae	*Lobophora variegata*
	Padina spp.
Gelidiellaceae	*Gelidiella acerosa*
Halimedaceae	*Halimeda macroloba*
Hydrocharitaceae	*Halophilia ovalis*
	Halophilia stipulacea
	Thalassia hemprichii
	Thalassia spp.
Rhodomelaceae	*Leveillea jungermanniodes*
	Polysiphonia denudata
Sargassaceae	*Cystoseira myrica*
	Sargassum spp.
	Turbinaria conoides
	Turbinaria decurrens
	Turbinaria spp.
Siphonocladaceae	*Dictyosphaeria cavernosa*
Solieriaceae	*Sarconema filiforme*
Sporolithaceae	*Sporolithon spp.*
Udoteaceae	*Avrainvillea obscura*
Ulvaceae	*Ulva pulchra*

Echinoderma - Echinoderms

FAMILY	*GENUS/SPECIES*
Acanthasteridae	*Acanthaster planci*
Brissidae	*Metalia sternalis*
Cidaridae	*Prionocidaris baculosa*
Diadematidae	*Diadama savignyi*
	Diadama setosum
Echinometridae	*Echinometra mathaei*
	Echinostrephus molaris
Holothuriidae	*Actinopyga echinites*
	Actinopyga lecanora
	Actinopyga miliarus
	Bohadschia atra
	Bohadschia subrubra
	Bohadschia vitensis
	Bohadscia graeffei
	Holothuria atra
	Holothuria fuscorubra
	Holothuria leucospilota
	Holothuria nobilis
	Holothuria parva
	Holothuria pervicax
	Pearsonothuria graeffei
Ophidiasteridae	*Linckia guildingi*
	Linckia lavigata
Oreasteridae	*Culcita schmideliana*
	Pentacerestar mammilatus
	Pentacerestar tuberculatus
	Protoreaster lincki
Stichopodidae	*Stichopus chloronotus*
	Stichopus herrmanni
	Stichopus horrens
	Stichopus sp. (tairi)
	Theleonota anax
Synaptidae	*Synapta maculata*
Toxopnjeustidae	*Tripneustes gratilla*

Crustacea - Crustaceans

FAMILY	*GENUS/SPECIES*	COMMON NAME
Coenobitidae	*Birgus latro*	Coconut (Robber) Crab
	Coenobita rugosus	Rugosis
	Coenobita violascens	Land Hermit crab (violascens)
Diogenidae	*Dardanus megistos*	White-spotted (Red) Hermit Crab
Eriphiidae	*Eriphia smithii*	Rough Red-eyed Crab (smithi)
Gonodactylidae	*Gonodactylus spp.*	-
Grapsidae	*Grapsus albolineatus*	Mottled rock
	Grapsus fourmanoiri	Rock crab (Sally Lightfoot)
Ocypodidae	*Macrophthalmus spp.*	Speckled sand
	Ocypode ceratophthalmus	Common ghost crab
Odontodactylidae	*Odontodactylus scyllarus*	Peacock mantis shrimp
Palinuridea	*Panilirus versicolor*	East African Painted Spiny Lobster
Pilumnidae	*Pilumnus verspertilio*	Hairy crab
Stenopodidae	*Stenopus hispidus*	Banded Cleaner (Boxer) Shrimp
Tetraclitidae	*Tetraclita squamosa rufotincta*	Barnacle - acorn

Reptilia - Reptiles

FAMILY	*GENUS/SPECIES*	COMMON NAME
Cheloniidae	*Chelonia mydas*	Green Turtle
	Eretmochelys imbricata	Hawksbill Turtle

Porifera - Sponges

FAMILY	*GENUS/SPECIES*	COMMON NAME
Clionidae	*Spheciospongia globularis*	
Spongiidae	*Carteriospongia foliascens*	Sponge - foliose
	Strepsichordaia radiata	
Tedaniidae	*Tedania anhalens*	Chilli pepper sponge

Appendix species list

Aves - Birds

Family	Genus/Species	Common name
Acciptridae	Elanus caeruleus	Black-shouldered Kite
	Haliaeetus vocifer	African Fish Eagle
Acrocephalidae	Hippolais pallida	Olivaceous Warbler
Alcedinidae	Ceryle rudis	Pied Kingfisher
	Ceyx pictus	African Pigmy Kingfisher
	Halcyon farquhari	Chestnut-bellied Kingfisher
	Halcyon leucocephala	Grey-headed Kingfisher
	Halcyon senegaloides	Mangrove Kingfisher
	Ispidina picta	Pygmy Kingfisher
Apodidae	Apus affinis	Little Swift
	Apus apus	European Swift
	Cypsiurus parvus	Palm Swift
	Telacanthura ussheri	Mottled Spinetail
Ardeidae	Ardea cinerea	Grey Heron
	Ardea goliath	Goliaths Heron
	Ardeola ibis	Cattle Egret
	Bubulcus ibis	Cattle Egret
	Butorides striatus	Green-backed Heron
	Casmerodius albus	Great Egret
	Egretta dimorpha	Dimorphic Egret
	Egretta garzetta	Little Egrett
	Egretta intermedia	Yellow-billed Egret
Burhinidae	Burhinus vermiculatus	Water Thick-knee
Caprimulgidae	Caprimulgus europaeus	Eurasian Nightjar
	Caprimulgus fossii	Gabon Nightjar
Charadriidae	Charadrius hiaticula	Ringed Plover
	Charadrius leschenaultii	Greater Sand Plover
	Charadrius mongolus	Lesser Sand Plover or Mongolian Sandplover
	Pluvialis squatarola	Grey Plover
Ciconiidae	Anastomus lamelligerus	Open-billed Stork
Columbidae	Streptopelia capicola	Cape Turtle Dove
	Streptopelia semitorquata	Red-eyed Dove
Coraciidae	Coracias caudatus	Lilac-breasted Roller
Corvidae	Corvus splendens	Indian house Crow
Cuculidae	Centropus superciliosus	White-browed Coucal
	Crysococcyx capreus	Didric Cuckoo
Dicruridae	Dicrurus adsimilis	Drongo
Dromadidae	Dromas ardeola	Crab Plover
Falconidae	Falco cuvieri	African Hobby
	Falco subbuteo	European Hobby
Haematopodidae	Haematopus ostralegus	Oyster Catcher
Hirundinidae	Hirundo abyssynica	Lesser Striped Swallow
	Hirundo rustica	European Swallow
	Riparia riparia	European Sand Marin
Laniidae	Lanius collurio	Red-backed Shrike
Laridae	Larus argentatus taimyrensis	Herring Gull
	Larus fuscus fuscus	Lesser Black-Backed Gull
	Larus hemprichii	Sooty Gull
	Larus heuglini	Heuglin's Gull
Meropidae	Merops persicus	Blue-cheeked bee-eater
Monarchidae	Terpsiphone viridis	Paradise Flycatcher
	Trochocercus cyanomelas	Crested Flycatcher
Muscicapidae	Cossypha natalensis	Red-capped Robin Chat
	Cossypha niveicapilla	Snowy-crowned Robin Chat
	Muscicapa striata	Spotted Flycatcher
Nectariniidae	Nectarinia bifasicata	Purple-banded Sunbird
	Nectarinia olivacea	Olive Sunbird
	Nectarinia veroxii	Mouse-coloured Sunbird
Oriolidae	Oriolus oriolus	Eurasian Golden Oriole
Phalacrocoracidae	Phalacrocorax africanus	Long-tailed Cormorant
Phylloscopidae	Phylloscopus sibilatrix	European Wood Warbler
Ploceidae	Euplectes hordacea	Black-winged Red Bishop
Pycnonotidae	Andropadus importunus	Sombre Greenbul
	Pycnonotus barbatus	Common Bulbul
Scolopacidae	Actitis hypoleucos	Common Sandpiper
	Arenaria interpres	Ruddy Turnstone
	Calidris alba	Sanderling
	Calidris ferruginea	Curlew Sandpiper
	Calidris minuta	Little Stint
	Numenius arquata	Eurasian Curlew
	Numenius phaeopus	Whimbrel
	Tringa nebularis	Common Greenshank
	Xenus cinereus	Terek Sandpiper
Stercorariidae	Stercorarius parasiticus	Arctic Skua
	Stercorarius pomarinus	Pomerine Skua
Sternidae	Anous stolidus	Brown or Common Noddy
	Sterna albifrons	Little Tern
	Sterna anaethetus	Brided tern
	Sterna bengalensis	Lesser Crested Tern
	Sterna bergii	Greater Crested Tern
	Sterna dougalii	Roseate Tern
	Sterna fuscata	Sooty Tern
	Sterna hirundo	Common Tern
	Sterna saundersi	Saunder's Tern
Strigidae	Strix woodfordi	African Wood Owl
Sulidae	Sula dactylatra	Masked Booby
Sylviidae	Acrocephalus baeticatus	African Reed Warbler
	Acrocephalus scirpaceus	Eurasian Reed Warbler
Tyrannidae	Alsionax adustus	Dusky Flycatcher
Viduidae	Virua paradisaea	Eastern Paradise Wydah
Unknown	Eromela icteropygialis*	Yellow-belled Eromela*
	Clyanomitra veroxii	Mouse-coloured Sunbird
	Cinnyris bifasciata	Purple-banded Sunbird

Chiroptera - Bats

Family	Genus/Species	Common name
Pteropodidae	*Eidolon helvum*	Straw-colored fruit bat
	Epomophorus wahlbergi	Whalberg's epaulleted fruit bat
Hipposideridae	*Hipposideros commersoni*	Commerson's roundleaf bat

Appendix species list & Appendix References

Lepidoptera - Butterflies

Family	Genus/Species	Common name
Acraeidae	*Acraea natalica*	Natal Acraea
	Acraea sp.	East-coast Acraea
	Acraea zetes	Large-spotted Acraea
	Acrea spp. (Other spp. present)	
Hesperiidae	*Coeliades forestan*	Striped Policeman
	Gegenes sp.	Grizzle Skipper
Lydanidae	-	-
Nymphalidae	*Bicyclus safitza*	Common Bush Brown
	Byblia anvatara	Joker Red-orange & black
	Danaus chrysippus	African Monarch
	Euphaedra neophron	Gold-banded Forester
	Hypolimnas misippus	Diadem
	Junonia hierta	Yellow Pansy
	Junonia natalica	Brown Commodore
	Junonia oenone	Black Pansy
	Neptis saclava	Small-spotted Sailer
	Phalantha phalantha	Poplar Leopard
	Pseudoacraea lucretica	False Acraea
	Vanessa cardui	Painted Lady
Papilionidae	*Princeps demodocus*	Citrus Swallowtail
	Princeps lyaeus	Green-banded Swallowtail
Pieridae	*Belenois aurota*	Brown-veined White
	Belenois creona	African Common White
	Belenois thysa	False Dotted Border
	Catopsilia florella	African Migrant
	Colotis ione	Purple-tip
	Colotis sp.	Black-barred Red Tip
	Colotis sp.	Salmon Colotis
	Eurema hecabe	Common Grass Yellow

Bayliss J & Stubblefied LK, 1993: preliminary Results of a Biological Survey of Chumbe Island, Zanzibar (Frontier Study)

Boswell, A. et al., 2008: Flowers and Butterflies of MIKUMI NATIONAL PARK

Lieske, E., Myers, R. 2002 Coral Reef Fishes - Indo-Pacific and Caribbean

Iles, D. B. 1995: Checklist of Butterflies 1994-1995

Iles, D.B. Ornithological notes from Chumbe Island, Jan-Aug 1995

Iles, D.B. recent observation (1995)

Iles, D.B. 1995: A Checklist from Zanzibar

Kielland, J.1990: Butterflies of Tanzania

Kohler P. & Kohler U., 1995: A preliminary Survey of Birds on Chumbe Island

Richmond, M.D.(eds). 1997. A Field Guide to the seashores of East Africa and the Western Indian Ocean Islands, Second Edition.

Skillings, H.L. 2000. The Birds of Chumbe Island: A Case Study
Taquet Marc, Diringer Alain. 2007. Poissons de l'océan Indien et de la mer Rouge.

Waycott, M. et al. 2004. A guide to Tropical Seagrasses of the Indo-West Pacific

Webb, H. 2003 Migratory Birds on Chumbe Island. Zanzibar. 3rd report Nov. 1994 - Jan. 1995

www.algaebase.org/

www.birdlife.info/docs/SpcChecklist/Checklist_v3_June10.zip

Note: The species list is updated from the management plan 2006 - 2016