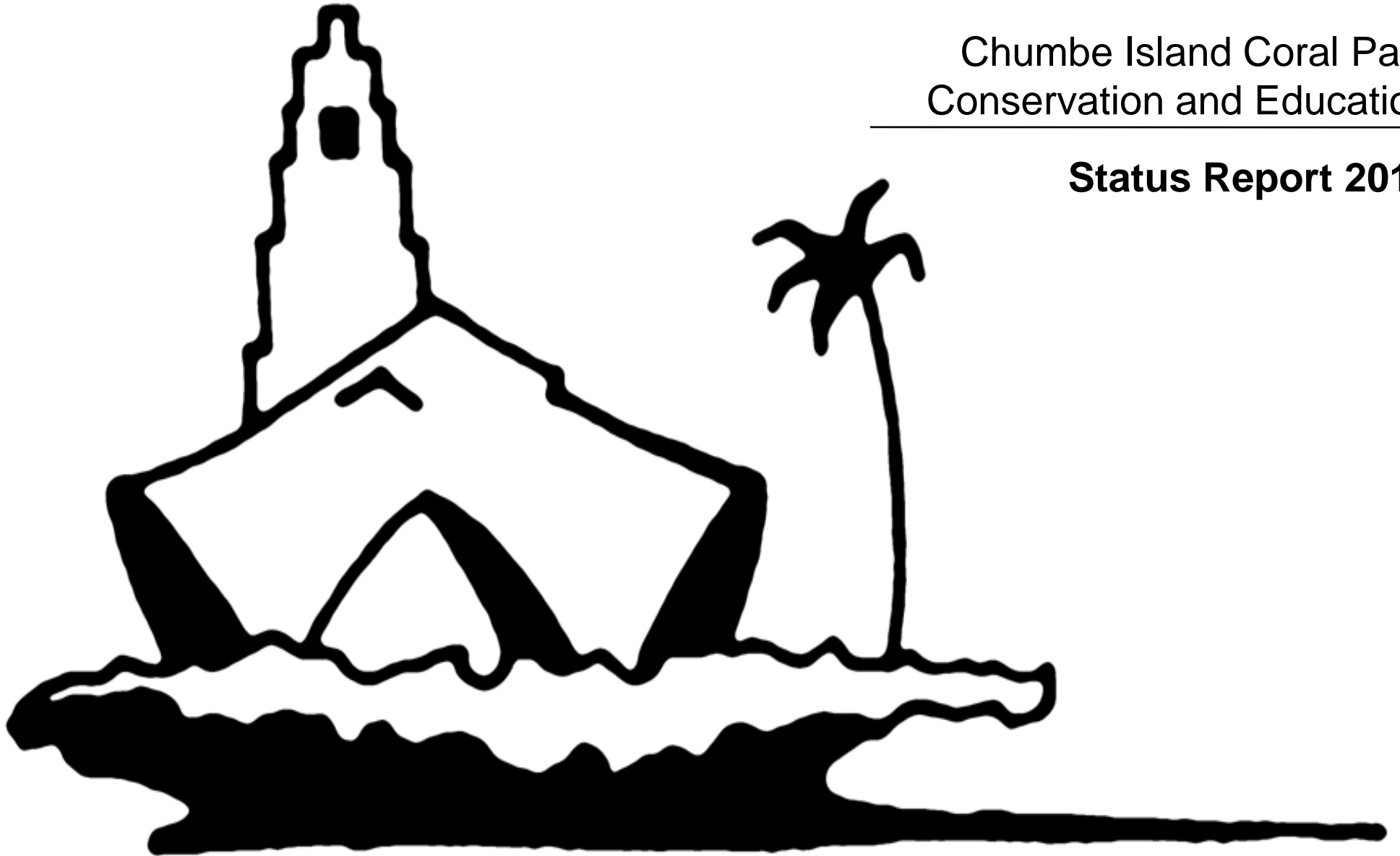


Chumbe Island Coral Park
Conservation and Education

Status Report 2013



Zanzibar, Tanzania

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Chumbe Reef Sanctuary, Photo by Markus Meissl

Foreword

Chumbe Island Coral Park, Ltd. (CHICOP), established in 1992 as a private non-profit company, just off Zanzibar Island in Tanzania, is a unique example of successful Marine Protected Area (MPA) management through income generation from eco-tourism. Even though our nature reserve is small, many interesting projects have been implemented by CHICOP's Conservation and Education team and are presented in this status report. The framework of this report was developed in 2010 and we are happy to present up-dates and new initiatives for the Status Report 2013.

One thing that differentiates Chumbe from most projects with social, rather than financial goals, is that we don't receive donor funds for our core activities. Therefore, I would like to thank all our guests that decide to visit our project - without them there would be no conservation and education programs!

Over the last two years Chumbe has further evolved in response to our ever changing, dynamic world. Our research findings suggest that through our conservation efforts, the Chumbe Reef Sanctuary has been able to maintain its health and biodiversity status, and we are also proud of our education efforts: over 1200 students have visited Chumbe Island for education purposes since 2010. We can not think of a better location to educate and inspire our future leaders about environmental conservation.

An exciting season 2013/14 is ahead of us and it is the collective passion of each one of our team members that drives Chumbe and inspires our guests, regardless if they are tourists, Zanzibari students or community members. We hope to see you soon!

Ulli Kloiber & Team
Conservation and Education Manager



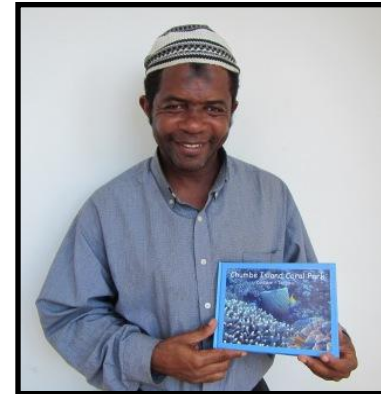
I started to work on Chumbe as a marine park ranger in September 1992. At that time the Chumbe project was just a concept with its main dream to protect the reef and the forest for conservation and education activities. Twenty years later I am happy to say that the dream has become reality. After years and years educating fishermen about the benefits of protecting a coral reef, we have observed an increase in awareness amongst fishermen. The Chumbe Reef Sanctuary has remained as one of the most spectacular coral gardens in the world, and we are proud to present our conservation efforts within 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 big lack of knowledge about the importance of environmental issues. Within the Chumbe Education Program, 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 Program contributes to the millennium development goals especially on resource management and strategies for addressing poverty. We are happy to present you the proceedings we have achieved during the past two years.

Khamis Khalfan Juma and Enock Kayagambe
Environmental Educators



Introduction CHICOP



From left to right: hermit crab and the education centre, Chumbe flag, 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. It is one amongst several MPA's in Tanzania, but the only MPA amongst four conservation areas in Zanzibar. The Chumbe MPA closely borders the Menai Bay Conservation Area.

Chumbe Island Coral Park Ltd (CHICOP) has been 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 is registered as a MPA with the UNEP-World Conservation Monitoring Centre (WCMC) in Cambridge/UK and was also distinguished as Member of the UNEP Global500 Forum in 2000.

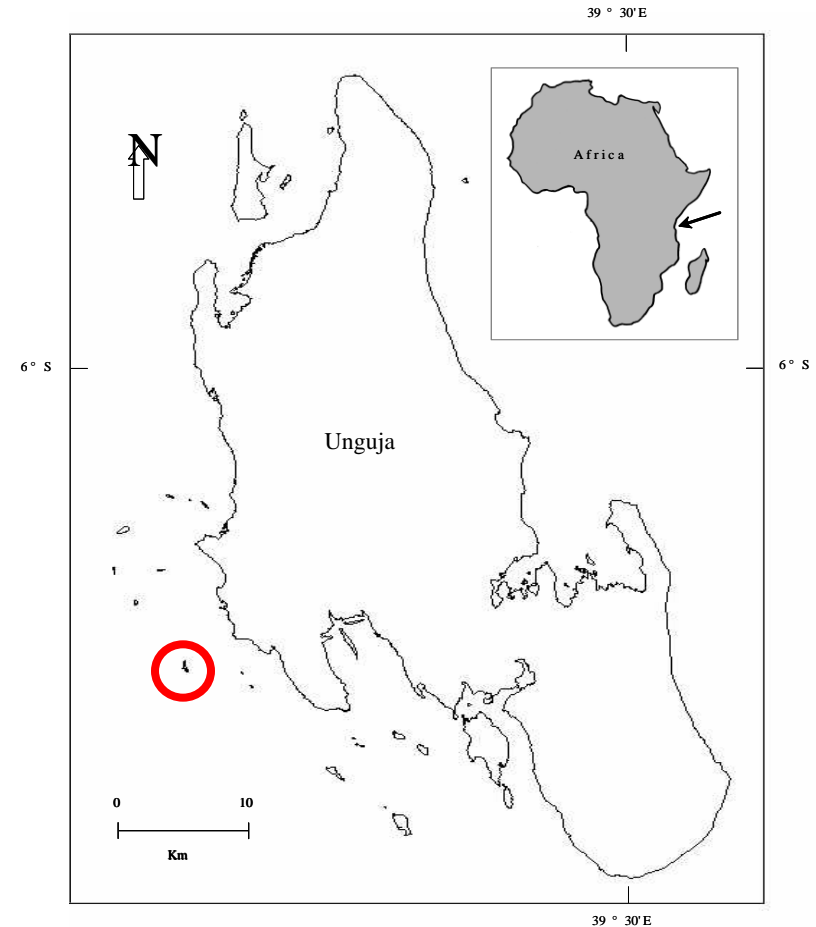
The nature reserve includes the Chumbe Reef Sanctuary (gazetted in 1994), a Closed Forest Habitat, a Visitors Centre and an Eco-Lodge. Management is based on consecutive Management Plans 1995-2005 and 2006-2016 (for project details see www.chumbeisland.com).

A key reason for CHICOP's early establishment, investment proposal and campaigning to gazette the Chumbe MPA was the observation of high biodiversity values, 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: Conservation Programs

Chumbe Island Coral Park Ltd (CHICOP) was registered in Zanzibar in 1992 for the sole purpose of establishing and managing the nature reserve. On 3rd January 1994 an agreement was signed between the Ministry of Agriculture, Livestock and Natural Resources 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. On 3rd January 2004 this arrangement was reviewed and extended 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 22nd 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 Chumbe Reef Sanctuary has been declared as one of the most diverse in the region, and is believed to host 90% of East Africa's hard coral species (more than 200 species from 55 genera), 424 reef fish species, as well as the critically endangered Hawksbill Turtle (*Eretmochelys imbricata*) and the endangered Green Turtle (*Chelonia mydas*). The Closed Forest Habitat possesses several, healthy individuals of the critically endangered Ader's duikers antelope (*Cephalophus adersi*) and a large population of the IUCN data deficient Coconut crab (*Birgus latro*), along with various species of endangered birds. The tree *Uvariadendron 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.

Steps involved in the development of the 2006-2016 management plan

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 has been undertaken.

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

Conservation objectives of the Chumbe Island MPA: 2006 -2016

- I. To protect & manage the marine & forest ecosystems in the nature reserve
- II. To promote research in the CRS and CFH in support of management
- III. To develop and implement biodiversity monitoring systems for both the marine & forest habitats in the nature reserve
- IV. To promote the conservation of rare & endemic species

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.



The eco-lodge on Chumbe Island. Revenue from eco-tourism activities is channeled back into conservation, education and research. Photo by Oskar Henriksson

Key Values of the MPA

Biodiversity values:

Value	Justification
Species-rich habitats & ecosystems	High species diversity in the CRS, including 55 hard coral genera and more than 400 coral reef species. 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 No-Take-Area (NTA) and is therefore, a rare historical example of non-impacted fringing reef representative of the region. 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) Ader's duiker (<i>Cephalophus adersi</i>), and the CRS is a feeding ground for the critically endangered (IUCN-CR) Hawksbill turtle (<i>Eretmochelys imbricata</i>) and the endangered (IUCN-E) Green turtle (<i>Chelonia mydas</i>).
Rare species nationally	The CFH is host to the data deficient (IUCN-DD) Coconut crab (<i>Birgus latro</i>) which is considered to be increasingly rare in the region. <i>Uvariadendron kirkii</i> , is a tree species previously considered regionally extinct, with little research undertaken to date.



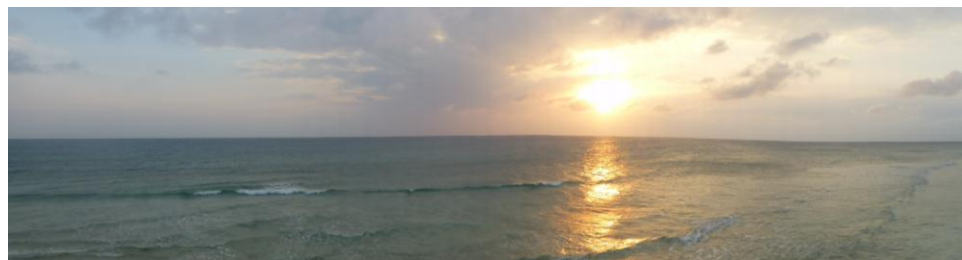
Other natural values:

Value	Justification
Specific fringing reef habitat formation	Shallow habitat with dramatic formations, high rugosity and diverse topography providing diverse habitat niches.
Island ecosystems	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 currents converge. A 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 which enables 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 Eco-lodge guests on their way to the Chumbe Reef Sanctuary for snorkeling. Bottom: sunset above the Chumbe Reef Sanctuary. Photos by Oskar Henriksson and Warren Devine.

Chumbe Reef Sanctuary (CRS)



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

After the discovery of Chumbe's incredibly diverse reef eco-system, CHICOP succeeded in officially closing the fringing reef west of Chumbe Island in October 1992 (after several years of campaigning!). With Chumbe being located upstream of the most important fishing grounds opposite Stone Town, Zanzibar's capital, the Chumbe Reef provides a protected breeding ground for fish, corals and other species which can spread out to decolonize nearby, overfished and degraded reef areas. Being a source reef makes Chumbe's protection of vital importance to both the preservation of biodiversity 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" (CRS) and with this Chumbe had become the first marine park in Tanzania, and the first privately managed MPA in the world. 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:

- 1) Pelagic
- 2) Coral Reef
- 3) Coastal Shallows
- 4) Intertidal areas

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



Coastal Shallows: Shallow, rock and sand dominated areas. Photo by Lina Mtwana Nordlund



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



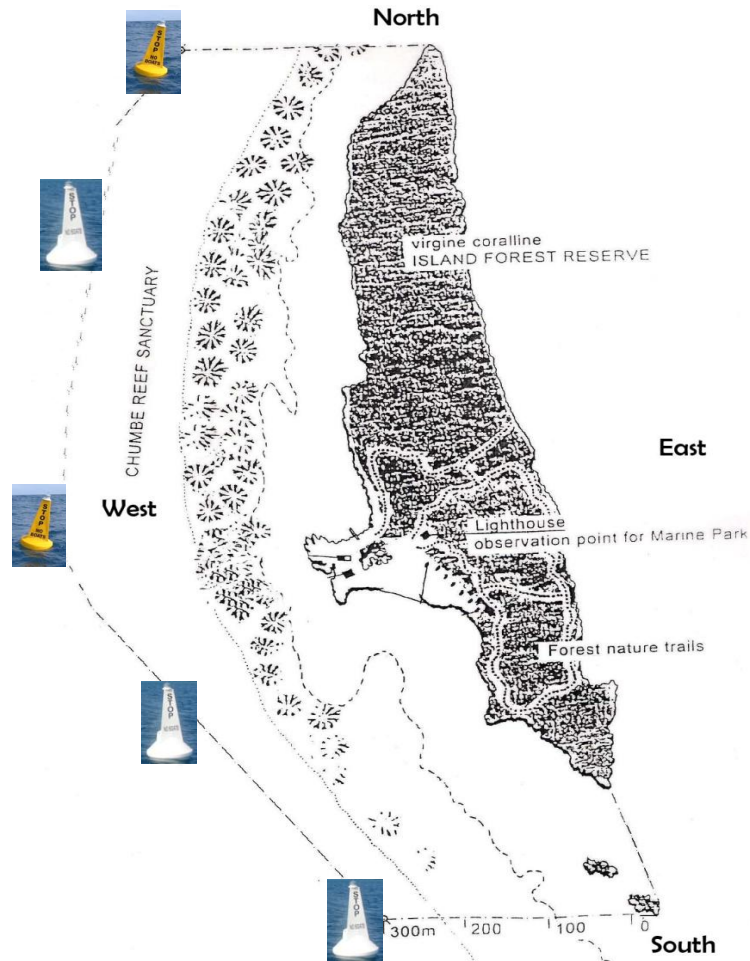
Borders of the CRS

Since August 2012 Chumbe Island has had five demarcation buoys on the boundaries of the CRS to serve as a reminder of the no-fishing zone for local fishermen and to alert passing boats of the protected area (please see map for details).

CHICOP was very grateful to receive funding from Seacology (www.seacology.org) by the end of 2011 in order to purchase three additional, state of the art mooring buoys (Sealite, SLB700) with solar powered lights that further help indicating the boundaries of the marine park, especially at night!

The new buoys came all the way from Australia and it took more than 6 months (order, transport, clearance) until they finally arrived in Zanzibar. Stainless steel chains and new nylon ropes were used to install the additional buoys, however, due to low chain quality available on site and challenging current and weather conditions (observed only a few times during the year), a certain risk of losing the buoys remains. Therefore, CHICOP's conservation team conducts regular maintenance dives by Scuba which involve cleaning the rope from overgrowth and photographic checks of the stainless steel material.

Buoy location within the CRS	GPS coordinates
Demarc Middle	S6 16.822 E39 10.365
Demarc North	S6 16.440 E39 10.416
Demarc North/Middle	S6 16.631 E39 10.343
Demarc South	S6 17.197 E39 10.611
Demarc South Middle	S6 16.988 E39 10.428



Trespassing

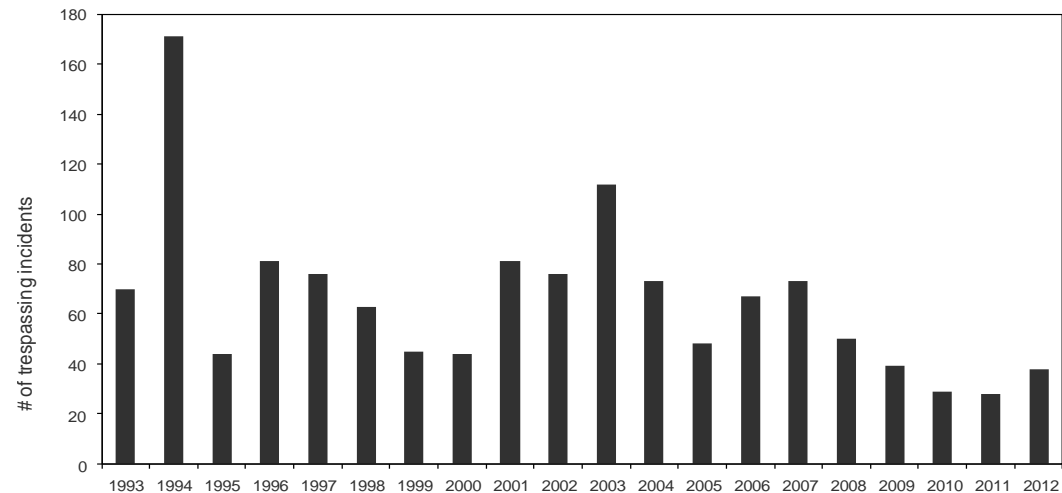


From the very beginning, CHICOP employed and trained former fishermen from adjacent villages as park rangers and stationed them on the island. Up to now their main tasks are to patrol the reef and the closed coral rag forest, ensuring that the laws prohibiting fishing, anchoring and wood cutting within the protected area are met. Since 1992 the rangers have been monitoring any event or infringement, and their reports provide daily data on the type and number of vessels involved, nature of the intended activity and the fishers' reaction to the rangers' intervention.

Previous to the MPA establishment, the western side of Chumbe Island was little accessed and had no traditional fishing grounds. Since colonial times the area has been 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. Additionally, there was a military base on the adjacent coast which had used the area around Chumbe Island for shooting range exercises. When village outreach meetings were conducted in the early years of the project, the response from the community representatives regarding Chumbe becoming an MPA was therefore, generally positive (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 that were reported, have coincided with political events, such as election campaigns (mid nineties) and/or the timing of Ramadhan, or stormy conditions when fishermen anchored temporarily and did not denote attempted trespassing (which involves poaching and anchoring). The trespassing has decreased to less than 50 incidents per year since 2008.

Total number of trespassing incidents per year in the Chumbe Reef Sanctuary (1993 - 2012)



From top: Ngalawa, Ranger Juma Salum with fishing trap found in the intertidal area of CRS, poaching attempt by a local spear gun fisherman. Photos by Ulli Kloiber and from Chumbe archive.

Fauna in the CRS

A variety of marine species inhabit the CRS (see species list of recorded fauna in appendix).

Out of the four key habitats the coral reef is the most diverse, hosting 90 % of the hard coral species in East Africa which are represented by at least 16 coral families. Zvuloni et al. (2010) reports that *coral diversity* across several reefs in Zanzibar (Bawe, Mnemba, Changuu and Chumbe) was *highest at Chumbe* which supported the highest number of taxonomic units (TAUs).

As for fish: a total number of 425 coral reef fish species has been recorded inside the borders of the CRS since 1992.

Chumbe is welcoming further inventory studies in order to be able to identify and record more species, especially within the group of invertebrates. Research proposals that follow the non-destructive principle as outlined in CHICOP's management plans should be submitted through CHICOP's Conservation Manager (chumbe@zitec.org).



The majestic Arc-eye hawkfish. Photo by Markus Meissl

“...one of the most spectacular ‘coral gardens’ to be found anywhere in the world.”

J.E.N Vernon Australian Institute of Marine Science

Endangered Green turtle. Photo by Ulli Kloiber



Ghost pipe fish in the coastal shallows of the CRS. Photo by Frida Lanshammar



Monitoring Programs

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).

A long-term monitoring program should allow data to be collected over the timescales by providing stronger evidence of the effects of terrestrial and marine reserve protection than comparative studies (Russ, 2002). By providing increased evidence of the benefits of nature reserves, monitoring data will therefore, increase locally and internationally support for nature reserves. Monitoring data can also be used to assess whether management objectives are being achieved, to highlight issues for which that reserve needs support or funding and to report achievements (Wells & Mangubhai, 2005).

Chumbe Island is surrounded by incredibly diverse, marine ecosystems that provide a natural laboratory full of research opportunities. CHICOP's conservation team is involved in the following monitoring programs:

1. Seawater temperature monitoring

Started in 1997, by Dr. Christopher Muhando from the Institute of Marine Science, University of Dar es Salaam in collaboration with Chumbe Island

2. Coral reef monitoring

Designed in 2006 by E.H.M Tyler, recorded are fish communities, coral health, crown-of-thorn starfish, and sea urchin species

3. Seagrass monitoring

Started in 2006, data submitted to a global, online database called SeagrassNet

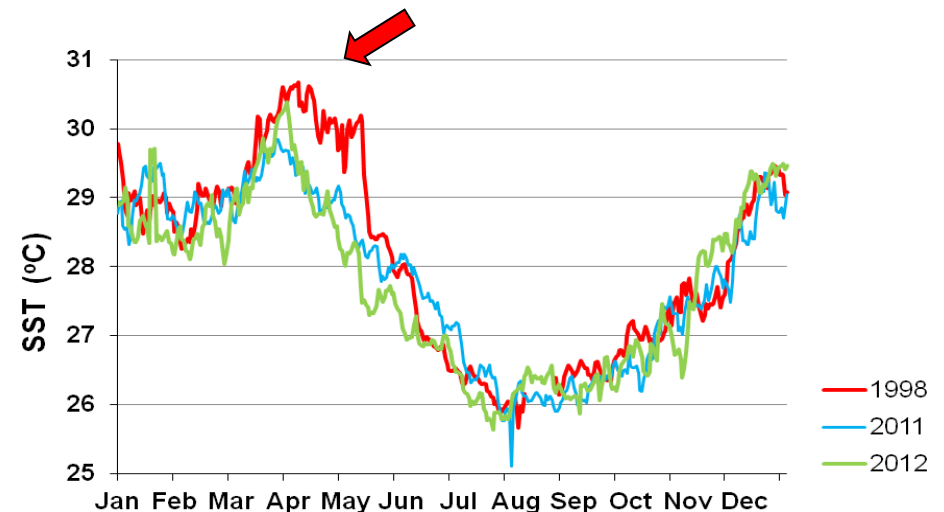
4. Humpback whale monitoring

Chumbe joined a regional monitoring program in 2008 and annually submits recorded sightings and whale behavior

Sea Surface Temperature (SST) Monitoring

Two loggers are installed in the CRS and provide a continuous dataset of sea surface temperature. The loggers are removed every three months for data retrieval (in cooperation with the Institute of Marine Science in Zanzibar). The data (see graph) helps draw correlations between high water temperatures and coral bleaching events. The years 2011 and 2012 were relatively 'cool' compared to 1998.

In April 1998 (red arrow) El Niño held sea surface temperature 2°C higher than average (over 30°C) causing severe bleaching and coral mortality events through out the Indo-Pacific. The Chumbe Reef Sanctuary was also affected but it's coral health and diversity is believed to have helped the reef recover quicker and with more coral diversity compared to surrounding reefs in Zanzibar.



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

Coral Reef Monitoring

CHICOP's Conservation team has been monitoring the Chumbe Reef Sanctuary (CRS), which is a 0.3 km² no-take area, since 2006. The monitoring program was specifically designed to provide evidence of management effectiveness and to inform management, with the key aim of making this sustainable within the resources of the MPA.

A total of 20 transects are monitored annually by a trained ranger who collects data by snorkelling. Since 2008 a reef similar in benthic habitat quality but unprotected and located outside the CRS has been established as a control reef. Data collection includes recording of commercial fish from six families and corallivorous Chaetontids via belt transects, whereas urchin species, crown-of-thorns starfish (COT) and the proportion of coral colonies afflicted by COT predation, bleaching, disease and damage are measured in 5m radii. The collected data is handed over to the conservation manager who analysis the data and writes the reports including recommendations.

Fish communities

Fish surveys are focused on particular fish families that are commercially targeted in the Zanzibar archipelago. Since the CRS is closed to fishing, it is important to see how this influences fish populations and sizes. The following indicator species are linked to fishing pressure and reef health:

Triggerfish are sea urchin predators that also indicate fishing pressure since they are easily caught by hook and line.

Butterfly fish (3 species in specific) eat coral polyps, and when found in abundance are linked to live hard coral cover.

Sweetlip, Snapper, Grouper are omnivorous fish that provide insight into the predation conditions on the reef.

Rabbitfish and Parrotfish are fish families often caught by local fishermen, and indicate the area's fishing disturbance.

From top: Omari Nyange conducting coral monitoring (photo by Karlyn Langjahr), middle left: orange striped trigger fish (photo by Martin Leyendecker), middle right: indicator butterfly fish (photo by Markus Meissl). Bottom: diverse hard coral species in the CRS (photos by Lina Mtwana Nordlund)



Coral monitoring 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

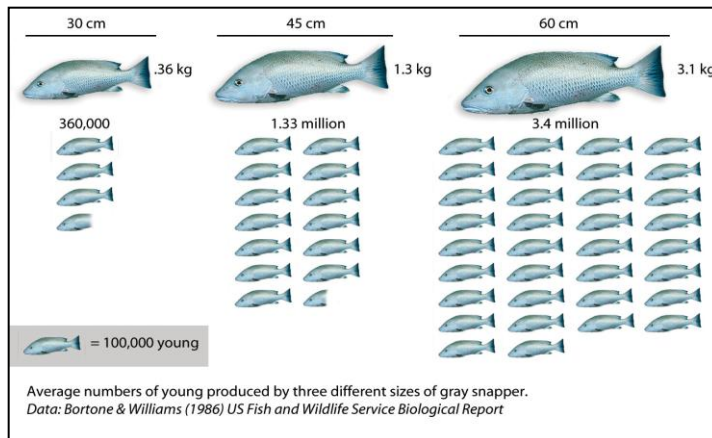
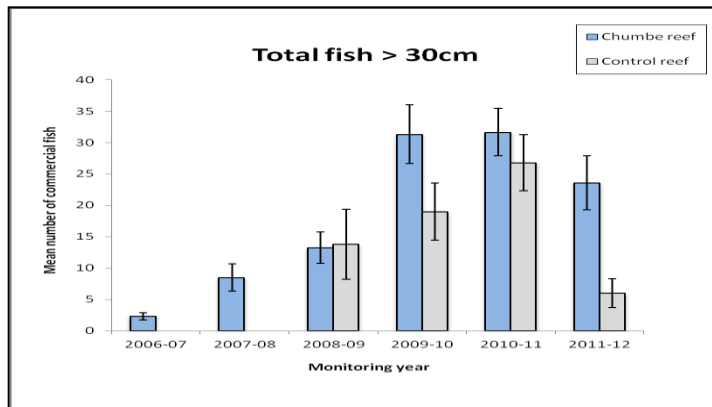


Monitoring Results: Fish Communities

Insights into 6 years of coral reef monitoring in the CRS: 2006 - 2012

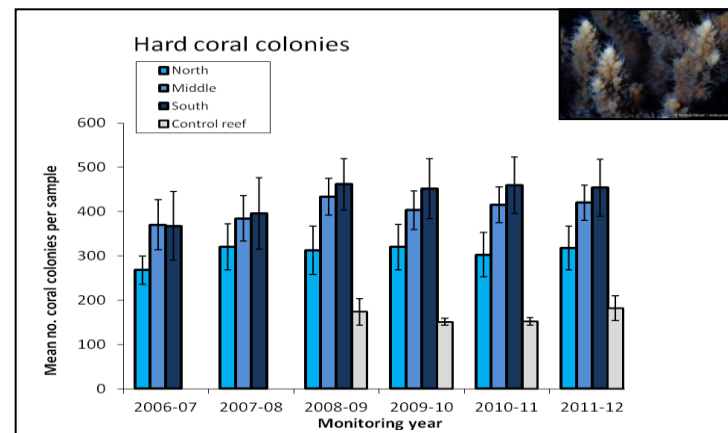
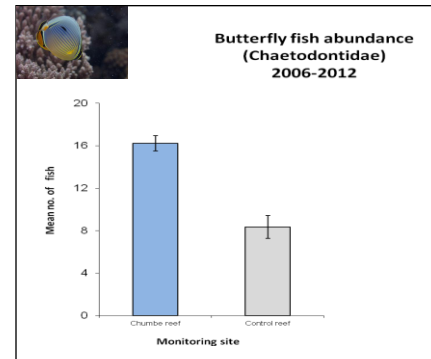
Graph 1: Why does size matter?

Comparing the abundance of large commercial fish (more than 30 cm in length) between Chumbe and the fished control reef, reveals that larger fish are found in the CRS. This is because large fish tend to be removed first by fishing methods. Large fish produce more young and help rejuvenate near-by reefs!



Graph 2 and 3: why are healthy hard corals important?

Compared to the fished control reef, Chumbe shows a much higher abundance of corallivore (coral polyp eating) butterfly fish. This abundance is linked to a high abundance of live hard corals in the sanctuary that provide a diverse reef habitat and food source for species like the butterfly fish. Unprotected reefs worldwide are facing severe habitat degradation resulting in reefs dominated by dead coral rubble and macro-algae instead of live hard corals!



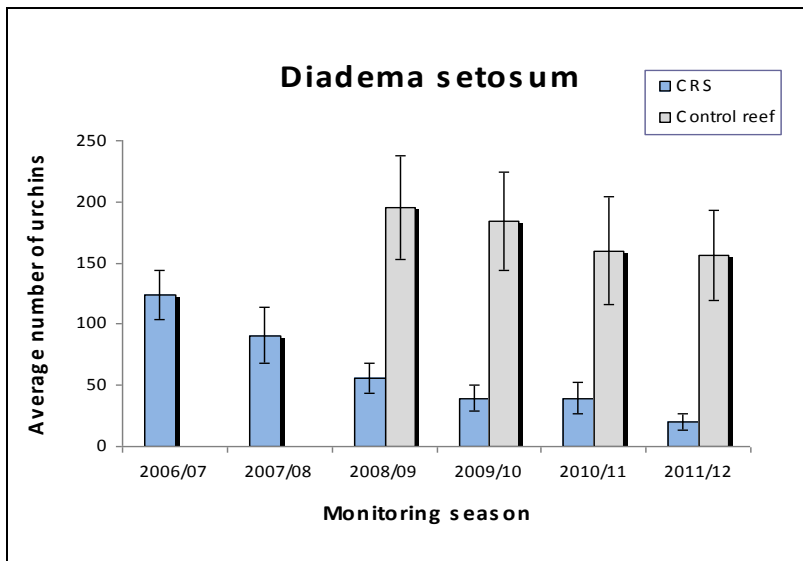
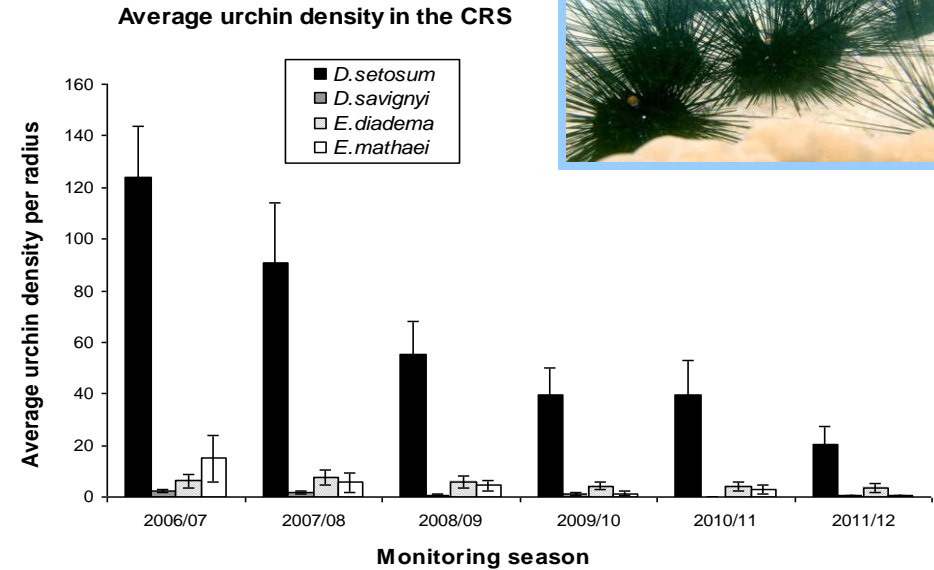
Monitoring Results: Sea Urchins

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 this species. However, the population dynamics of *Diadema setosum* are poorly understood, and the effects of any management initiatives are difficult to predict.

As part of the Coral Reef Monitoring manual, CHICOP's conservation team has been recording the distribution and abundance of the following sea urchin species:

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

Since 2006 the average number of sea urchins, especially of *Diadema setosum*, has gradually decreased. Compared to a unprotected and fished site outside the CRS (control reef), the CRS has a significant lower number of Diadem sea urchins. Research suggests that intensive fishing and shell collection through decades have removed most of the natural urchin predators such as the orange-striped triggerfish in Zanzibar's unprotected reefs.



Above right:
Long-spine sea urchin
(*Diadema setosum*). Photo by
Leyendecker.

Below right:
Orange striped trigger fish
(*Balistapus undulatus*) eating
a sea urchin.

Below left:
Echinothrix diadema.
Photos by Nell Hamilton.



Monitoring Results: Crown-of-Thorns

The Crown-of-thorns starfish (COT), *Acanthaster planci*, grows up to 50 cm across, has 12 to 19 arms, and is covered in poisonous spines. COT are hard coral predators, feeding preferably on polyps of staghorn corals from the genus *Acropora* which are important and abandoned reef-building coral. During the last 50 years their numbers have been increasing and outbreaks seem to occur more frequent, causing great damage to coral reefs world wide.

There are three common theories regarding COT outbreaks: 1) removal of predators, 2) human influence on water quality and 3) natural fluctuations.

During an outbreak the COT density increases, the competition for food increases and the feeding preference broadens from tabular corals (preferably *Acropora* sp.) to other coral species. Lanshammar & Muhando (2008) looked at coral mortality and recovery after the last major El Niño in 1998 and its relation to COT population densities in the Zanzibar archipelago. Benthic data from three islands on the west coast of Zanzibar (Chumbe, Bawe, and Changuu) showed that the % cover of *Acropora* corals dropped to 10-15% during the El Niño event in 1998, after which a slow coral recovery could be seen on all reefs. However, after a major COT outbreak in 2002/03, % cover of *Acropora* corals has further dropped dramatically down to around 1% on all reefs except for Chumbe, where live *Acropora* coverage has recovered to pre-bleaching numbers.



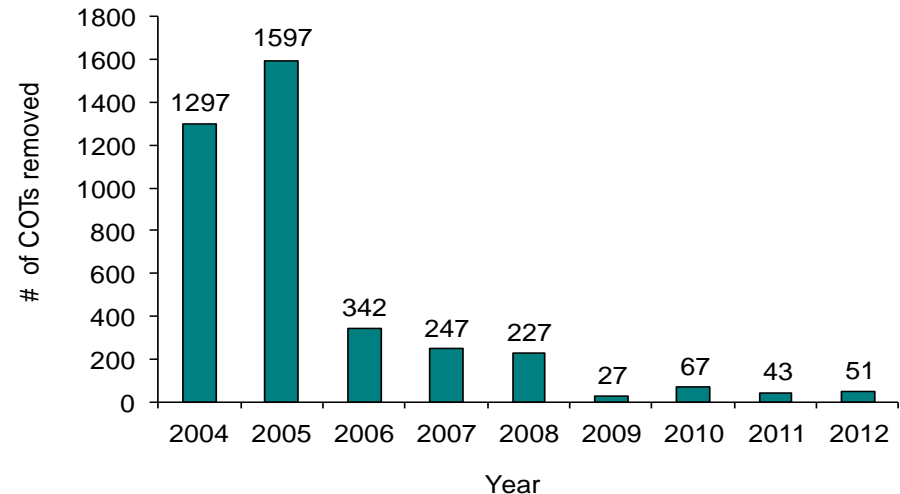
Size information of COTs per year since 2006							
	2006	2007	2008	2009	2010	2011	2012
Min (cm)	16	15	15	20	16	14	8
Max (cm)	32	34	40	31	33	32	46
Av. Size (cm)	24,5	26,4	38,1	25,3	24,8	25,8	28,8

COT removal program in Chumbe

When increased densities of COT were noticed inside the CRS in 2004, CHICOP management initiated a manual COT removal program which involves park rangers who collect, count and measure all COTs detected during random swims inside the CRS. This removal program has proven to be a very effective management tool as a total number of 3898 COT starfish could be removed since 2004 (see graph below), which had a very positive effect on the health status of the CRS.



COTs removed per year since 2004



Seagrass Monitoring

Seagrass meadows are vitally important to the health of adjacent coral reefs (Dorenbosch, 2006) as they provide nurseries, shelter, and food for a variety of commercially and ecologically important species like fish, sea turtle, seahorse, and crustaceans (Orth et al., 1984; Bell and Pollard, 1989; Nagelkerken et al., 2000).

Seagrasses are marine angiosperms that are commonly distributed in tropical and subtropical coastal intertidal areas where they assist in stabilizing the seafloor with their root systems and filter or trap harmful pollutants or particles derived from land production (Howard et al., 1989; Duarte and Chiscano, 1999).

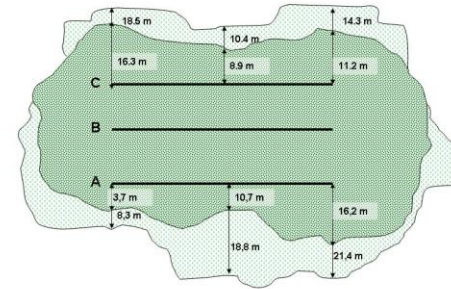
Of the 13 seagrass species known from the region (Bandeira and Björk, 2001), **7 species** are found around Chumbe Island:

- *Cymodocea rotundata*
- *Cymodocea serrulata*
- *Halodule* sp.
- *Thalassia hemprichii*
- *Thalassodendron ciliatum* (formerly *Cymodocea ciliata*)
- *Halophila ovalis*
- *Syringodium isoetifolium*

Since 2006 CHICOP's conservation team has monitored 3 permanent transects covering seagrass beds at different depths within the CRS (see detailed set-up map). Species diversity and distribution are recorded every 3 months and data is sent to SeagrassNet, a global monitoring network which works towards preserving the global seagrass ecosystem by increasing knowledge and public awareness of this threatened coastal ecosystem.

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."



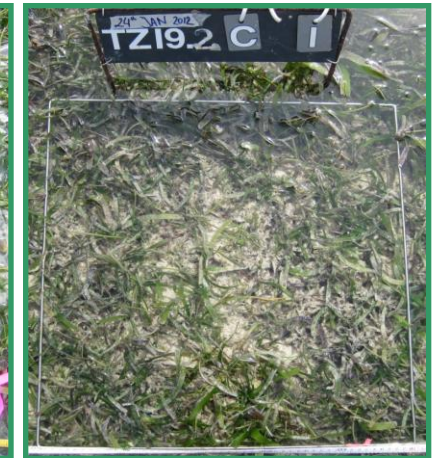
Beach, Chumbe, TZ 19.2

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

2007



2012



Bottom: *Thalassodendron ciliatum*, photo by Nell Hamilton. Top: CHICOP guiding rangers conducting seagrass monitoring, photo by Ulli Kloiber

Bottom right: visual comparison of seagrass coverage in two photo quadrats from 2007 and 2012, indicating the highly dynamic character of a seagrass ecosystem, photos by Ulli Kloiber and from Chumbe archive

Closed Forest Habitat (CFH)

Approximately 90% of Chumbe Island is covered by one of the last remaining pristine 'coral rag' forests in Zanzibar. This forest was declared a Closed Forest Habitat (CFH) in 1994 by the Government of Zanzibar, and the management was entrusted to CHICOP.

The CFH hosts a highly specialized plant community, that has developed to survive without any groundwater, as the bedrock of the island is made up of an impressive substrate of fossilized coral that is unable to store rainwater. The forest is dense with adventitious roots thrusting out in all directions, capturing moisture from the humid air, and epiphytic species wrapping themselves around all available surfaces. It's taken researchers up to 4 hours to navigate the length of the island.

There are three key habitat areas in the CFH:

- **The Mangrove pools**
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 Tropical Dry Forest**
Relatively tall (6m) dense coastal thicket covering the majority of the island.

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 program in May 1997, which was managed by CHICOP with support from specialists from the Cork University in Ireland and the Zanzibari Plant Protection Division, the island was freed from this non-indigenous species and conditions further improved for the island's flora (that had been under pressure from competition from the rats consuming the vital regenerating fruiting bodies).

A master thesis in 2010 has recorded **124 identified plant species**. In addition, the forest is refuge for an abundance of **93 recorded bird species**, crustaceans, non-poisonous snakes and lizards. Rare species occupying the forest include **Ader's duiker**, a critically endangered mini-antelope, and the **Coconut crab**, the largest land-living arthropod in the world.

There are nature trails available in the southern end of the island which can be explored alone or with a guide.

The Scrub, photo by Antony Gillingham

The Mangrove pool area, photo by Anita Walther

The Forest, photo by Oskar Henriksson



Aders' Duiker

Ader's duiker (*Cephalophus adersi*) rank as one of the most threatened antelope species in the world, 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). The Wildlife Department under the Ministry of Agriculture, Natural Resources and Environment of Zanzibar is working on a survival strategy, but tackling the root causes of this species' demise, such as de-forestation, is a long-term and difficult task, and time is in short supply for the Ader's duiker.

In order to improve the future of 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 CHICOP studied vegetation conditions, and found the Chumbe forest be of exceptionally good quality to provide suitable habitat for these duikers (D. Aplin; A. Williams). Therefore, a small breeding population of 6 Ader's Duikers was translocated from the Mtende Region to the fully protected forest reserve of Chumbe Island: in December 1998 one female and 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 have been in place since then. In the beginning remote camera sensors located in key areas in the forest were used to monitor the animals behaviour, territory and feeding patterns (personal comm. J. MacPherson & D. MacPherson).

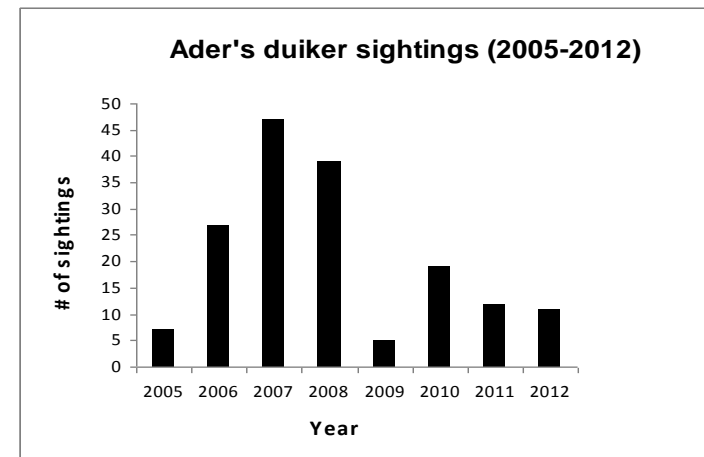


Top right and bottom left: Ader's duiker (*Cephalophus adersi*), photos derived from monitoring cameras. Middle: scent mark. Right monitoring camera, both photos by Lina Mtwana Nordlund.

After the cameras failed to work, monitoring nowadays includes production of sighting records (see graph below), observation of scent marks and implementation of so-called "drives" to estimate the number of these shy individuals.



The most recent drive was carried out in June 2012 and confirmed at least four adult individuals and one juvenile. All individuals looked healthy and the monitoring program will be further continued.



The Ader's duiker 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."

Coconut Crab

The Coconut Crab (*Birgus latro*), also called Robber Crab, is the largest land-living arthropod in the world with a carapace diameter of up to 45cm. The common name derives from the crab's ability to climb coconut trees and easily crack coconuts, their favorite food, 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.

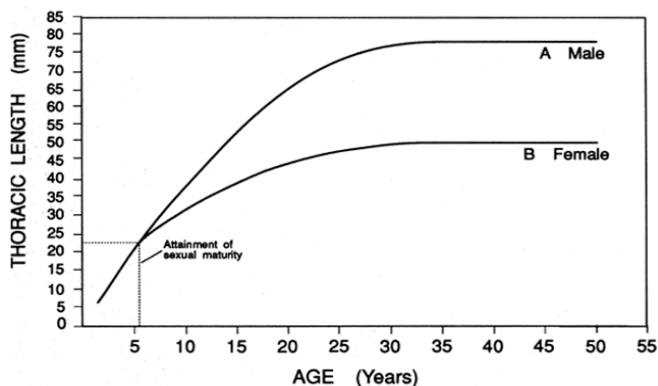
Unfortunately, coconut crabs are hunted for their tasty meat and have become locally extinct in areas typically close to human settlements, such as Zanzibar. However, coconut crab research in the East African region is extremely limited and the disappearing species is unfortunately still listed as data deficient in the IUCN endangered species listing, as nobody knows how many are left.

A healthy *Birgus latro* population of more than 300 reported individuals is still found on Chumbe Island which has become a study base for international researchers and students.

In February 2013 a team of two Swedish students from the University of Gothenburg have investigated population dynamics of Chumbe's coconut crabs by capturing, marking, weighing and measuring individual animals and taking blood samples for genetic analyses. We are looking forward to the results of this study and hope that at last the species may gain international support in its protection.



Coconut crab (*Birgus latro*). Top photo by Oskar Henriksson. Coconut crabs have two morphotypes that are not linked to gender: red/brown and purple/blue. Photo bottom left by Ulli Kloiber shows a buried female with eggs. Photo bottom right by Oskar Henriksson shows a female of the blue morphotype.



The graph on the left side is taken from Schiller 1992 (<http://www.fao.org/docrep/field/003/AC281E/AC281E00.htm>). It shows that the thorax length (TL) of a coconut crab can be used to estimate its age. Males become in general larger than females, both reach sexual maturity at age 6 and stop growing after about 35 years.



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), beetle (photo by Antony Gillingham), fruit bats (photo by Antony Gillingham) and gecko (photo by J Sofie).



Birds

Chumbe Island has a rich bird life and so far a total of 93 bird species have been recorded (details are outlined in the species list in the appendix).

The **most common birds** that can be seen frequently during a visit are:

- Grey Heron
- Dimorphic heron
- Little egret
- Paradise flycatcher
- Mangrove kingfisher
- Eurasian swallows
- Eurasian golden oriole
- Little swifts
- Fish eagles
- Red eyed dove
- Common sandpiper
- Grey plover
- House sparrow
- Ringed plover

Sea bird conservation

In Zanzibar the Roseate tern (*Sterna dougalli*) is a rare migratory coastal seabird. The species is listed on the IUCN Red List, however, with the status 'Least Concern' due to an extremely large global range and an estimated global population of 80,000 individuals. Roseate terns are threatened by a number of agents of which hunting in the wintering quarters may be the most significant. Natural predators can also take a great toll on localized colonies, particularly when terns are disturbed from the nest by other birds and humans. Finally, habitat loss and extreme weather events have caused local extinction of some colonies.

In 1994, 2006 and 2012 large breeding colonies (600-800 birds!) settled on Chumbe's small islets in the south for a period of about 3 months each. The colonies have been closely monitored and detailed reports are available in the CHICOP office.

Paradise flycatcher, photo by Antony Gillingham



Roseate terns, photo by Mikala Peters



Mangrove kingfisher, photo by Antony Gillingham



Conferences

We are proud to be in charge of a successful, private nature reserve where the eco-lodge fully funds the sustainable management of a Marine Sanctuary and a Forest Reserve and, provides environmental education for local and international students. To share our experience, success and lessons learned we attend, exhibit, and present research papers at conservation-related conferences whenever options are coming up. During the last two years the highlights were:

7th WIOMSA scientific symposium, 24-29th Oct 2011, Kenya

Two posters were presented entitled: "Chumbe Island communicating environmental awareness" by Lina Mtwana Nordlund, and "Compete for a sustainable future – Chumbe Challenge Environmental Award, a way to motivate youth" by Sophia C. Masuka and Lina Mtwana Nordlund.

8th Tanzania Wildlife Research Conference (TAWIRI), 6-8th Dec 2011, Tanzania

The theme of the conference was climate change; challenges and opportunities towards sustainable wildlife conservation and development. Paper presented was: 'The contribution of environmental education in reducing marine resource utilization' by Sophia C. Masuka and Khamis Khalfan.

International Conference on Sustainable Tourism in Developing Countries, 8-9th August 2012, Zanzibar

Organized by the University of Dar es Salaam and held in Zanzibar, the aim of this conference was to advance sustainable tourism projects by facilitating discussion among scientists, managers, and policy makers. Ulli Kloiber, Conservation and Education Manager, had the opportunity to give an oral presentation titled: *Sustainable Marine Park Management and Eco-Architecture: Lessons Learned by Chumbe Island Coral Park, Zanzibar.*

WildAid – Marine Protected Areas Conference, 25th Nov 2012, USA

CHICOP's Director, Sibylle Riedmiller presented at the first-ever global marine protected area (MPA) enforcement conference in San Francisco, California. The conference aimed at learning about the most innovative strategies being used in MPAs around the world and fellow marine experts explored common obstacles to MPA management, as well as potential solutions to common challenges such as weak legal frameworks, poor surveillance capacity and limited political will, among others.

10th International Seagrass Conference, 25-30 Nov 2012, Brazil

Dr. Lina Mtwana Nordlund, scientific adviser of CHICOP, participated in the 10th International Seagrass Conference in Rio de Janeiro, Brazil. The conference focused on cutting-edge global and regional issues in seagrass research, methods, conservation and habitat health. Dr. Nordlund arranged a workshop on "Seagrass ecosystem services" and presented two posters "Management approaches and future possibilities for seagrass ecosystems in the Western Indian Ocean" and "Seagrass and environmental education - an example from Chumbe Island Coral Park" for which she won best presentation.



Research

In addition to our ongoing monitoring programs, CHICOP was honored to host researchers from around the globe over the past two years. Here are the highlights:

Small-scale migration patterns of fish in tropical coastal habitats - an individual-based model (IBM) approach

From October 2011 - February 2012, Maren Kruse from the Leibniz Center for Tropical Ecology, Bremen/Germany collected data about fish community composition in the different habitat types at Chumbe Island. Aim of the study was to find out if and how the community composition is influenced by tidal amplitude and/or diel cycle and which species would be affected.

Diversity of ground dwelling arthropods in the Chumbe Coral Rag Forest

Nossim Daniel, from College of African Wildlife Management Mweka/Tanzania stayed on Chumbe for to 2 days in May 2012 to investigate the diversity of ground dwelling arthropods in Chumbe's coral rag forest.

Promoting Biodiversity and Increasing Sustainability through the Use of Escape Gap Fishing Traps in Zanzibar

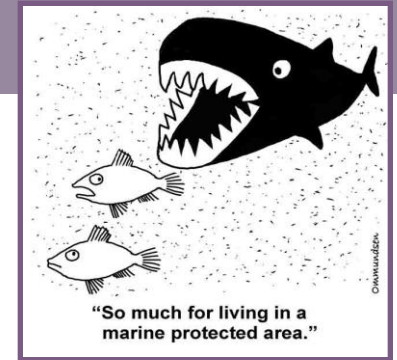
In September 2012, Amir Shekiondo, from the University of Dar es Salaam, joined our team to complete a 3 month pilot study that aimed to reduce fish by-catch by retrofitting locally used traps with rectangular escape gaps. The project was based on successful projects carried out by the Wildlife Conservation Society in Curaçao and Kenya. Amiri tested the effectiveness of these gaps within an artisanal fishing community in Zanzibar.

Long-term Coral Reef Monitoring Study

Dr. Tim McClanahan, a Senior Conservation Zoologist at the Wildlife Conservation Society and one of the leading experts on reef ecology, fisheries, climate change, and social-ecological systems, visited Chumbe in November 2012 to conduct a follow-up reef survey.

Investigating Sea Level Change in Chumbe Island

A team of 3 researchers - Prof. Dr. Anton Eisenhaer, Dr. Volker Liebetrau and Rashid Juma Rashid - from the GEOMAR, Center for Ocean Research in Germany, visited Chumbe in December 2012 to investigate the geological history of the island. The researchers are re-constructing a timeline of sea-level change in the mid to late Holocene period and will help answer the ultimate question of how old Chumbe Island really is and will help us to understand the possible impacts of climate change and sea level rise in the future.



Part II: Environmental Education

School education in Zanzibar, as elsewhere in the region, is based on rote-learning of an extremely academic syllabus that has 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 2000, CHICOP officially started an Environmental Education (EE) program with the aim to provide hands-on environmental education for schoolchildren, and at the same time to give teachers ideas on how to conduct field-based environmental education in marine biology, forest ecology and environmental protection. CHICOP's EE program is the only regular and large-scale program 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 the participating children which are guided by environmental educators on the coral reef and along nature trails, benefit greatly from the insight they gain while exploring the habitats. Additional lectures in marine biology, forest ecology and environmental protection discussing climate change and biodiversity issues enhance the practical experience.

In addition to field 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 they 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 EE program was further 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 EE program.

CHICOP is also building a reputation for having great knowledge in marine resource management and 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. Since the consequences of climate change have become more evident throughout the region (e.g. increased coastal erosion and changing weather patterns), CHICOP's stakeholders have shown a growing interest in learning how to mitigate these impacts.

Management Plan 2006-2016

Education objectives of the Chumbe Island MPA (2006 -2016)

- I. To promote environmental education issues regionally
- II. To provide environmental education through the Chumbe Education Program,
- III. To educate national and international visitors to the MPA

Between 1996 and 1999, the early EE program focused on trial excursions to Chumbe Island, only conducted with local school children. Through lessons learned during this initial phase, the program has continuously been developed through new phases. In April 2013, the program has completed Phase 8, which focused even more on teacher training through hands on seminars and workshops where teachers learned about simple experiments that are easily applied in their local environment.

In order to fulfill the education objectives of the Management Plan, CHICOP continues operating its EE program with a very adaptive management approach, constantly trying to find new ways to evolve and adapt the program in response to a constantly changing environment.



EE educator, Enock Kayagambe in the Chumbe classroom, explaining local secondary school children about coral bleaching. Photo by Ulli Kloiber

EE educator, Khamis Khalfan teaches snorkeling to Zanzibari students 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 to Chumbe Island provide hands-on environmental education for school children of all ages, and at the same time they give teachers ideas for how to conduct field-based environmental education in marine biology, forest ecology and conservation.

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, pre-visits give CHICOP's EE team the opportunity to get to know the students and find out more about their interests, so that the activities can be planned accordingly.

Snorkelling:

Although they have grown up near to coral reefs, most students have never seen live corals. Many students, especially girls, can't swim at all and are snorkelling for the first time. Therefore, life jackets, floating rings, and tuition are a must!



Intertidal walk

During spring low tides students get the chance to walk in the intertidal zone, guided by an EE educator. Laminated ID cards of common animals and plants help the kids with species identification in a fun way.

Eco-bungalow study

Students visit one of Chumbe's 7 eco-bungalows and are encouraged to think and discuss about different processes that have been designed to minimize environmental impacts on Chumbe e.g. students investigate the rain water harvesting system and the concept of compost toilets.

Forest walk

Students explore the unique and protected coral rag forest on Chumbe Island. While learning more about medicinal plants and the geological history of the island, students are encouraged to also use their other senses such as hearing to bird songs, touching waxy leaves and smelling at mangroves roots.

Classroom

During interactive classroom sessions in Chumbe's unique education centre, students learn more about concepts of ecology, waste disposal and coral reef conservation.



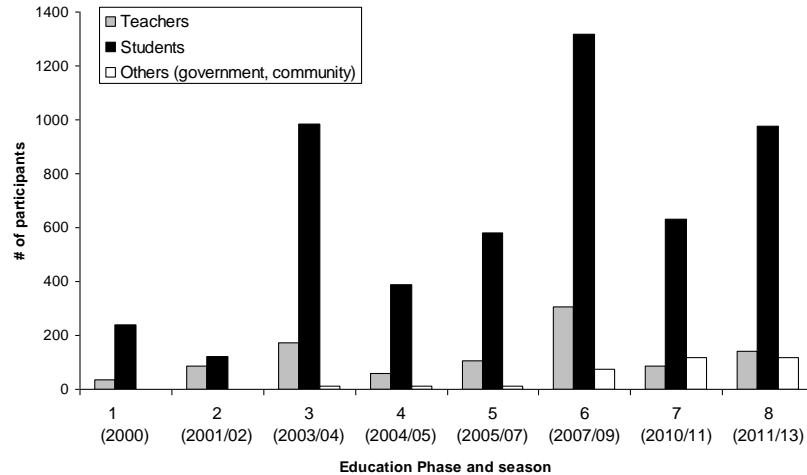
Photos by Markus Meissl, Ulli Kloiber and Anita Walther

Educational Outcomes

Since the establishment of the EE program, CHICOP has offered one-day school excursions to Chumbe Island to more than 5600 students, 980 teachers and 346 community members and government officials. Most of the participating students are coming from local secondary schools (80%).



Local students studying in the Chumbe classroom. Photo by Markus Meissl.
Diagram left: number of participants during the different EE phases (2000-2013)



Outcomes

- The number of different schools applying each year to participate in the program has increased significantly, reflecting the program's popularity.
- The number of total education trips per year has constantly been increasing since its initiation in the year 2000.
- Increased interest from national and international universities to participate in the education trips.
- Teacher evaluation seminars, held after each EE season, confirmed early 2013 that awareness about environmental issues has increased among students, after participating in the Chumbe Field Excursions
- Inspired by the Chumbe Island Excursions many secondary schools have started Environmental clubs, aiming to further increase environmental knowledge and awareness in their communities.
- 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) or Lamu Island (Kenya).



CHICOP promotes gender equality and for each island excursion, the EE team makes sure that not only boys, but also girls get the opportunity to participate in the program.

Therefore, the students groups visiting Chumbe Island are always mixed regarding the gender of the students. Between 2000 and 2012, 48% of the students have been girls. Especially the guided snorkelling 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.

Zanzibari girl returning from snorkeling in the reef sanctuary during her educational trip to Chumbe. Photo by Markus Meissl

The Chumbe Challenge



The Chumbe Challenge Environmental Award was introduced by CHICOP's Environmental Education team in 2006. The project is a continuation of the Chumbe Challenge Environment Award Toolkit aiming to help students continuing with their EE learning and investigating environmental issues that affect them.

After each EE season, CHICOP's EE team invites environmental clubs from all schools that have been participating in educational trips to join the competition. During the competition students, guided by a committed teacher, are asked to establish two environmental projects, one within their school compound and another one outside of the school. At the end of the competition, projects are assessed by CHICOP's EE team, and presented at an annual ceremony where the best projects are awarded.

Generally it was observed that the Chumbe Challenge Award competition has encouraged students to be more observant and to take positive actions on environmental issues in their surrounding communities.

The 7 steps to achieve the Chumbe Challenge Award

To participate in the Chumbe Challenge Award competition, students have to do the following:

1. Establish an Environment Group/Club
2. Carry out an Eco Audit
3. Develop an Environment Statement
4. Complete a Local Area Study in the school
5. Choose at least one other focus area outside the school
6. Take Action
7. Review, complete and submit your portfolio



5th Chumbe Challenge Environmental Award

After the EE season 2011/12, 13 schools were approached to participate in the 5th Chumbe Challenge Environmental Award competition. Out of those 13 schools, 9 schools reached the final. The majority of the projects focused on waste management and gardening.

The Chumbe Challenge Award ceremony was held in the Benbella School Hall on the 25th of May 2013, and attended by about 70 people, including students, teachers, government representatives, NGO members and a private recycling company (ZANREC). The first winner of all 9 projects was Maungani Secondary School which did a project on gardening (establishing a tree nursery and food crops garden). They received the Chumbe Challenge Award flag, gardening tools and a one year waste collection contract with ZANREC.



Top left: Bububu Secondary school students working on 3D teaching models made of recycled material.
Top right: Maungani Secondary school student that won the competition and students from Zanzibar Junior Academy performing an environmental drama. Photos by Ulli Kloiber.

CHICOP's EE team, together with ZANREC team, visiting Maungani Secondary School. As winners of the 5th Chumbe Challenge, the E-club was awarded with plants for their nursery and a one year waste collection contract with ZANREC which included funded waste collection bags, tools and the service to buy off plastic and metal from the school, so that the E-club will earn a small income that can be re-invested in E-activities.

Community Outreach

CHICOP's EE team works hard to increase environmental awareness, sustainability, and conservation throughout communities on and off Chumbe Island. We organize community workshops, teacher trainings, peer-education seminars, radio shows, international celebrations and school health camps to rally the people of Zanzibar to take action for a healthy environment and healthy community!

Community Workshops

Our goal in organizing community workshops is to provide information to community members about marine ecology, ecotourism, sustainable fishing practices, and climate change adaptation strategies. Each year we organize **2-3 community workshops** to help us achieve this goal.

Additional training is done in cooperation with other NGO's in Zanzibar such as the Continuing Professional Development seminar on climate change which was conducted with Sazani Associates in 2012. Workshop participants, teachers from various government schools, were given up-to-date climate change news and were taught how to implement hands-on climate change activities in their own classrooms.

Peer Education

Our Peer Education program involves 10 communities around Zanzibar. Initiated by the ReCoMap outreach project in 2011, 23 community members have been trained as peer educators over the last two years. Although the ReCoMap project ended in 2011, training twice a year still continues.

Demanded topics by the peer educators include: how to increase awareness on climate change impacts in the community, importance of wetlands and waste management strategies. The EE team often invites local experts as guest speakers for the respective raining sessions.

CHICOP's Environmental Radio Show

CHICOP sponsored an environmental radio program in May and June 2012. It aired on the local radio channel Chuchu FM and focused on promoting biodiversity, the issues of waste management, and the leading threats to Zanzibar's fisheries. A total of four shows were aired live from Stone Town, and throughout each show listeners had the chance to call in and ask topic related questions.

An educational quiz at the end of each show sent 8 Zanzibari winners on 23rd June 2012 to Chumbe Island to learn more about sustainable technologies and ecotourism concepts within a nature reserve. The program received great feedback and managed to educate local people on a broad scale.



All photos from Chumbe Education archive:
Teacher workshop in Zanzibar, Dec 2012



Chumbe's Peer educators learning about climate change adaptation in Zanzibar, Jan 2013



CHICOP's environmental radio show aired live from Stone Town, June 2012



CHICOP promoting sustainable fishing methods in a local fishing village, Nov. 2012

Island Ranger Training

Over the past two years, CHICOP's Guiding Rangers have participated in a comprehensive education program aimed to increase their knowledge about local ecology, human impacts on the marine environment, and global environmental change.

Highlights of the training were the ranger field trips which took the rangers to various sites around Zanzibar. These outings allowed the rangers to see, experience, and expand their knowledge about community projects, different tourism practices around Zanzibar, and also served as a fun way to get out of the Chumbe classroom.



In 2011, Marine Biologist Ulli Kloiber conducted a three months in house training in marine science and communication techniques. All guiding rangers successfully completed the training in December 2011.

Peace Corps Environment Volunteer, Dana Baker, continued the ranger training in August 2012 and worked as a ranger capacity builder for 10 months on Chumbe Island. Her training has further helped the rangers develop new skills, and improve the overall guest experience.



With the aim to also deepen the knowledge in terrestrial ecology, Mr. Alfred from the Zanzibar Butterfly Centre conducted two butterfly ecology sessions in March 2012 on Chumbe Island. Additional training sessions in forest ecology, plant identification, environment and sustainability were held by the EE team.



In December 2012, Chumbe welcomed Aida Ayers from Creative Solutions, who inspired our rangers to create fun and sustainable ways to brighten and redecorate the Chumbe Island classroom by using only recycled material. This training highlighted the need to reduce, reuse, and recycle solid waste in Zanzibar and to encourage students and community members to look at trash in a new light by giving solid waste a 'second life'.

Chumbe aims for ZERO WASTE

As many other developing countries, Zanzibar does not have a regional solid waste management system in place. Due to lack of infrastructure and lack of public organization, solid waste is burned in the streets or thrown in illegal dumps, creating a multitude of public health concerns and environmental hazards. In order to tackle this enormous issue, CHICOP has taken active steps to further reduce and recycle the solid waste it produces and continues to increase awareness of solid waste management in local communities.

To help reduce the amount of solid waste produced, CHICOP controls and restricts the numbers of visitors to the island and avoids the purchase of non-biodegradable products. Where possible, goods are sourced locally and transported in locally made, biodegradable baskets. Non-cooked fruit and vegetable waste is collected and successfully composted on the island, and where non-biodegradable waste is created it is removed from the island, sorted and recycled.

In July 2012, Chumbe Island conducted a comprehensive waste audit to find out how much waste was actually produced on the island. Based on the waste audit findings CHICOP also got a better understanding of the nature of solid waste produced on the island and has started to implement new recycling initiatives.

In addition to the waste audit, our EE team organizes annual beach clean-ups, involving local secondary schools and conducts waste recycling workshops on the island. Such activities illustrate CHICOP's commitment to environmental sustainability and the commitment to share knowledge and the importance of waste management through hands-on learning experiences.

Bottom left: Waste audit on Chumbe Island and CHICOP staff setting up a new waste and recycling system with ZANREC team. Photos by Ulli Kloiber.



Top left: CHICOP EE Team linking up with local students to learn about the hazards of marine debris.

Top right: coconut candle made from left over wax from the Chumbe Island eco-lodge and a sea cucumber made from recycled soda caps! Photos by Ulli Kloiber.

At the beginning of 2013 CHICOP has also partnered with ZANREC, a private waste operator in Zanzibar that focuses on the collection, processing and selling of recyclable materials and waste, both locally and internationally. CHICOP joined ZANREC's pilot recycling project which includes (1) setting up recycling bags for plastic bottles and metals in the CHICOP office that are now collected weekly by ZANREC, and (2) comprehensive in house training for CHICOP staff in the office and on the island. This is an exciting venture towards a shared mission of a "clean Zanzibar"!

Celebration of International Events!

To inspire communities to take action and to further promote environmental awareness, every year CHICOP plans small events for the commemoration of international, environmental days. CHICOP's past experience shows that especially students can act as passionate advocates for responsible environmental behavior and can lead the way to new attitudes and behaviors in the wider community.

World Wetlands Day, February 2

To commemorate this event in 2012, Chumbe Island hosted 13 teachers from different schools in Zanzibar, to increase awareness on 'Wetlands and Tourism'. In addition, a total of 21 peer educators were trained on the benefits of sustainable tourism, wetland ecosystems and marine biodiversity.



World Water Day, March 22

World Water Day intends to make us internationally aware of the importance of freshwater and advocates for its sustainable management! In 2012 CHICOP hosted local students who presented drama, poem, songs and experiments on how to save, re-use and protect freshwater for our future generation!

World Environment Day, June 5

CHICOP commemorated this event by bringing together Zanzibar government officials from the Vice President Office/ Division of Environment and Department of Fisheries talking about Zanzibar's role within a greener future; Kidoti women group promoting organic soap production as an alternative livelihood project; Chumbe guests, staff and students from local schools presenting briquettes and 3D models made from recycled material, rapping for environmental responsibility, and displaying artwork. The drawings were left on the island for guests to vote throughout June. Local press covered the event through TV and newspaper and spread the word about local environmental issues and solutions in Zanzibar using World Environment Day as a platform!



World Ocean Day, June 8

CHICOP's EE team conducted an interactive classroom visit at Zanzibar Junior Academy to celebrate World Ocean Day in 2012. Educational video clips, discussions with the Environmental Educators and a fun, interactive marine quiz made this day very special. Students also expressed their ideas about being the next wave for change through a visual pledge that they shared with the world.

International Coastal Clean-up, Sept 21

International coastal clean-ups help people take concrete actions to protect our ocean and to bring awareness to the issues of trash in Zanzibar and globally.

In 2012, CHICOP's EE team, teamed up with students from Zanzibar Muslim Academy and CHICOP volunteers to collect beach litter along the beach of a local fishing village. The waste was then brought back to CHICOP's head office and sorted out for recyclable material under the supervision of waste management volunteer, Tim. More than 20 kg of plastic bottles could be retrieved which were cleaned and given to students from the environmental club in order to sell the bottles to ZASEA, a local recycling centre in town.



Acknowledgements

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

Current team:

Sibylle Riedmiller, Director of Chumbe Island Coral Park Ltd.

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Enock Kayagambe, Conservation & Education Assistant

Khamis Khalfan, Environmental Educator & Outreach Officer

Omari Nyange, Head Ranger on Chumbe Island since 1992

Christopher Muhando, Researcher at Institute of Marine Science, Zanzibar

Markus Meissl, Nature Photographer

Former team members:

Lina Mtwana Nordlund, Conservation & Education Manager

Dana Baker, Peace Corps Environmental Officer

Jacob Skaggs, Volunteer at Chumbe

Nell Hamilton, Community Outreach Coordinator

Kendra Collier, founder of the Chumbe Challenge Award program

Elizabeth Tyler, Founder of the coral monitoring program

Mikala Peters and Anders Knudby, marine biologists

Frida Lanshammar, Karlyn Langjahr, Helen Peeks and Eleanor Carter, Project Managers



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

The Chumbe Conservation Team !



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Appendix species list

Pisces - Fish

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

FAMILY	GENUS/SPECIES	COMMON NAME	
	<i>Apogon nigrofasciatus</i>	Blackstripe cardinal	
	<i>Archamia fucata</i>	Orange-lined cardinal	
	<i>Archamia mozambiquensis</i>	Mozambique cardinal	
	<i>Cheilodipterus arabicus</i>	Arabian cardinal	
	<i>Cheilodipterus artus</i>	Yellow-lined cardinal	
	<i>Cheilodipterus caninus</i>	Dogtooth cardinal	
	<i>Cheilodipterus lineatus</i>	Brown-lined cardinal	
	<i>Cheilodipterus macrodon</i>	Large-toothed cardinal	
	<i>Cheilodipterus quinquelineatus</i>	Five-lined cardinal	
	<i>Rhabdamia gracilis</i>	Slender cardinal	
	Atherinopsidae	<i>Atherina boyeri</i>	Silversides
	Aulostomidae	<i>Aulostomus chinensis</i>	Trumpetfish
	Balistidae	<i>Balistapus undulatus</i>	Orange-striped triggerfish
<i>Balistoides conspicillum</i>		Clown Triggerfish	
<i>Balistoides viridescens</i>		Moustache triggerfish	
<i>Melichthys indicus</i>		Indian triggerfish	
<i>Melichthys niger</i>		Black triggerfish	
<i>Sufflamen ablicaudatus</i>		Bluethroat triggerfish	
<i>Sufflamen chrysopterus</i>		Halfmoon triggerfish	
<i>Sufflamen fraenatus</i>		Bridled triggerfish	
Belontiidae		<i>Strongylura leiura</i>	Banded needlefish
		<i>Tylosurus crocodilus crocodilus</i>	Reef Needlefish (Garfish)
Blenniidae	<i>Aspidontus taeniatus</i>	Cleaner wrasse mimic	
	<i>Cirripectes castaneus</i>	Chestnut eyeblash-blenny	
	<i>Cirripectes stigmaticus</i>	Redstreaked blenny	
	<i>Exallias brevis</i>	Shortbodied (Leopard) blenny	
	<i>Istiblennius lineatus</i>	Black-lined fangblenny	
	<i>Meicanthus mossambicus</i>	Mozambique fangblenny	
	<i>Plagiotremus rhinorhynchus</i>	Blue-stripe fangblenny	
	<i>Plagiotremus tapeinosoma</i>	Scale-eating fangblenny	
	Bothidae	<i>Bothus pantherinus</i>	Panther flounder
	Caesionidae	<i>Caesio caerulea</i>	Scissortail fusilier
<i>Caesio lunaris</i>		Lunar fusilier	
<i>Caesio teres</i>		Yellowback fusilier	
<i>Caesio xanthonota</i>		Yellowtop fusilier	
<i>Pterocaesio pisang</i>		Banana fusilier	

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

Appendix species list

Continue Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Clupeidae	<i>Herklotsichthys quadrimaculatus</i>	Bluestripe herring
Congridae	<i>cf. Conger cinereus</i>	Longfin african conger
	<i>cf. Gorgasia sillneri</i>	Garden eel
Dactylopteridae	<i>Dactyloptena orientalis</i>	Oriental flying gunnard
Dasyatididae	<i>Dasyatis kuhlii</i>	Kuhl's blue-spotted stingray
	<i>Himantura jenkinsii</i>	Jenkin's whipray
	<i>Himantura undulata</i>	Leopard whipray
	<i>Taeniura lymma</i>	Blue-spotted ribbontail ray
	<i>Taeniura melanospila</i>	Black-bloched stingray
	<i>Urogymnus africanus</i>	Thorny stingray
Echeneidae	<i>Echeneis naucrates</i>	Striped remora
Engraulidae	<i>Stolephorus indicus</i>	Indian anchovy
Ephippidae	<i>Platax orbicularis</i>	Circular batfish
	<i>Platax pinnatus</i>	Dusky batfish
	<i>Platax teira</i>	Longfin batfish
Fistulariidae	<i>Fistularia commersonii</i>	Flutemouth
Gobiidae	<i>Amblyeleotris steinitzi</i>	Steinitz' prawn-goby
	<i>Amblyeleotris sungami</i>	Magnus' prawn-goby
	<i>Amblyeleotris wheeleri</i>	Burgundy partner goby
	<i>Amblygobius hectori</i>	Hectors' goby
	<i>Cryptocentrus caeruleopunctatus</i>	Harlequin prawn-goby
	<i>Cryptocentrus lutheri</i>	Luthers partner goby
	<i>Cryptocentrus octafasciatus</i>	Blue speckled prawn-goby
	<i>Cryptocentrus strigilliceus</i>	Target prawn-goby
	<i>Exyrias bellissimus</i>	Mud reef-goby
	<i>Fusigobius neophytus</i>	Fine spotted sand-goby
	<i>Gnatholepis cauerensis</i>	Gladiator goby
	<i>Gnatholepis scapulostigma</i>	Shoulderspot goby
	<i>Gobiodon citrinus</i>	Citron goby
	<i>Istigobius decoratus</i>	Decorator goby
	<i>Lotilia graciliosa</i>	Whitecap goby
	<i>Valenciannea helsdingenii</i>	Twostripe goby
<i>Valenciannea strigata</i>	Blue-streak goby	
Grammistidae	<i>Grammistes sexlineatus</i>	Sixstriped soapfish
Haemulidae	<i>Diagramma pictum</i>	Painted sweetlip
	<i>Plectorhinchus flavomaculatus</i>	Gold-spotted sweetlip
	<i>Plectorhinchus gaterinus</i>	Black-spotted sweetlip

FAMILY	GENUS/SPECIES	COMMON NAME
	<i>Plectorhinchus gibbosus</i>	Brown sweetlip
	<i>Plectorhinchus multivittatum</i>	Many-lined sweetlip
	<i>Plectorhinchus obscurus</i>	Giant sweetlip
	<i>Plectorhinchus orientalis</i>	Oriental sweetlip
	<i>Plectorhinchus picus</i>	Spotted sweetlip
	<i>Plectorhinchus playfairi</i>	Whitebanded sweetlip
	<i>Plectorhinchus schotaf</i>	Sombre sweetlip
	<i>Plectorhinchus vittatus</i>	Oriental sweetlip
Hemiramphidae	<i>Hemiramphus far</i>	Spotted halfbeak
	<i>Hyporhamphus affinis</i>	Tropical half beak
Holocentridae	<i>Myripristis hexagona</i>	Doubletooth soldier
	<i>Myripristis murdjan</i>	Blotcheye soldier
	<i>Myripristis violacea</i>	Lattice soldier
	<i>Myripristis vittata</i>	White-tipped soldier
	<i>Neoniphon opercularis</i>	Clearfin/Blackfin squirrel
	<i>Neoniphon sammara</i>	Bloodspot/Spotfin squirrel
	<i>Plectrypops lima</i>	Rough scale soldier
	<i>Sargocentrum caudimaculatum</i>	Tailspot squirrel
	<i>Sargocentrum diadema</i>	Crown squirrel
	<i>Sargocentrum spiniferum</i>	Long-jawed squirrel
Kyphosidae	<i>Kyphosus vaigiensis</i>	Brassy chub
Labridae	<i>Anampses caeruleopunctatus</i>	Blue-spotted wrasse
	<i>Anampses lineatus</i>	Lined wrasse
	<i>Anampses melanurus</i>	White-spotted wrasse
	<i>Anampses meleagrides</i>	Chequered wrasse
	<i>Anampses twistii</i>	Yellow-breasted wrasse
	<i>Aspidontus taeniatus tractus</i>	Cleaner Mimic
	<i>Bodianus anthioides</i>	Lyretail hogfish
	<i>Bodianus axillaris</i>	Axilspot hogfish
	<i>Bodianus bilunulatus</i>	Hogfish
	<i>Bodianus diana</i>	Dianaa's hogfish
	<i>Cheilinus chlorourus</i>	Floral wrasse
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse
	<i>Cheilinus oxycephalus</i>	Snooty wrasse
	<i>Cheilinus trilobatus</i>	Tripletail maori wrasse
	<i>Cheilinus undulatus</i>	Humphead wrasse
	<i>Cheilio inermis</i>	Cigar wrasse
		<i>Cirrhilabrus exquisitus</i>

FAMILY	GENUS/SPECIES	COMMON NAME
	<i>Coris africana</i>	African coris
	<i>Coris aygula</i>	Clown coris
	<i>Coris batuensis</i>	Batu coris
	<i>Coris caudimacula</i>	Spottail coris
	<i>Coris cuvieri</i>	African sand wrasse
	<i>Coris formosa</i>	Queen coris
	<i>Coris gaimard</i>	Yellowtail coris
	<i>Epibulus insidiator</i>	Slingjaw wrasse
	<i>Gomphosus caeruleus</i>	Indian ocean bird wrasse
	<i>Halochoeres leucoxanthus</i>	Whitebelly wrasse
	<i>Halochoeres hortulanus</i>	Checkerboard wrasse
	<i>Halochoeres iridis</i>	Rainbow wrasse
	<i>Halochoeres marginatus</i>	Dusky wrasse
	<i>Halochoeres scapularis</i>	Zigzag wrasse
	<i>Halochoeres zeylonicus</i>	Goldstripe wrasse
	<i>Hemigymnus fasciatus</i>	Blackedge thicklip
	<i>Hemigymnus melapterus</i>	Thicklip wrasse
	<i>Hologymnosus annulatus</i>	Ring wrasse
	<i>Hologymnosus doliatus</i>	Longface wrasse
	<i>Labrichthys unilineatus</i>	Tubelip wrasse
	<i>Labroides bicolor</i>	Bicolor cleaner wrasse
	<i>Labroides dimidiatus</i>	Cleaner wrasse
	<i>Lorabicus quadrilineatus</i>	Four-line wrasse
	<i>Macropharyngodon bipartitus</i>	Vermiculate wrasse
	<i>Novaculichthys taeniourus</i>	Rockmover wrasse
<i>Oxycheilinus arenatus</i>	Speckled maori wrasse	
<i>Oxycheilinus diagramma</i>	Bandcheek wrasse	
<i>Oxycheilinus mentalis</i>	Mental wrasse	
<i>Pseudocheilinus evanidus</i>	Striated wrasse	
<i>Pseudocheilinus hexataenia</i>	Six-line wrasse	
<i>Pseudocheilinus octotaenia</i>	Eightline dwarf wrasse	
<i>Pteragogus flagellifer</i>	Cocktail wrasse	
<i>Pteragogus pelycus</i>	Sideburn wrasse	
<i>Stethojulis albovittata</i>	Blue-lined wrasse	
<i>Stethojulis bandanensis</i>	Red-shoulder wrasse	
<i>Stethojulis interrupta</i>	Cutribbon wrasse	
<i>Stethojulis strigiventer</i>	Three-ribbon wrasse	
<i>Thalassoma amblycephalum</i>	Twotone wrasse	
<i>Thalassoma hardwicke</i>	Sixbar wrasse	

Appendix species list

Continue Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME	FAMILY	GENUS/SPECIES	COMMON NAME	FAMILY	GENUS/SPECIES	COMMON NAME	
Labridae	<i>Thalassoma hebraicum</i>	Goldbar wrasse	Muraenidae	<i>Parupeneus barberinus</i>	Blackstripe goatfish	Pomacanthidae	<i>Pomacanthus chrysurus</i>	Earspot angel	
	<i>Thalassoma lunare</i>	Crescent wrasse		<i>Parupeneus ciliatus</i>	White-lined goatfish		<i>Pomacanthus imperator</i>	Emperor angel	
	<i>Thalassoma purpurium</i>	Surge wrasse		<i>Parupeneus cyclostomus</i>	Yellow saddle goatfish		<i>Pomacanthus maculosus</i>	Yellowbar angelfish	
Lethrinidae	<i>Gnathodentex aurolineatus</i>	Glowfish, Yellowspot emperor		<i>Parupeneus macronema</i>	Longbarbel goatfish		<i>Pomacanthus semicirculatus</i>	Semicircle angel	
	<i>Lethrinus amboinensis</i>	Ambon emperor		<i>Parupeneus forsskali</i>	Red sea goatfish		<i>Pomacanthus xanthometopon</i>	Blueface angel	
	<i>Lethrinus borbonicus</i>	Snubnose emperor		<i>Parupeneus macronemaus</i>	Long barbel goatfish		<i>Pygoplites diacanthus</i>	Regal angel	
	<i>Lethrinus chrysostomus</i>	Sweetlip emperor		<i>Parupeneus pleurostigma</i>	Round-spot goatfish		<i>Abudefduf notatus</i>	Dusky damself/ Yellowtail sergeant	
	<i>Lethrinus conchylatus</i>	Red lip/red axel emperor		<i>Parupeneus rubescens</i>	Ruby goatfish		<i>Abudefduf septemfasciatus</i>	7-bar or banded sergeant	
	<i>Lethrinus erythrancauthus</i>	Yellowspotted emperor		<i>Upeneus tragula</i>	Blackstriped goatfish		<i>Abudefduf sexfasciatus</i>	Scissortail sergeant	
	<i>Lethrinus harak</i>	Blackspot emperor		Muraenidae	<i>Echidna nebulosa</i>		Snowflake moray	<i>Abudefduf sordidus</i>	Spot sergeant
	<i>Lethrinus lentjan</i>	Pink-ear emperor			<i>Echidna polyzona</i>		Ringed moray	<i>Abudefduf sparoides</i>	False-eye sergeant
	<i>Lethrinus mahensa</i>	Sky emperor			<i>Gymnomuraena zebra</i>		Zebra moray	<i>Abudefduf vaigensis</i>	Sergeant major
	<i>Lethrinus microdon</i>	Smalltooth emperor			<i>Gymnothorax javanicus</i>		Giant moray	<i>Amblyglyphidon leucogaster</i>	White-belly damsel
	<i>Lethrinus nebulosus</i>	Spangled emperor			<i>Gymnothorax meleagris</i>		Whitemouth moray	<i>Amphiprion akalopisos</i>	Skunk clown
	<i>Lethrinus obsoletus</i>	Orange-stripe emperor	<i>Rhinomuraena quaesita</i>		Ribbon eel		<i>Amphiprion allardi</i>	Anemone fish	
	<i>Lethrinus olivaceus</i>	Longface emperor	<i>Siderea grisea</i>		Geometric moray		<i>Amphiprion ocellaris</i>	Western clownfish	
	<i>Lethrinus rubrioperculatus</i>	Redgill emperor	<i>Siderea picta</i>		Peppered moray		<i>Chromis agilis</i>	Bronze reef chromis	
	<i>Lethrinus variegatus</i>	Slender emperor	Nemipteridae		<i>Scolopsis bimaculatus</i>		Thumbprint spinecheek	<i>Chromis atripectoralis</i>	Black-axil chromis
	<i>Lethrinus xanthochilus</i>	Goldlip/Yellowtail emperor			<i>Scolopsis frenatus</i>		Bridled spinecheek	<i>Chromis caerulea</i>	Blue puller
	<i>Monotaxis grandoculis</i>	Bigeye emperor		<i>Scolopsis ghanam</i>	Dotted spinecheek		<i>Chromis dimidiata</i>	Chocolate dip chromis	
	Lutjanidae	<i>Aprion virescens</i>	Greater jobfish	Ostraciidae	<i>Ostracion cubicus</i>		Cube boxfish	<i>Chromis lepidolepsis</i>	Scaly chromis
<i>Lutjanus bohar</i>		Twinspot snapper	<i>Ostracion meleagris</i>		Whitespotted boxfish		<i>Chromis leucura</i>	White-tail chromis	
<i>Lutjanus ehrenbergii</i>		Ehrenbergs snapper	Pemppheridae	<i>Parapriacanthus guentheri</i>	Slender sweeper		<i>Chromis nigrrura</i>	Blacktail chromis	
<i>Lutjanus fulviflamma</i>		Blackspot snapper		<i>Parapriacanthus ransonneti</i>	Yellow Sweeper		<i>Chromis opercularis</i>	Doublebar chromis	
<i>Lutjanus gibbus</i>		Humpback snapper		<i>Pempheris adusta</i>	Dusky sweeper		<i>Chromis pembae</i>	Yellow edge chromis	
<i>Lutjanus lutjanus</i>		Bigeye snapper		<i>Pempheris oualensis</i>	Copper Sweeper		<i>Chromis ternatensis</i>	Golden chromis	
<i>Lutjanus monostigma</i>		Onespot snapper		<i>Pempheris schwenkii</i>	Schwenk's sweeper		<i>Chromis viridis</i>	Blue-green chromis	
<i>Lutjanus rivulatus</i>		Maori seaperch		<i>Pempheris vanicolensis</i>	Cave sweeper	<i>Chromis weberi</i>	Weber's chromis		
Monacanthidae		<i>Macolor niger</i>	Blacksnapper/Black and white Seaperch	Pinguipedidae	<i>Parapercis hexoptalma</i>	Speckled sandperch	<i>Chromis xutha</i>	Buff chromis	
		<i>Aluterus scriptus</i>	Scribbled filefish		<i>Parapercis punctulata</i>	Spotted Sandperch	<i>Chrysiptera annulata</i>	Footballer damsel	
	<i>Amanses scopas</i>	Black brush-sided/ broom filefish	Platycephalidae	<i>Papilloculiceps longiceps</i>	tentacled flathead	<i>Chrysiptera biocellata</i>	Twinspot damsel		
	<i>Cantherhines dumerilii</i>	White-spotted filefish		<i>Platycephalus indicus</i>	Bartailed flathead	<i>Chrysiptera glauca</i>	Blue damsel		
	<i>Cantherhines pardalis</i>	Honeycomb filefish		<i>Thysanophrys otaitensis</i>	Fringelip flathead	<i>Chrysiptera leucopoma</i>	Surge damsel		
	<i>Oxymonacanthus longirostris</i>	Longnose filefish	Plotosidae	<i>Plotosus lineatus</i>	Striped catfish	<i>Chrysiptera unimaculata</i>	Onespot damsel		
<i>Pervagor janthinosoma</i>	Earspot filefish	Pomacanthidae		<i>Centropyge acanthops</i>	African dwarf-angelfish	<i>Dascyllus aruanus</i>	Zebra humbug		
Mullidae	<i>Mulloidis flavolineatus</i>		Yellowstripe goatfish	<i>Centropyge bispinosus</i>	Two-spined angel	<i>Dascyllus carneus</i>	Twobar humbug		
	<i>Mulloidis vanicolensis</i>	Yellowfin goatfish	<i>Centropyge flavicauda</i>	Whitetail dwarf angelfish	<i>Dascyllus trimaculatus</i>	Domino			
	<i>Parupeneus barberinoides</i>	Bicolor goatfish	<i>Centropyges multispines</i>	Multispined angel	<i>Neoglyphidodon melas</i>	Black/zulu damsel			
			<i>Pomacanthus asfur</i>	Yellowband angel	<i>Neopomacentris azyrsron</i>	Yellowtail damsel			

Appendix species list

Continue Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME	FAMILY	GENUS/SPECIES	COMMON NAME	FAMILY	GENUS/SPECIES	COMMON NAME		
Pomacanthidae	<i>Neopomacentrus cyanomos</i>	Regal damsel		<i>Scarus globiceps</i>	Violet-lined parrotfish		<i>Epinephelus lanceolatus</i>	Giant grouper		
	<i>Plectroglyphidodon dickii</i>	Narrowbar damsel		<i>Scarus japanensis</i>	Pale bullethead parrotfish		<i>Epinephelus malabaricus</i>	Malabar grouper		
	<i>Plectroglyphidodon imparipennis</i>	Stop-start/bright-eye damsel		<i>Scarus niger</i>	Swarthy parrotfish		<i>Epinephelus spilotoceps</i>	Foursaddle grouper		
	<i>Plectroglyphidodon johnstonianus</i>	Johnston Island damsel		<i>Scarus psittacus</i>	Palenose parrotfish		<i>Grammistes sexlineatus</i>	Six-stripe soapfish		
	<i>Plectroglyphidodon lacrymatus</i>	Jewel damsel		<i>Scarus pyrrhurus</i>	Redtail parrotfish		<i>Plectropomus laevis</i>	Saddleback coral grouper		
	<i>Plectroglyphidodon leucozonus</i>	Sash damsel		<i>Scarus rubriviolaceus</i>	Redlip parrotfish		<i>Plectropomus pessuliferus</i>	Leopard grouper		
	<i>Pomacentrus baenschi</i>	East africa's damsel		<i>Scarus russelli</i>	Russel's parrotfish		<i>Plectropomus punctatus</i>	African trout grouper		
	<i>Pomacentrus caeruleus</i>	Careulean damsel		<i>Scarus scaber</i>	Dusky-capped parrotfish		<i>Pseudanthias cooperi</i>	Coopers's fairy basslet		
	<i>Pomacentrus grammorhynchus</i>	Bluespot damsel		<i>Scarus stronglylocephalus</i>	Steephead parrotfish		<i>Pseudanthias squamipinnis</i>	Lyre-tail fairy basslet/Sea goldie		
	<i>Pomacentrus leptus</i>	Slender damsel		<i>Scarus tricolor</i>	Tricolor parrotfish		<i>Serranus tigrinus</i>	Harlequin bass		
	<i>Pomacentrus pavo</i>	Sapphire damsel		<i>Scarus viridifucatus</i>	Greenlip parrotfish		<i>Variola albimarginata</i>	Jewel grouper		
	<i>Pomacentrus sulfureus</i>	Sulfur damsel		Scorpaenidae	<i>Inimicus filamentosus</i>		Indian Ocean walkman	<i>Variola louti</i>	Lyre tail grouper	
	<i>Pomacentrus trichourus</i>	Yellowtail damsel			<i>Pterois antennata</i>		Antenna firefish	Siganidae	<i>Siganus argenteus</i>	Fork-tailed rabbit
	<i>Pomacentrus triineatus</i>	Three-line damsel			<i>Pterois miles</i>		Devil firefish		<i>Siganus stellatus</i>	Stellate rabbit
	<i>Stegastes albifasciatus</i>	Whitebanded gregory			<i>Pterois radiata</i>		Radiating firefish		<i>Siganus sutor</i>	African white-spotted rabbit
	<i>Stegastes fasciolatus</i>	Dark damsel			<i>Pterois volitans</i>		Common lionfish	Soleidae	<i>Pardachirus marmoratus</i>	Finless sole
	<i>Stegastes nigricans</i>	Black damsel/ Dusky gregory			<i>Scorpaenodes guamensis</i>		Guam scorpionfish		<i>Pardachirus pavoninus</i>	Peacock sole
Priacanthidae	<i>Priacanthus blochii</i>	Bloch's bigeye	<i>Scorpaenodes minoa</i>		Minor scorpion	Solenostomidae	<i>Solenostomus cyanopterus</i>	seagrass ghost pipefish		
	<i>Priacanthus hamur</i>	Zaiaer's Bigeye	<i>Scorpaenopsis otxcephala</i>		Tassled scorpion		Sparoidae	<i>Acanthopagrus latus</i>	Yellofin seabream	
Ptereleotridae	<i>Ptereleotris evides</i>	Blackfin dartfish	<i>Scorpaenopsis venosa</i>		Raggy Scorpion	Sphyracnidae		<i>Sphyracna barracuda</i>	Great barracuda	
	Scaridae	<i>Calotomus carolinus</i>	Stareye parrotfish		<i>Sebastapistes cyanostigma</i>			Yellowspotted scorpionfish	<i>Sphyracna flavicauda</i>	Yellowtail barracuda
<i>Cetoscarus bicolor</i>		Bicolor parrotfish	<i>Sebastapistes strongia</i>		Barchin scorpion			<i>Sphyracna forsteri</i>	Forsters barracuda	
<i>Chlorurus atrilunula</i>		Bluemoon parrotfish	<i>Taenianotus triacanthus</i>		Leaf scorpionfish		<i>Sphyracna qeina</i>	Blackfin barracuda		
<i>Chlorurus sordidus</i>		Bullethead parrotfish	Serranidae		<i>Aethaloperca rogaa</i>	Redmouth grouper	Syngnathidae	<i>Corythoichthys flavofasciatus</i>	Network pipefish	
<i>Chlorurus stronglylocephalus</i>		Steephead parrotfish			<i>Anyperodon leucogrammicus</i>	White-lined rockcod		<i>Trachyrhamphus bicoarctatus</i>	Double-ended pipefish	
<i>Hipposcarus harid</i>		Indian longnose parrotfish			<i>Belonoperca chabanaudi</i>	Chabanaud's soapfish	Synodontidae	<i>Saurida gracilis</i>	Graceful lizardfish	
<i>Leptoscarus vagiensis</i>		Seagrass parrotfish			<i>Cephalopholis argus</i>	Peacock grouper		<i>Synodus dermatogenis</i>	Sand lizardfish	
<i>Scarus atrinula</i>		Black crescent parrotfish			<i>Cephalopholis boenak</i>	Chocolate hind or brown-barredrockcod		<i>Synodus indicus</i>	Indian lizardfish	
<i>Scarus diminiatus</i>		Turquoise capped parrotfish		<i>Cephalopholis leopardus</i>	Leopard hind	<i>Synodus variegatus</i>		Variiegated lizardfish		
<i>Scarus dubius</i>		Regal parrotfish		<i>Cephalopholis miniata</i>	Coral grouper	Terapontidae		<i>Terapon jarbua</i>	Crescent bass	
<i>Scarus ferrugineus</i>		Rusty parrotfish		<i>Cephalopholis sexmaculata</i>	Sixspot grouper					
<i>Scarus frenatus</i>		Bridled parrotfish		<i>Ephinephelus tukula</i>	Potato Grouper					
<i>Scarus ghobban</i>		Blue-barred parrotfish		<i>Epilephelus melanostigma</i>	Blackspot grouper					
<i>Scarus gibbus</i>		Red sea parrotfish		<i>Epinephelus caeruleopuntatus</i>	White Spotted grouper					
				<i>Epinephelus chlorostigma</i>	Brownspotted grouper					
		<i>Epinephelus fuscoguttatus</i>		Brown marbled grouper						

Appendix species list

Continue Pisces - Fish

FAMILY	GENUS/SPECIES	COMMON NAME
Tetraodontidae	<i>Arothron hispidus</i>	Whitespotted pufferfish
	<i>Arothron mappa</i>	Map puffer
	<i>Arothron nigropunctatus</i>	Blackspotted puffer
	<i>Arothron stellatus</i>	Star pufferfish
	<i>Canthigaster bennetti</i>	Bennet's toby
	<i>Canthigaster coronata</i>	Crowned toby
	<i>Canthigaster solandri</i>	Solander's toby
	<i>Canthigaster valentini</i>	Black-saddled toby
	<i>Diodon hystrix</i>	Common porcupinefish
	<i>Diodon liturosus</i>	Masked porcupinefish
	<i>Ablabys binotatus</i>	Redskin waspfish
Torpedinidae	<i>Hypnos monopterygium</i>	Electric ray
	<i>Myrichthys maculosus</i>	Ocellated snake eel
Zanclidae	<i>Zanclus cornutus</i>	Moorish idol

Cnidaria – Cnidarians

Acroporidae	<i>Acropora</i>	
	<i>Astreopora</i>	
	<i>Montipora</i>	
Agariciidae	<i>Coeloseris</i>	
	<i>Gardineroseris</i>	
	<i>Leptoseris</i>	
	<i>Pachyseris</i>	
	<i>Pavona</i>	
Anthoathecata	<i>Millepora</i>	
Astrocoeniidae	<i>Stephanocoenia</i>	
Caryophylliidae	<i>Gyrosmitia</i>	
	<i>Physogyra</i>	
	<i>Plerogyra</i>	
Dendrophylliidae	<i>Dendrophyllia</i>	
	<i>Heteropsammia</i>	
	<i>Tubastrea</i>	

Cnidaria – Cnidarians

FAMILY	GENUS
Dendrophylliidae	<i>Turbinaria</i>
Faviidae	<i>Caulastrea</i>
	<i>Cyphastrea</i>
	<i>Diploastrea</i>
	<i>Echinopora</i>
	<i>Favia</i>
	<i>Favites</i>
	<i>Goniastrea</i>
	<i>Leptastrea</i>
	<i>Leptoria</i>
	<i>Montastrea</i>
	<i>Oulophyllia</i>
	<i>Platygyra</i>
Fungiidae	<i>Cycloseris</i>
	<i>Fungia</i>
	<i>Halomitra</i>
	<i>Herpolitha</i>
	<i>Podabacia</i>
	<i>Hydnophora</i>
Merulinidae	<i>Merulina</i>
Mussidae	<i>Acanthastrea</i>
	<i>Blastomussa</i>
	<i>Lobophyllia</i>
	<i>Scolymia</i>
	<i>Symphyllia</i>
Oculinidae	<i>Galaxea</i>
Pectiniidae	<i>Echinophyllia</i>
	<i>Mycedium</i>
	<i>Oxypora</i>

Pectiniidae	<i>Pectinia</i>
Pocilloporidae	<i>Pocillopora</i>
	<i>Seriatopora</i>
	<i>Stylophora</i>
Poritidae	<i>Alveopora</i>
	<i>Goniopora</i>
	<i>Porites</i>
	<i>Porites solida</i>
Siderastreidae	<i>Coscinaria</i>
	<i>Psammocora</i>
Tubiporidae	<i>Tubipora</i>
Zoanthidea	<i>Protopalpythoa nelliae</i>

Mollusca - Molluscs

FAMILY	GENUS/SPECIES
Aglajidae	<i>Chelidonura punctuata</i>
Arcidae	<i>Anadara spp.</i>
Buccinidae	<i>Engina mendicaria</i>
Cerithiidae	<i>Clypeomorus bifasciatus</i>
Chitonidae	<i>Acanthopleura brevispinosa</i>
	<i>Acanthopleura gemmata</i>
Chromodorididae	<i>Chromodoris elisabethina</i>
	<i>Chromodoris magnifica</i>
Comasteridae	<i>Comanthina nobilis</i>
	<i>Comanthina spp.</i>
Conidae	<i>Conus miles</i>
Cypraeidae	<i>Cypraea annulus</i>

Cont, Mollusca - Molluscs

FAMILY	GENUS/SPECIES
Cypraeidae	<i>Cypraea tigris</i>
	<i>Cypraea vitellus</i>
Fasciolaridae	<i>Fusinus colus</i>
Gryphaeidae	<i>Hyotissa hyotis</i>
Hexabanchidae	<i>Hexabanchus sanguineus</i>
Kentrodorididae	<i>Kentrodoris rubescens</i>
Lottidae	<i>Patelloida profunda</i>
Mitridae	<i>Mitra spp.</i>
Muricidae	<i>Drupella rugosa</i>
	<i>Morula granulata</i>
Neritidae	<i>Nerita spp.</i>
Octopodidae	<i>Octopus cyanea</i>
	<i>Octopus aegina</i>
Patellidae	<i>Cellana radiata</i>
Phyllidiidae	<i>Phyllidia ocellata</i>
	<i>Phyllidia varicosa</i>
	<i>Phyllidopsis kremphi ?</i>
Phylloporidae	<i>Neothyonidium magnum</i>
Pseudocerotidae	<i>Pseudoceros bifurcus</i>
	<i>Pseudoceros lindae</i>
	<i>Pseudoceros sp.</i>
	<i>Thysanozoon nigropapillosum</i>
Ranelidae	<i>Charonia tritonis</i>
Sepiidae	<i>Sepia officinalis</i>
	<i>Sepia pharaonis</i>
Stichopodidae	<i>Stichopus chloronotus</i>
Strombidae	<i>Dolabella auricularia</i>
	<i>Lambis lambis</i>
Synaptidae	<i>Euapta godeffroyi</i>

Appendix species list

Continue Mollusca – Molluscs

FAMILY	GENUS/SPECIES
Tridacnidae	<i>Tridacna maxima</i>
	<i>Tridacna squamosa</i>
Phyllophoridae	<i>Neothyonidium magnum</i>
Pseudocerotidae	<i>Pseudoceros bifurcus</i>
	<i>Pseudoceros lindae</i>
	<i>Pseudoceros sp.</i>
	<i>Thysanozoon nigropapillosum</i>
Ranellidae	<i>Charonia tritonis</i>
Sepiidae	<i>Sepia officinalis</i>
	<i>Sepia pharaonis</i>
Stichopodidae	<i>Stichopus chloronotus</i>
Strombidae	<i>Dolabella auricularia</i>
	<i>Lambis lambis</i>
Synaptidae	<i>Euapta godeffroyi</i>
Tridacnidae	<i>Tridacna maxima</i>
	<i>Tridacna squamosa</i>

Echinodermata - Echinoderms

FAMILY	GENUS/SPECIES
Acanthasteridae	<i>Acanthaster planci</i>
Brissidae	<i>Metalia sternalis</i>
Cidaridae	<i>Prionocidaris baculosa</i>
Diadematidae	<i>Diadema savignyi</i>
	<i>Diadema setosum</i>
	<i>Echinothrix diadema</i>
Echinometridae	<i>Echinometra mathaei</i>
	<i>Echinostrephus molaris</i>
Holothuriidae	<i>Actinopyga echinites</i>
	<i>Actinopyga lecanora</i>
	<i>Actinopyga miliaris</i>

Cont. Echinodermata - Echinoderms

FAMILY	GENUS/SPECIES	
	<i>Bohadschia atra</i>	
	<i>Bohadschia subrubra</i>	
	<i>Bohadschia vitensis</i>	
	<i>Bohadschia graeffei</i>	
	<i>Holothuria atra</i>	
	<i>Holothuria fuscocubra</i>	
	<i>Holothuria leucospilota</i>	
	<i>Holothuria nobilis</i>	
	<i>Holothuria parva</i>	
	<i>Holothuria pervicax</i>	
	<i>Pearsonothuria graeffei</i>	
	Ophiasteridae	<i>Leiaster coriaceus</i>
		<i>Linckia guildingi</i>
<i>Linckia lavigata</i>		
Oreasteridae	<i>Culcita schmideliana</i>	
	<i>Pentacerestar mammilatus</i>	
	<i>Pentacerestar tuberculatus</i>	
	<i>Protoreaster lincki</i>	
Stichopodidae	<i>Stichopus chloronotus</i>	
	<i>Stichopus herrmanni</i>	
	<i>Stichopus horrens</i>	
	<i>Stichopus sp. (tairi)</i>	
	<i>Theleonota anax</i>	
Synaptidae	<i>Synapta maculata</i>	
	<i>Euapta godeffroyi</i>	
Toxopneustidae	<i>Tripneustes gratilla</i>	

Crustacea - Crustaceans

FAMILY	GENUS/SPECIES	COMMON NAME
Coenobitidae	<i>Birgus latro</i>	Coconut (Robber) Crab
	<i>Coenobita rugosus</i>	Rugosus
	<i>Coenobita violascens</i>	Land Hermit crab (violascens)
Diogenidae	<i>Calcinus latens</i>	Blue sock hermit crab
	<i>Dardanus megistos</i>	White-spotted (Red) hermit crab
Eriphiidae	<i>Eriphia smithii</i>	Rough Red-eyed Crab (smithii)
Gonodactylidae	<i>Gonodactylus spp.</i>	-
Grapsidae	<i>Grapsus albolineatus</i>	Mottled rock
	<i>Grapsus fourmanoiri</i>	Rock crab (Sally Lightfoot)
	<i>Percnon gibbesi</i>	Sally lightfoot crab
Hippolytidae	<i>Saron sp.</i>	Marble shrimp
Ocypodidae	<i>Macrophthalmus spp.</i>	Speckled sand
	<i>Ocypode ceratophthalmus</i>	Common ghost crab
Odontodactylidae	<i>Odontodactylus scyllarus</i>	Peacock mantis shrimp
Palinuridea	<i>Panilirus versicolor</i>	East African Painted Spiny Lobster
Pilumnidae	<i>Pilumnus versperillio</i>	Hairy crab
Procelanidae	<i>Neopetrolishtes maculatus</i>	Spotted procelain crab
Scyllaridae	<i>Thenus orientalis</i>	Slipper lobster, Flathead lobster
Stenopodidae	<i>Stenopus hispidus</i>	Banded Cleaner (Boxer) Shrimp
Tetraclitidae	<i>Tetraclita squamosa rufotincta</i>	Barnacle - acorn

Reptilia – Reptiles (marine)

FAMILY	GENUS/SPECIES	COMMON NAME
Cheloniidae	<i>Chelonia mydas</i>	Green Turtle
	<i>Eretmochelys imbricata</i>	Hawksbill Turtle

Appendix species list

Plantae - Marine Plants & Macro Algae

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

Porifera – Sponges

FAMILY	GENUS/SPECIES
Clonidae	<i>Sphecospongia globularis</i>
Spongiidae	<i>Carteriospongia foliascens</i>
	<i>Strepsichordaia radiata</i>
Tedaniidae	<i>Tedania anhalens</i>

Aves - Birds

FAMILY	GENUS/SPECIES	COMMON NAME
Acciptridae	<i>Elanus caeruleus</i>	Black-shouldered Kite
	<i>Haliaeetus vocifer</i>	African Fish Eagle
Acrocephalidae	<i>Hippolais pallida</i>	Olivaceous Warbler
Alcedinidae	<i>Ceryle rudis</i>	Pied Kingfisher
	<i>Ceyx pictus</i>	African Pigmy Kingfisher
	<i>Halcyon farquhari</i>	Chestnut-bellied Kingfisher
	<i>Halcyon leucocephala</i>	Grey-headed Kingfisher
	<i>Halcyon senegaloides</i>	Mangrove Kingfisher
	<i>Ispidina picta</i>	Pygmy Kingfisher
Apodidae	<i>Apus affinis</i>	Little Swift
	<i>Apus apus</i>	European Swift
	<i>Cypsiurus parvus</i>	Palm Swift
	<i>Telacanthura ussheri</i>	Mottled Spinetail
Ardeidae	<i>Ardea cinerea</i>	Grey Heron
	<i>Ardea goliath</i>	Goliaths Heron
	<i>Ardeola ibis</i>	Cattle Egret
	<i>Bubulcus ibis</i>	Cattle Egret
	<i>Butorides striatus</i>	Green-backed Heron
	<i>Casmerodius albus</i>	Great Egret
	<i>Egretta dimorpha</i>	Dimorphic Egret
	<i>Egretta garzetta</i>	Little Egret
	<i>Egretta intermedia</i>	Yellow-billed Egret
Burhinidae	<i>Burhinus vermiculatus</i>	Water Thick-knee
Caprimulgidae	<i>Caprimulgus europaeus</i>	Eurasian Nightjar
	<i>Caprimulgus fossii</i>	Gabon Nightjar
Charadriidae	<i>Charadrius hiaticula</i>	Ringed Plover
	<i>Charadrius leschenaultii</i>	Greater Sand Plover
	<i>Charadrius mongolus</i>	Lesser Sand Plover or Mongolian Sandplover
	<i>Pluvialis squatarola</i>	Grey Plover
Ciconiidae	<i>Anastomus lamelligerus</i>	Open-billed Stork
Columbidae	<i>Streptopelia capicola</i>	Cape Turtle Dove
	<i>Streptopelia semitorquata</i>	Red-eyed Dove
Coraciidae	<i>Coracias caudatus</i>	Lilac-breasted Roller
Corvidae	<i>Corvus splendens</i>	Indian house Crow

Appendix species list

Cont. Aves - Birds

FAMILY	GENUS/SPECIES	COMMON NAME
Cuculidae	<i>Centropus superciliosus</i>	White-browed Coucal
	<i>Crysococcyx capreus</i>	Didric Cuckoo
Dicruridae	<i>Dicrurus adsimilis</i>	Drongo
Dromadidae	<i>Dromas ardeola</i>	Crab Plover
Falconidae	<i>Falco cuvieri</i>	African Hobby
	<i>Falco subbuteo</i>	European Hobby
Haematopodidae	<i>Haematopus ostralegus</i>	Oyster Catcher
Hirundinidae	<i>Hirundo abyssynica</i>	Lesser Striped Swallow
	<i>Hirundo rustica</i>	European Swallow
	<i>Riparia riparia</i>	European Sand Marin
Laniidae	<i>Lanius collurio</i>	Red-backed Shrike
Laridae	<i>Larus argentatus taimyrensis</i>	Herring Gull
	<i>Larus fuscus fuscus</i>	Lesser Black-Backed Gull
	<i>Larus hemprichii</i>	Sooty Gull
	<i>Larus heuglini</i>	Heuglin's Gull
Meropidae	<i>Merops persicus</i>	Blue-cheeked bee-eater
Monarchidae	<i>Terpsiphone viridis</i>	Paradise Flycatcher
	<i>Trochocercus cyanomelas</i>	Crested Flycatcher
Muscicapidae	<i>Cossypha natalensis</i>	Red-capped Robin Chat
	<i>Cossypha niveicapilla</i>	Snowy-crowned Robin Chat
	<i>Muscicapa striata</i>	Spotted Flycatcher
Nectariniidae	<i>Nectarinia bifasciata</i>	Purple-banded Sunbird
	<i>Nectarinia olivacea</i>	Olive Sunbird
	<i>Nectarinia veroxii</i>	Mouse-coloured Sunbird
Oriolidae	<i>Oriolus oriolus</i>	Eurasian Golden Oriole
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	Long-tailed Cormorant
Phylloscopidae	<i>Phylloscopus sibilatrix</i>	European Wood Warbler
Ploceidae	<i>Euplectes hordacea</i>	Black-winged Red Bishop
Pycnonotidae	<i>Andropadus importunus</i>	Sombre Greenbul
	<i>Pycnonotus barbatus</i>	Common Bulbul
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
	<i>Arenaria interpres</i>	Ruddy Turnstone
	<i>Calidris alba</i>	Sanderling
	<i>Calidris ferruginea</i>	Curlew Sandpiper
	<i>Calidris minuta</i>	Little Stint
	<i>Numenius arquata</i>	Eurasian Curlew
	<i>Numenius phaeopus</i>	Whimbrel

Lepidoptera - Butterflies

FAMILY	GENUS/SPECIES	COMMON NAME
	<i>Tringa nebularis</i>	Common Greenshank
	<i>Xenus cinereus</i>	Terek Sandpiper
Stercorariidae	<i>Stercorarius parasiticus</i>	Arctic Skua
	<i>Stercorarius pomarinus</i>	Pomerine Skua
Sternidae	<i>Anous stolidus</i>	Brown or Common Noddy
	<i>Sterna albifrons</i>	Little Tern
	<i>Sterna anaethetus</i>	Bridled tern
	<i>Sterna bengalensis</i>	Lesser Crested Tern
	<i>Sterna bergii</i>	Greater Crested Tern
	<i>Sterna dougalii</i>	Roseate Tern
	<i>Sterna fuscata</i>	Sooty Tern
	<i>Sterna hirundo</i>	Common Tern
	<i>Sterna saundersi</i>	Saunders's Tern
Strigidae	<i>Strix woodfordi</i>	African Wood Owl
Sulidae	<i>Sula dactylatra</i>	Masked Booby
Sylviidae	<i>Acrocephalus baeticatus</i>	African Reed Warbler
	<i>Acrocephalus scirpaceus</i>	Eurasian Reed Warbler
Tyrannidae	<i>Alisionax adustus</i>	Dusky Flycatcher
Viduidae	<i>Virua paradisaea</i>	Eastern Paradise Wydah
Unknown	<i>Eromela icteropygialis*</i>	Yellow-belled Eromela*
	<i>Clyanomitra veroxii</i>	Mouse-coloured Sunbird
	<i>Cinnyris bifasciata</i>	Purple-banded Sunbird

Chiroptera - Bats

FAMILY	GENUS/SPECIES	COMMON NAME
Pteropodidae	<i>Eidolon helvum</i>	Straw-colored fruit bat
	<i>Epomophorus wahlbergi</i>	Wahlberg's epauleted fruit bat
	<i>Hipposideros commersoni</i>	Commerson's roundleaf bat
Hipposideridae		

FAMILY	GENUS/SPECIES	COMMON NAME
Acraeidae	<i>Acraea natalica</i>	Natal Acraea
	<i>Acraea sp.</i>	East-coast Acraea
	<i>Acraea zetes</i> <i>Acraea spp.</i> (Other spp. present)	Large-spotted Acraea
Hesperiidae	<i>Coeliades forestan</i>	Striped Policeman
	<i>Gegenes sp.</i>	Grizzle Skipper
Nymphalidae	<i>Bicyclus safitza</i>	Common Bush Brown
	<i>Byblia anvatar</i>	Joker Red-orange & black
	<i>Danaus chrysippus</i>	African Monarch
	<i>Euphaedra neophron</i>	Gold-banded Forester
	<i>Hypolimnas misippus</i>	Danaid Egfly
	<i>Junonia hierta</i>	Yellow Pansy
	<i>Junonia natalica</i>	Brown Pansy
	<i>Junonia oenone</i>	Blue Pansy
	<i>Neptis saclava</i>	Small-spotted Sailer
	<i>Phalantha phalantha</i>	Common Leopard
	<i>Pseudoacraea lucretica</i>	False Acraea
Papilionidae	<i>Vanessa cardui</i>	Painted Lady
	<i>Priniceps demodocus</i>	Citrus Swallowtail
	<i>Priniceps lyaeus</i>	Green-banded Swallowtail
Pieridae	<i>Belenois aurota</i>	Brown-veined White
	<i>Belenois creona</i>	African Common White
	<i>Belenois thysa</i>	False Dotted Border
	<i>Catopsilia florella</i>	African Migrant
	<i>Colotis ione</i>	Purple-tip
	<i>Colotis sp.</i>	Black-barred Red Tip
	<i>Colotis sp.</i>	Salmon Colotis
	<i>Eurema hecabe</i>	Common Grass Yellow

Note: this species list has been up-dated from the management plan 2006 – 2016