CONSERVATION REPORT

for the Chumbe Reef Sanctuary & Forest Reserve

Chumbe Island Coral Park

Mikala Peters, Marine Biologist

May 2005 – Oct 2006

CONSERVATION REPORT

Chumbe Island Coral Park
May 2005 – October 2006

(Please note: some of the monitoring data and analysis include information from Carol Daniels' Marine and Terrestrial Science Updates, Oct 2004)

Marine

Monitoring Programmes

Coral Reef Monitoring

A new coral reef monitoring programme for the Chumbe Reef Sanctuary was implemented in March 2006. Dr Elizabeth Tyler (UK) assisted CHICOP's conservation team in the analysis of previous systems and the design of the new programme. The main objective of the new programme is to provide a sustainable monitoring system for Chumbe's coral reef, which would play an important role in the conservation and management of the reef. The main participants in the programme are Omari Nyange (Head ranger) and Rashid Hamad (Guiding/Research ranger), as well as CHICOP's Conservation Coordinator.

The essence of the programme is that permanent transects (the distances between the markers) are surveyed yearly for the following factors:

- **Coral health**
- **Fish population sizes**
- **COT Starfish and Sea Urchin populations**

Since the programme has been designed to be effective for a long-term period, it will be possible to observe trends in the above factors. We can then answer questions such as;

"When does coral bleaching occur most frequently?"
"Are fish stocks increasing in the MPA?"
"Do Crown-of-Thorn Starfish populations fluctuate in seasons?"

Methods

A total of fifteen 50m-transects have been marked on the reef crest to the west of Chumbe Island, using permanent markers. These markers consist of durable electrical cable, tied to solid dead coral, and plastic labels with a series of holes, marking the site number. The transects are grouped in 3 sites, North, Middle and South - 5 transects within each site.

Surveys need to be carried out once a year for each transect. The order of the surveys is selected at random at the beginning of each year.

All surveys are carried out by snorkelling; this is to ensure long-term sustainability and continuity.

The first results of the monitoring programme will be analysed in April 2007.

Seagrass monitoring

In Sept 2006, CHICOP joined **SeagrassNet**, a scientific global monitoring program based at the University of New Hampshire. The ultimate aim of SeagrassNet is to preserve the seagrass ecosystem by increasing scientific knowledge and public awareness of this threatened coastal resource.

Three specialists (Dr. Fred Short, Dr. Rob Coles, and Aaren Freeman) from this group visited Chumbe Island in mid September 2006, to set up the permanent transects. Three transects lines (50m each) have been marked on a seagrass bed, on the western shore of the island. Surveys are to be done quarterly – Jan, April, July, Oct. A complete Survey Kit was donated to CHICOP, with the agreement that CHICOP will collect data for SeagrassNet for a minimum of two years.

General survey results

During their stay on Chumbe, the specialists identified **6 seagrass species** on the western shore of the island:

- *Thalassia hemprichii*
- *Cymodocea rotundata*
- *Syringodium isoetifolium*
- *Thalassodendron cilitaum*
- *Halodule uninervis*
- *Halophila ovalis*

(Note: There are 10 seagrass species found in Tanzanian waters)

It was observed that the seagrass beds on the western shore of Chumbe look very 'healthy', i.e. there is a high species diversity, and minimal damage or evidence of anthropogenic impacts. Seagrass beds (or 'meadows') provide nurseries, shelter, and food for a variety of commercially, recreationally, and ecologically important species (e.g. fish, sea turtle, seahorse, crustaceans).

The leaves of *Syringodium isoetifolium* were found to be generally much shorter than elsewhere on Zanzibar's shores. This may indicate a high degree of grazing by fish.

The *Thalassodendron cilitaum* was flowering at the time of surveying; this is a rare sight (Rob Coles, *pers. comm.*).

Temperature Loggers

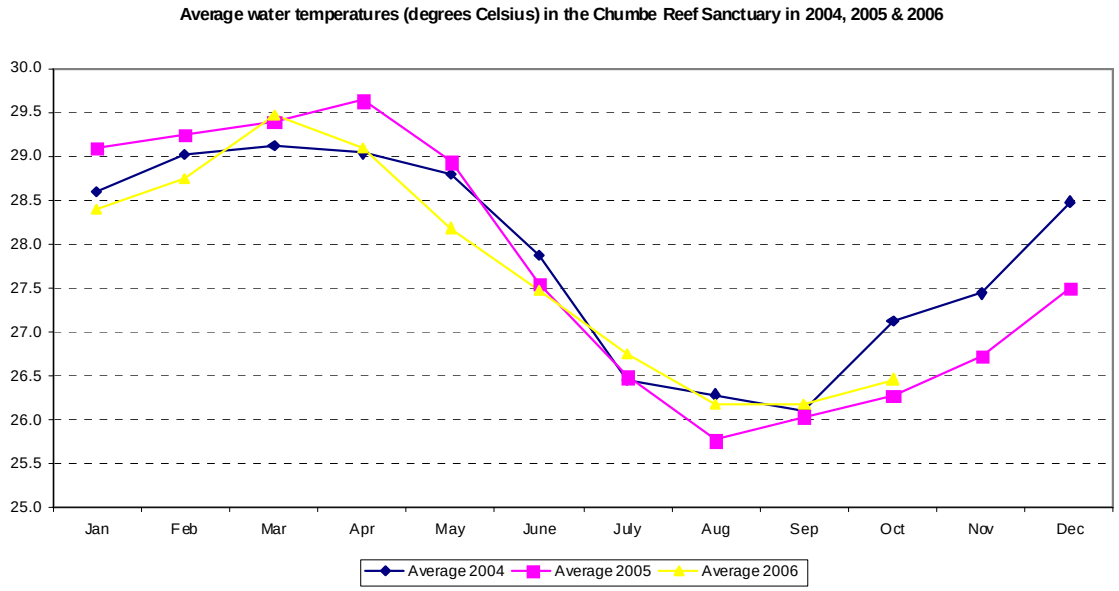
Various temperature loggers have been installed in the Chumbe Reef Sanctuary, providing the conservation team with a complete and continuous temperature data set since 15 Dec 2003. Long-term temperature data plays an important role in the monitoring of the coral reef, e.g. correlations between high temperatures and bleaching events, or COTS outbreaks.

IMS loggers

A temperature logger was installed on the Chumbe reef by IMS on 15 Dec 2003. It is placed in a fixed position before the reef crest, northwest of the Education centre. The

logger records temperature data every half hour. The water depth ranges between 2 –6m, depending on the tide. The data is downloaded by IMS every 3 months.

In Nov 2005 it was noted that the logger seemed to be recording lower temperatures on average than the previous year. A second (control) logger was placed in the same location on 6 Nov 2005. In Feb 2006 it was evident that over time the logger had gradually recorded lower temperatures. The data has consequently been adjusted, to include the corrected temperature data.



In all three years, for a period of four months, between mid January and mid May, the average temperature ranged between 28.75ºC and 29.63ºC. A relatively high average compared to the rest of the year. The temperature drops gradually beginning in June, by 3 to 4ºC lower, reaching lowest average temperatures in August and September.

The highest recorded water temperature was 34.54ºC, in January 2004, while the lowest recorded temperature was 22.67ºC, in August 2006.

Within the past three years, the highest average temperatures in the 'warm' months January – May occurred in 2005. The 'cool' months (June-Nov) saw higher temperatures in 2004, compared to the other years.

Tim McClanahan's logger

Tim McClanahan placed a logger on the Chumbe reef on 24 April 2005. He collected and downloaded the data on 5 April 2006. The logger recorded temperature every hour for 330 days. He placed a new logger in (5 April 2006), which will record temperature data every 2 hours for the next 660 days (due for downloading in Jan 2008). The logger is located on a dead coral bommy shallower than IMS' loggers. The data generated from this logger has also been used to adjust the IMS that appeared to be misreading.

SeagrassNet loggers
Two iButton loggers are located within the SeagrassNet monitoring site, installed on 17 Sept 2006, and will be downloaded by CHICOP during every SeagrassNet survey period (Jan, April, July, Oct). Since the seagrass monitoring site is exposed during spring low tides, these temperature loggers would be expected to record much higher temperatures than the IMS loggers (these are permanently submerged).

Bleaching

In September 2005 and October 2006, there have been periods of extreme low tides (the days following full or new moon), when large coral colonies have bleached quite suddenly. The combination of sun exposure during the hottest hours of the day and the consequent higher temperatures caused considerable bleaching of branching *Acropora* and *Porites* corals. These colonies were characteristically white after bleaching. However, since the average water temperature stayed within the 'normal' range following these exceptionally warm days, most of the corals recovered. The colonies that did not recover (mostly *Acropora*) were soon covered by algae.

In February and March 2006, partial bleaching was observed on many *Porites* colonies. This was described as 'sloughing' off of the polyp tissue, a 'slimy' transparent tissue coming off the colony. The colour of the colony appeared lighter than normal, but did not turn white. These colonies generally recovered and re-gained their usual colour within the few months following the warm season.

COTS

Introduction
The Crown-of-thorn-starfish (COTS) removal programme was implemented at Chumbe Island in April 2004. Zanzibar had been experiencing outbreaks of COTS of increasing severity since 1995, mainly on reefs around Bawe, Changuu and Pange. But it was not until early 2004 that the rangers noticed these starfish in the Chumbe Reef Sanctuary. The removal programme in the Reef Sanctuary has been monitored for two years, the results are outlined below.

Results & Discussion
A total of just under 3000 COTS have been removed from the Reef Sanctuary (Table 1). It was established quite early on that there were two aggregations within the Reef Sanctuary: one towards the north of the island, in the shallower areas behind the main reef; one on the southern Reef Sanctuary border, in deeper water, on the coral reef.

There are some differences between these two sites:

- Over the two year period, 814 COTS were collected in the north, compared to 2182 in the south.

- The average number of COTS collected in the south was also higher (68 per day, compared to 19 per day in the north site).

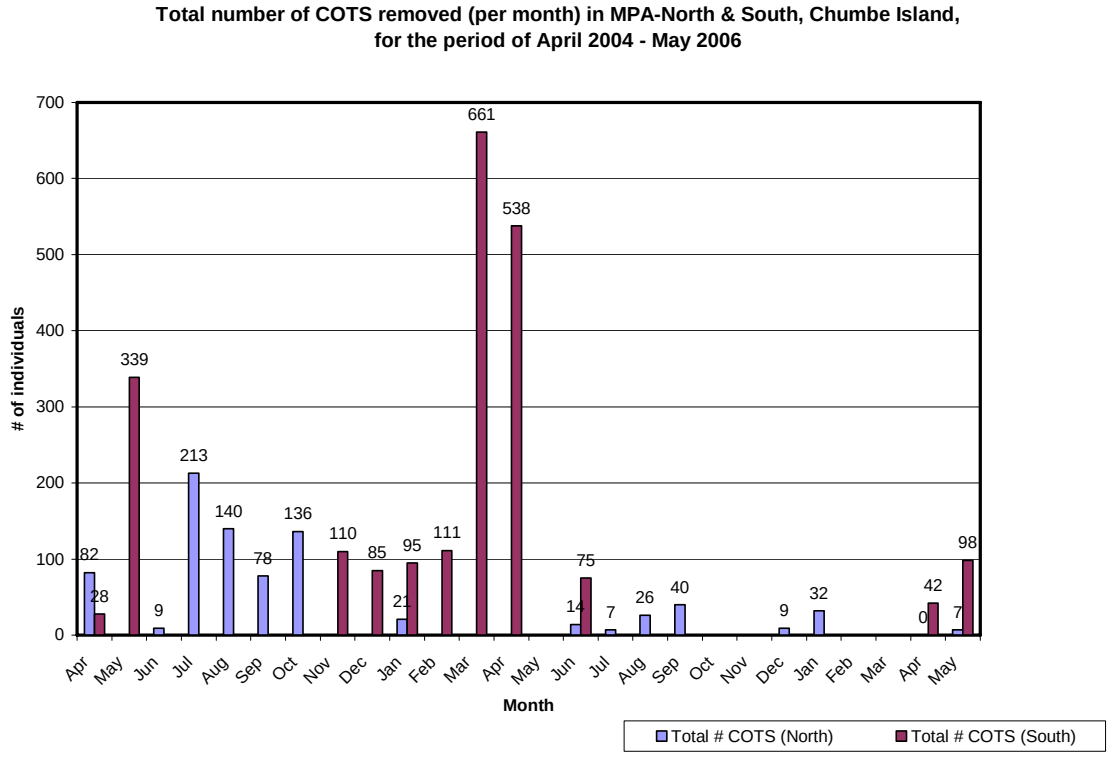
Collection days ranged from 1 to 7 days a month, depending on the density of COTS, and availability of rangers. There were also some months when no collection was carried out.

Table 1: Data summary of COTS removal programme

	North	South	Total
Total #	814	2182	2996
Average # collected per day	19	68	
# collection days	42	32	74
Average Size	25	24	
Average Minimum	19	17	
Average Maximum	32	33	

The COTS ranged in size from 8cm to 45cm, with an average of 24-25cm. Most of the smaller COTS were approx. 18cm, while the largest ones averaged 33cm.

While the average size of COTS are similar for both sites, more smaller (15-20cm) COTS were found in the south, this is most likely due to the coral composition in the north being mostly branching Acropora, making it very difficult to spot the smaller COTS.



There seems to be a seasonality for the COTS appearance in the Reef Sanctuary. The above chart shows that the highest numbers of COTS were seen in March - April – May.

During these months the seawater temperatures are the highest compared to the rest of the year.

It is also interesting that there seems to be a sharp decrease in the number of COTS collected in the north in 2005, compared to 2004. This may indicate that the consistency of the removal programme has succeeded in keeping the numbers down for the next 'season'. It is unclear whether the COTS found in the Chumbe Reef Sanctuary were recruited locally or spread from nearby reefs. Nevertheless, removing the large adults certainly has the potential to decrease the occurrences of COTS in the following years.

Recommendations
The COTS removal programme will continue as before. The data will further our knowledge regarding the COTS distribution and seasonality in the Reef Sanctuary. It is recommended that CHICOP works closely with IMS, to compile data on COTS distribution in the Zanzibar archipelago, in order to understand the impacts of removal programmes on the COTS populations. Many reefs around Unguja are affected, and removal programmes have proven to be successful in providing a long-term solution for the problem caused by this invasive species.

Sea Urchins

Since June 2004, regular sea urchins removals have been carried out in the Chumbe Reef Sanctuary (see also ***Marine Science Update* by Carol Daniels, Oct 2004**). The reason for this was that there seemed to have been a dramatic increase in the number of sea urchins in the sanctuary. From years of monitoring observations, Omari Nyange (Head Ranger) and Khamis Khalfan (Assistant Head Ranger) believe that this may have been a result of overfishing on the east coast. At ecologically sound population levels urchins benefit the reef by grazing on algae that usually compete with corals for settlement space. However, in high densities urchins will clear vast areas by grazing and therefore also clear any settling corals(C. Daniels, Oct04).

Hence, the removals have been carried out in an effort to reduce the density of three sea urchin species; *Diadema savignyi*, *Diadema setosum*, *Echinothrix diadema*.

In June-August 2004 a total of 31,000 urchins were removed (21,000 *Diadema setosum*, 9,000 *Echinotrix*, and 922 *Diadema savignyi*). Please see Carol Daniels's report for further details.

Between December 2004 and January 2006, 80 removal days had occurred, with the result of the removal of 253,000 urchins. (84.5% *Diadema setosum*, 11.9% *Diadema savignyi*, and 3.6% *Echinotrix diadema*).

The effects of these urchin removals on the coral reef is currently not clear. Further studies need to be carried out to analyse the impact of the urchin removals on coral recruitment and coral health. It is also unclear at what rate the removals should be done to ensure a significant long-term decrease in the urchin numbers. Currently, the three urchin

species concerned, with the addition of *Echinometra mathaei*, are included in the Coral Reef Monitoring Programme which commenced in February 2006. With this monitoring programme the urchin densities in the Chumbe Reef Sanctuary are surveyed yearly. In a few years time the results will show whether there is an increase/decrease or stable population density of these urchins in the reef sanctuary.

Cetaceans

Dolphins and Humpback whales are transitory visitors to the Chumbe Reef Sanctuary. At least three species of dolphin have been observed in the protected area: Spinner Dolphins (*Stenella longirostris*), Common Dolphins (*Delphinus delphis*), and Humpback Dolphins (*Sousa chinensis*).While dolphin sightings are regular and common throughout the year, Humpback whales sightings are seasonally dependent. In 2005 and 2006, these whales were seen in the waters around Chumbe Island in July, August and September. Their songs were heard clearly when the rangers snorkelled in the reef sanctuary, and on several occasions a whale was seen off the west side of the island, passing the island, breaching and splashing its' tail.

Researchers and research done

Researchers

For the period between April 2005 and October 2006 the following research studies were carried out on Chumbe Island:

Date	Name	Research	Title
Apr 2005	Hillary Smith	SIT	Incidence of coral bleaching on the protected reef of CHICOP
Apr 2005	Roger Putnam	SIT	*Acanthaster planci* population movement on Chumbe Island reefs
Oct 2005	Francois Odendaal	Baseline	Baseline surveys (coral health and fish populations) for MACEMP project
Nov-Jan 2006	Kjersti Thorkildson	Msc	Socio-economic and ecological analysis of a privately managed Marine Protected Area: CHICOP
Jan-Feb 2006	Matilda Thyresson	MFS	Size-related foraging behaviour and functional performance by Daisy parrotfish (*Chlorurs sordidus*) on reefs outside Zanzibar, Tanzania
Jan-Feb 2006	Charlotte Johansson	MFS	The importance of size for the maintenance of ecological functions of the parrotfish *Scarus niger* on three reefs outside Zanzibar, Tanzania
Feb 2006	Jonathan Belmaker	Phd	Turnover and diversity of coral reef fish
April 2006	Emma White	SIT	A survey of coral genera diversity at Chumbe Island
April 2006	Matthew Ferris-Smith	SIT	Feeding habits of Crown-Of-Thorns on Chumbe Island

In July 2006, the Institute of Marine Sciences, Zanzibar, commenced Part II of the Centre of Excellence Five Year Project Plan. Chumbe Island forms part of this plan, and is particularly involved the study "Investigations of Coral settlement, recruitment, restoration and associated environmental factors", by C. A. Muhando, A. N. N. Muzuka, S. M. Mohammed, and M. Mtolera. As part of this study sediment traps are placed for one month periods in the southern part of the reef sanctuary. Existing recruitment plates will be used as well.

Ranger reports

Introduction

Rangers reports have been maintained by Chumbe Island Coral Park rangers since 1993. The main purpose of these reports is to record any poaching/trespassing incidents within the Chumbe Reef Sanctuary (CRS) and subsequent actions taken. The structure and detail of these reports have developed a lot over the last 13 years. The report system is much more uniform now and includes the following aspects:

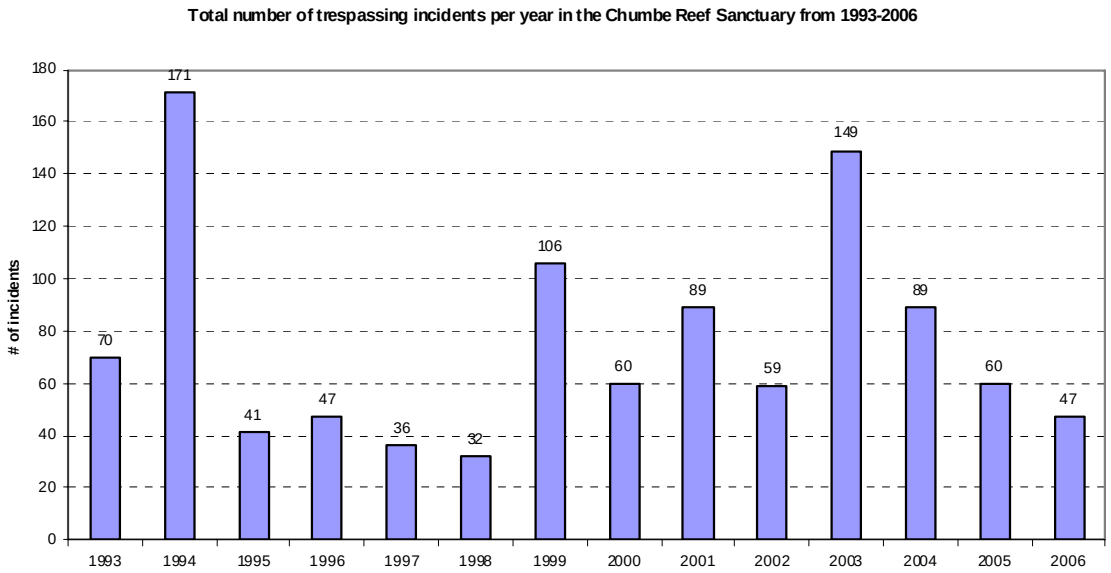
- Date, time and location of incident
- Type of vessel (ngalawa, canoe, dhow, snorkel)
- Number of people
- Type of gear used or carried
- Type of activity in the sanctuary (fishing, passing, anchoring, tourism, help required)
- Name of fishers, fishers' village name(s) and boat identification
- Action from the rangers, and their names
- Consequence of action i.e. did the fishers leave, threaten? Were the police from the island involved and if so, who?

These reports are photocopied and given to DFMR on a quarterly basis. The data is processed by the Conservation Coordinator at CHICOP and analysed every two years.

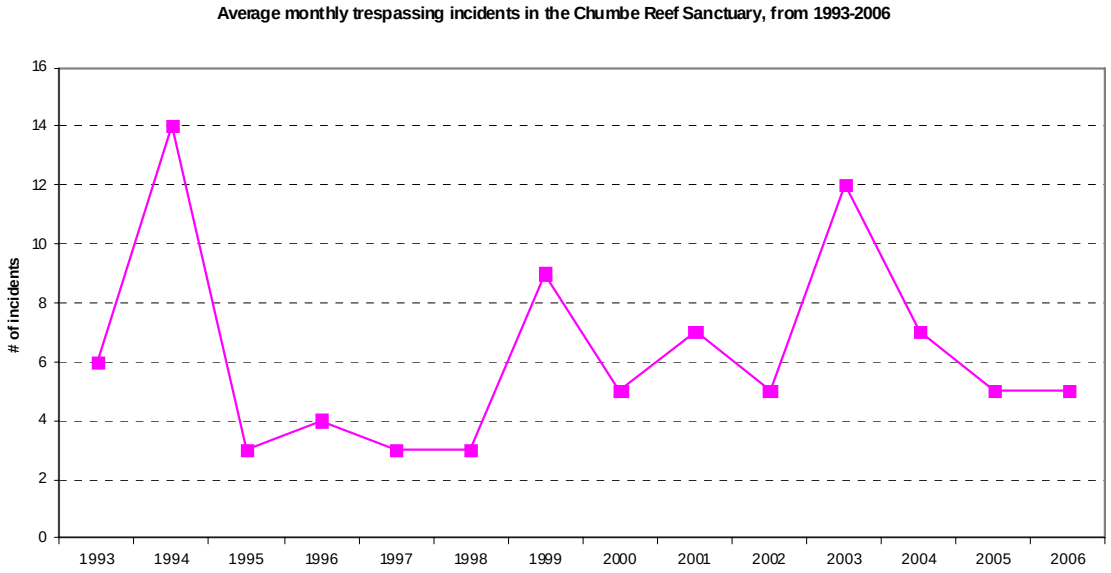
Results

An analysis of the ranger reports was carried out in Oct 2006, and showed the following results:

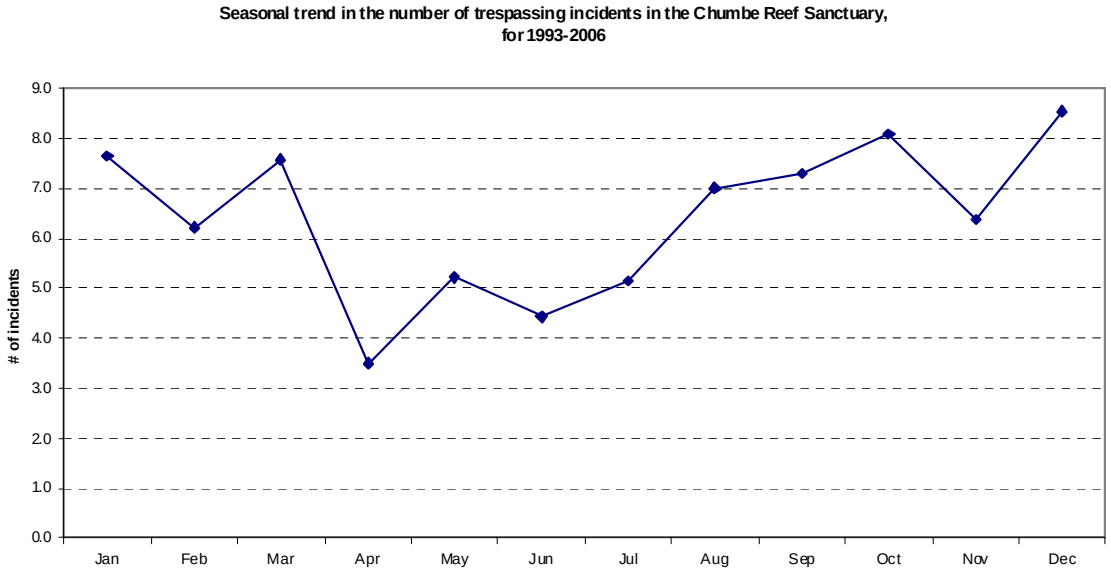
In 1994, 1999 and 2003 higher numbers of trespassing incidents occurred in the protected area. There is a steady decline in incidents in the past 3 years.



In 9 out of 14 years (1993 – 2006), the average number of trespassing incidents was between 3 and 6 per month.

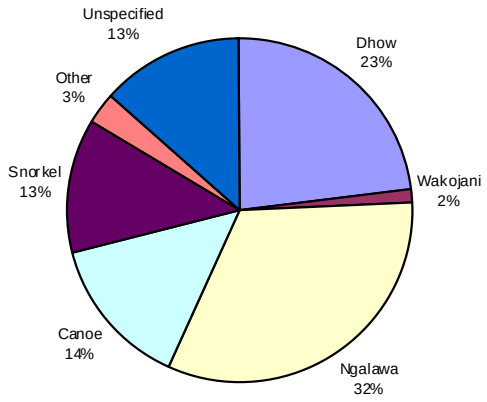


Over the years, there appears to be a trend in fishing season. Higher number of trespassing incidents occur in the second half of the year; Sept – Jan. While March also has higher trespassing incidents, the rainy months April to July see a relatively low number of incidents.

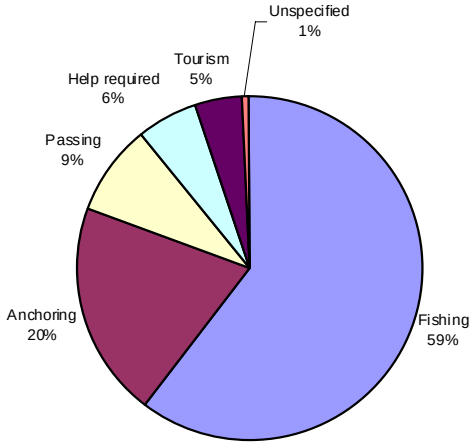


Since 2004, the ranger reports were specified to include the type of vessel entering the reef sanctuary. The below pie chart shows that the majority of fishers coming into the park use a ngalawa.

Type of trespassing vessel into the Chumbe Reef Sanctuary for 2004-2006 combined data



Reason for unauthorised entry into the Chumbe Reef Sanctuary for combined data 2004-2006



Of the total number of incidents in the reef sanctuary, 59% of trespassers do so with the intention to fish in the protected reef area.

Discussion

Increased awareness

An increased awareness of the project has helped to keep the number of fishers entering the CRS down at 4 to 5 incidents per month in the last two years. In 1999, 2001 and 2003, there was a higher frequency of incidents in the reef sanctuary. CHICOP has carried out village visits to the five communities closest to the Chumbe Island fishing grounds; Buyu, Nyamanzi, Mazizini, Chukwani, and Dimani. From the most recent village visits, Dec05-Jan06, the general opinion regarding CHICOP was positive; most people from the these villages understand the project's mission to conserve the reef and

to increase environmental awareness in the community through the Education Programme.

In 2006, CHICOP had also organised for two groups of fishermen and fisherwomen to visit Chumbe Island for a day. These visits were a great opportunity for the fishers to further their understanding of the benefits of marine protected areas to the wider community.

The installation of demarcation buoys in 2004 has also helped to reduce the number of trespassers into the reef sanctuary. It is therefore very important to regularly maintain these buoys and to replace them when necessary.

Seasonal trend

There is a seasonal trend in the frequency of the incidents. Fishers enter the reef area more frequently in Jan, Mar, Sept, Oct, and Dec. A significantly low number of trespassers is noted in April – July across the three years. This is the rainy season, and fewer fishers go fishing due to bad weather and lower accessibility to certain fishing grounds (due to wind directions).

Aid for fishers in need

Numerous incidents have occurred over the years whereby rangers were able to assist fishers who were in need. For example, a fishermen swam to Chumbe when his canoe sank – the rangers gave him dry clothes and food, and took him back to Zanzibar. On another occasion a fishing boat drifted to Chumbe with a ripped sail, the rangers towed the boat to a sheltered area where the fishers could mend their sail. In 2004-2006 the incidents whereby rangers assisted fishers in need represented 6% of the total number of incidents.

The mooring buoys located in the North and South boundaries of the CRS are also very helpful for fishers who need to anchor their boats in bad weather conditions.

Challenges

There were some problems regarding the demarcation buoys which were installed in late 2004, marking the boundaries of the CRS. They had broken off in late 2005, and were out of the water for maintenance for two months. Four months after re-installation, the buoys were presumable stolen and only one was retrieved. During the periods when the buoys were not in place, fishers had no reference points to where the boundaries of the CRS were.

Sometimes fishing boats drift into the CRS due to currents and strong winds.

Several incidents occurred during the night. The poachers anchor their boat out of view and enter the reef by snorkel, to fish for lobsters and sea cucumbers.

Conclusion & Recommendations

The ranger reports contain valuable information regarding trespassing incidents in the CRS. The rangers will continue to write them at high standards, and regular analysis will be able to indicate trends in the poaching status. Village visits prove to be very effective in increasing awareness of the CRS, and provide a good communication link between CHICOP and the local fishing communities. Awareness of the project should include a wider area, in order to decrease the number of trespassing incidents even further. Demarcation buoys are important reference points, and should be in place at all times. Regular maintenance of the buoys and a 24hr watch will ensure that the buoys remain in place for long term.

Terrestrial

Ader's Duikers

Sightings

Between Oct 2004 and July 2005 records of Ader's Duiker sightings were not kept, as there was a change-over of Conservation Coordinators at CHICOP and there was very little opportunity for updating the Ader's Duiker Programme. For earlier reports on Chumbe's Ader's Duikers, please refer to the document 'Terrestrial Science Update, October 2004', by Carol Daniels.

Since Aug 2005, the rangers have consistently reported sightings of Ader's Duikers in the Chumbe Forest Reserve (CFR). Below is a summary of all sightings between Aug 05 and Nov 06.

Date	Time	Ranger	# Duiker	Sex	Location
Aug 05	-	Jaku	1 adult	-	Mid/South, path crossing
23/09/05	-	Omar	1 adult	-	Mid/South, crossing
27/09/05	-	Omar	2 adults	-	Mid, path
Dec 05 - Jan 06	-	Omar & Others	5 single adult sightings	-	Mid/South, path crossings
20/04/06	4:50pm	Omar	1 adult	-	Mid, 50m east of lighthouse
29/05/06	1:00pm	Omar	1 adult	-	South
31/05/06	6:20am	Omar	1 adult	-	South
05/06/06	5:40pm	Omar	1 adult & 1 juvenile	-	South
15/06/06	6:00pm	Omar	1 adult	-	South
June 06	-	Neeva	1 adult	-	Mid
09/07/06	1:00pm	Omar	1 adult	-	South
10/07/06	7:50am	Omar	1 adult	-	South

25/07/06	5.37 pm	Omar	1 adult	-	moving from South to North
01/08/06	6.03 pm	Omar	1 adult	-	East side
15/08/06	2.47 pm	Omar	1 adult	-	Mid/South, crossing
20/08/06	5.09 pm	Omar	2 adults	one male, one female	Near South/Mid crossing
31/08/06	6.07 am	Omar	1 adult	-	North
18/09/06	5.45 pm	Omar	1 adult	-	Behind bungalow 7 (South)
09/10/06	5.02 pm	Omar	1 adult	-	Near bungalow 7
12/10/06	11.09am	Omar	1 adult	-	Mid forest
17/10/06	2.01 pm	Omar	1 adult	-	East
01/11/06	7.20 am	Mikala	1 adult	-	Mid/South, crossing
04/11/06	3.00 pm	Shabaani	1 adult	-	Near bungalow 7

During a period of 16 months, a total of 27 sightings were recorded, averaging 1.7 sightings per month.

It was often unclear what sex the Duiker was and whether it had an ear tag. Whenever the head was clearly visible, it was observed that none of them carried an ear tag.

Discussion

The duikers are usually seen in the early mornings and late afternoons, and only by single persons. The rangers often go into the forest alone to check the paths and check for any trail markings of the duikers. Forest walks are also carried out during the afternoons but since these walks usually comprise of more than one person (i.e. including guests), no sightings were ever made during afternoons. This is probably due to the duikers' very shy nature.

In the second half of 2005 and in mid 2006, rangers have observed an increasing frequency of sightings, this may be because certain individuals seem to have become less shy. It is not possible to say whether the sightings are of the same individuals, as none of them are wearing ear tags. On few occasions, two duikers been seen together, sometimes two adults and other times one adult with a fawn. This indicates that there are AT LEAST two adults and one fawn currently present on the island.

All of the Duikers seen seemed in good health and behaved normally.

Recommended research

Omar Nyange is very knowledgeable regarding the tracks of the duikers, he knows of a few permanent tracks made by the duikers; there are signs of scat, scent marks (knee height on certain branches) and feeding scars on certain plants. Omar can identify which

plants the duikers prefer to feed on. It is recommended that he continues collecting the sightings data.

An improved monitoring system needs to be implemented, in order to get better estimates of the number of duikers present on the island, and also to track certain individuals, observing their feeding, territorial and breeding behaviours. Using analog camera's is not recommended, as the camera's waste a lot of film and proved to be unreliable. Digital 'weatherproof' camera's would however be better suited for this purpose.

Previously, in 2003, trackers were invited to survey the island by minimal impact tracking techniques. This is not recommended anymore (Ali Mwinyim, *pers. comm*), as it is unwise to disturb them, especially when they have juveniles.

In Dec 2005 two researchers from the Macaulay Institute, Andrew McWilliam & Javier Perez-Barberia visited the island for one day together with Ali Mwinyi + 2 other officers from Jozani Forest. They did not see any Ader's Duikers during their visit, but Omar showed them tracks and trails. Andrew and Javier are still in the process of getting their proposal approved. If all goes well, they will investigate Ader's Duiker monitoring programmes in the near future, with most of their fieldwork based in Zanzibar.

In Sept 2006, Brooke ChilversLubin, member of the IUCN Antelope Specialist Group and the editor of African Sporting Gazette, stayed on Chumbe for two nights. She tracked the duikers but did not sight any. She will assist in linking CHICOP with Ader's Duikers specialists, to set up a good monitoring programme for Chumbe's duikers.

Birds

Roseate Terns* (*Sterna dougallii)

Summary

The Roseate Tern, an endangered seabird, returned to Chumbe Island after 12 years. A breeding colony of at least 300 adults was observed, occupying the two islets south of Chumbe for a period of 3 months. Egg-laying started in July, by mid August there were 100 chicks counted. The Southern islet was abandoned by mid August, most probably due to strong winds and spring high tides. The other threat to the Roseate Terns was predation by <10 Indian House Crows (*Corvus splendens*) resident on Chumbe. Protection of the birds was carried out with great care, enforcing limited visitation to the islets. Monitoring continued till mid September. Around September 5th there were very strong winds, and most of the adult Terns left the islets together with the fledglings. By mid September all Roseate Terns had left Chumbe Island and its islets.

Introduction

The Roseate Tern (*Sterna dougallii*) is similar in size to a Common Tern (*Sterna hirundo)* but very white-looking, with long tail-streamers, a black cap and a black beak with a reddish base. In summer adults have a pinkish tinge to their underbelly which

gives them their name. Colonies are almost always on small offshore islands and their nest sites be sheltered, often by overhung rocks or vegetation.

It is one of the rarest seabirds, and listed in the Least Concern category on the IUCN Red List. It has a global population estimated to be 78,000-82,000 individuals. The species is 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.

Vital statistics

Eggs:	1-2
Incubation:	21-26 days
Fledging:	22-30 days
Maximum lifespan:	21 years
Length:	33-38cm
Wingspan:	72-80cm
Weight:	92-133g

History of Roseate Terns breeding on Chumbe Island

Dudley Isles reported a large breeding colony on Chumbe Island in 1994, around the same time of the year; July-October. The terns were breeding on the two small islets South of Chumbe. In 1994, the breeding colony was much decimated by rats (invading the breeding spaces in masses to feed on eggs & chicks), and this can probably be a contributing factor to the long interval between the two breeding events on Chumbe. As there has since then been a succesful rat eradication campaign in 1997 (with the help of Dr. Patrick Sleeman of Cork University, Ireland), Chumbe has now become an ideal breeding place for bottom breeders, and there is hope that the Roseate terns may come more regularly now.

No accurate records exist for any sightings prior to 1994, although R.H.W. Pakenham in "The Birds of Zanzibar and Pemba (1979)" writes "*Sterna dougallii* has bred on Zanzibar and Pemba, "their movements are erratic and not fully understood" and "irregularly visits the islands to breed". According to Dudley Isles, the terns breeding on Chumbe in 1994 were typical of those breeding off the Kenyan coast, although the species is widespread throughout the tropics.

Initial observations of a breeding colony in 2006

The Roseate Terns arrived in mid June 2006. Both islets to the south of Chumbe were occupied, but none were observed to breed on the main island (In 1994 Dudley Isles counted 70 pairs on the southern tip of Chumbe). On July 12th, Omari Nyange, Chumbe Island's Head Ranger, climbed the islets and spent 70 minutes making observations and collecting data, as follows;

Location	# of eggs	# of eggs broken*	# of dead adults	# of dead chicks
South	689	20	0	0
North	426	51	0	1

* These broken eggs were probably eaten by Indian House Crows, or fell from higher nests and broke on the hard coral rag surface

Omari also noted the following observations:

- there are 4 Indian House Crows on Chumbe, they have been seen around the islets and are probably eating some of the eggs. It is suggested that the Crow shooter is invited so he can scare away the Crows.
- the African Fish Eagle has not been seen recently, in the past months.
- there are no rats on Chumbe, nor the islets.

Eleven days after Omari's first visit on the islets, he climbed the Northern islet once again, this time he was accompanied by Mr. Alawi Hija. They spent 40 min amongst the breeding colony and counted 41 live chicks and 1 dead chick.

Chicks, fledglings and ring tagging

On August 13th, one month after Omari's initial data collections, a team of 5 people climbed the Northern Islet to tag the young chicks. The team consisted of the following people:

- Dr. Bakari, Director of Department of Forestry
- Ali Mwinyi, Chief Warden of Jozani Forest
- Habib Abdulmajid, Jozani Forest ecologist
- Salum, Dr. Bakari's son
- Omari Nyange, CHICOP head ranger

The following people also joined but only came to observe and to take photographs:

- Helen Peeks, CHICOP project manager
- Ali Sultan, Journalist
- Mikala Peters, CHICOP marine biologist

It was observed that the Southern islet seems to have been abandoned by the terns, as no adult terns were landing on it. Time was limited; hence the team did not climb it for observations. The time spent on the Northern islet was 2hr and 45min, and the following data was collected:

Location	# of chicks	# of adults	# of dead adults	# of dead chicks
North	100	300	8	3

A total of 100 chicks were tagged. Dr. Bakari and Ali Mwinyi estimated a total of 300 adults in the breeding colony. The rings have the following numbers:

Inform Safring
Univ. Cape Town SA
4 H 23701 to 4 H 23800

Other observations:

- one Crow was flying above Northern islet when the team approached
- about a quarter of all adults were carrying small silvery fish (approx 6cm)
- majority of chicks were between 1 and 4 weeks old
- minority of chicks were a few days old
- there were some pools of water on the islet but no dead chicks found in them
- 8 adults found dead, probably due to entanglement in the vegetation (none had rings)
- 3 young chicks found dead (1-3 days old)
- plenty of eggs still around, some in nests, some just bare on the coral rag, some in the vegetation
- adults were found resting on the intertidal flat
- approx. 20 fledglings were seen on the intertidal flat, some of them seem very young

Problems & recommendations

The team encountered some problems during the ring tagging.

- there was limited time as the tide was returning, cutting off the access between the islets and the main island
- the vegetation made it difficult to reach some of the chicks, delaying the process
- some eggs were accidentally stood on as some people were not well prepared
- lack of instruments, i.e. weight measuring device

Future recommendations:

- a more elaborate briefing should be done prior to the tagging, so everyone knows their tasks
- by dividing tasks among participants there would be time to collect other data such as wing measurements of the chicks
- ensure all necessary equipment is organized prior to the trip

Reducing House Crow numbers

Mid August, action was taken to reduce the Indian House Crow numbers. A Crow-shooter stayed on Chumbe for 5 days, from 17/8 till 23/8, and killed 23 crows. However, it was not possible to completely eliminate the Crows as new ones kept coming in. The shooting was done far away from the Roseate Tern breeding colony.

End of breeding season

16/8/06 Omari climbed the Northern islet. He measured the islet; it is 28m x 10m. He counted the number of eggs in 1m square plots, 28 squares in a row. The average number of eggs per square m was 4.8. He thus estimated the total number of eggs to be around 1300.

27/8/06 On the Northern islet, 40 dead chicks were found, most of them drowned in the little pools on the islet, 7 had rings of the following numbers:
4 H 23758, 4 H 23748, 4 H 23720, 4 H 23726, 4 H 23764, 4 H 23788, 4 H 23755

Omari investigated the Southern islet to find out why the adults left this breeding site. Omari thinks that this site gets a lot of salt water spray from the waves. A lot of the eggs were found immersed in water. He found a total of 151 eggs. No sign of any adults.

There seems to have been more vegetation on this islet years ago, but has been affected by the salt water spray and burnt from the sun in dry season. The chicks did not have much hiding places.

1/9/06 Omari believes the Roseates are starting to leave, their numbers seem to be decreasing. One adult Roseate Tern was observed with a ring, but as the adult was not caught, the ring number remains unknown.

5/9/06 Very strong winds. Adults and fledglings have started to leave. By mid September no Roseate Terns were seen on Chumbe anymore.

Next breeding season?
Considering the long gap between the two breeding seasons on Chumbe (1994 & 2006), it is not likely that the colony will return in 2007. This species is known to have an erratic breeding pattern. However, Chumbe's Conservation Team will take the observations from both breeding events to create an Action Plan for the next breeding colony. This **Action Plan** will be helpful for the preparations of ringing, for the necessary measures to be taken to decrease chick deaths, by for example covering the small pools, and by placing a temporary fence around the islet during ringing, so the 'escaped' fledglings can be retrieved and returned on to the islet. It is important to prioritise the data that will be useful for long-term study, whilst also at all times minimising the impact on the breeding colony's success.

Crows
The Indian House Crows (*Corvus splendens*) have significantly increased their numbers on Chumbe since approximately 1997 (see Terrestrial science report by Carol Daniels, Oct 2004). This species was introduced in Zanzibar in 1891. By 1917 their population had increased so much that they were considered pests in Stonetown. Eradication methods have been attempted in Zanzibar's main island but have been mostly unsuccessful. It is hoped that, in contrast, the population on Chumbe Island can be controlled and/or eradicated. CHICOP started an eradication programme in 2003. The methods include a trap, nest spoiling and shooting adult crows.

It has been found that the programme is successful in controlling the number of crows. The trap alone cannot keep the numbers down, as the crows only get in the trap during breeding season when the adult crows are desperate for food (pers. Comm.., Omari Nyange). Nest spoiling is a difficult method as it requires someone to search for the crows' nests, which are sometimes hard to reach. Lastly, shooting the birds proves successful when there are many crows present on the island. In July 2006, when there were only 4-5 adult crows, shooting them had an adverse effect, i.e. once the 4 birds had been culled, more crows had flown to the island from Zanzibar. The crows seem to be territorial and it may well be that some birds are more dominant than others. It has then

been suggested that completely eradicating the crows on the island may not be sustainable in the long-term as it creates an unoccupied territory.

Researchers and research done

Researchers

In the period between April 2005 and Oct 2006, one terrestrial plant field study was carried out by an external researcher: Slim Juma (2005) *Investigation of the chemical potential of essential oils from Tanzanian tropical plants*, University of Dar es Salaam. Supervisor: Prof. Nkunya.

Scientists visits

- Andrew McWilliam & Javier Barberia, Nov 2005, The Macaulay Institute, Aberdeen
- Brooke ChilversLubin, Oct 2006, member of the IUCN Antelope Specialist Group and the editor of African Sporting Gazette.

Species Lists

Species lists were compiled and updated in March 2006, using existing raw data and reports since 1993. Currently there are species lists available for the following:

Marine species:	**Terrestrial species:**
• Fish • Intertidal species • Marine flora & macroalgae • Cnidaria	• Birds • Mammals – Ader's Duikers & Bats • Butterflies • Vascular plants

Baseline surveys need to be carried out to update the above lists, and for creating new species lists, such as:

- Cetaceans
- Crustaceans – marine & terrestrial
- Reptiles – marine & terrestrial
- Marine invertebrates

Ranger training

Between April 2005 and Oct 2006, the following ranger training activities took place:

- Forest ecology in the Jozani-Chwaka Bay Forest National Park
- PADI Open Water Scuba course, Zanzibar
- Marine ecology course, SIT Zanzibar
- Safari Blue daytrip to exchange skills and ideas on tourist guiding, Zanzibar
- Butterfly ecology at Amaani Reserve, Tanga, Tanzania
- Photography course, using digital and SLR camera's, Chumbe Island
- Seagrass monitoring methods

- Coral reef monitoring methods
- MPA Learning programme, Mafia Island

Further training in conservation science was also provided in the form of an exchange programme. Atwaa Salim Mohammed, from Lamu Island – Kenya, visited the project to share his experiences in turtle conservation projects with the rangers. One of CHICOP's rangers will visit Lamu Island in the near future.

Technical

Buoys

In Sept and Dec 2004 three new demarcation buoys had been installed to mark the marine park boundary. In addition to these demarcation buoys, two smaller mooring buoys had been installed for assisting fishermen who need to moor their boats in bad weather conditions. A year later, the three demarcation buoys broke off and drifted, all in a period of three months (Aug – Oct). The buoys were found again by the rangers. The rusted chains seem to have failed in all three cases. In November, the old paint was sanded off, and new paint was applied, as well as anti-fouling. The bolts on the bottom of the buoys were replaced and reconnected to a new chain with a 3m thick rope. This allows for some elasticity in strong weather. The repaired buoys were re-installed in Dec and Jan 2006.

Location	GPS name	GPS coordinates		Length of chain	Length of rope
North	DMN016	S 06º 16' 23.2"	E 39º 10' 26.6"	21m	3m
Middle	DMM125	S 06º 16' 48.5"	E 39º 10' 21.9"	22m	3m
South	DMS125	S 06º 17' 10.9"	E 39º 10' 32.8"	21m	3m

On Jan 8th, the North Mooring buoy (small white buoy) came loose and was retrieved by rangers. This mooring buoy had been re-installed but had disappeared again in Oct 2006. The South Mooring buoy was taken out of the water for repairs but seems to be beyond repair.

Unfortunately, the demarcation buoys that were re-installed in early 2006 had only lasted for 4 months. They were presumably stolen as the weather conditions were actually quite stable. One buoy had been retrieved and re-installed in the Mid position to mark off the most Western boundary of the marine park.

After consultations with the local port authority and other experts in this field, CHICOP decided to look for commercially designed marine buoys to replace the missing buoys. Fundraising was begun and funding has been generously provided by Seacology. New buoys have been purchased and will be installed before February 2007.