ADER'S DUIKER (*Cephalophus adersi*)

SURVEY REPORT
Chumbe Island, 2nd June 2012

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1) Background information

1.1 Ader's duiker conservation status

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The Ader's duiker *(Cephalophus adersi)* ranks as one of the rarest species of the mini antelope in the world (Finnie 2001). Today, only a relict population survives on Zanzibar (Unguja) island and Arubuko Sokoke Forest Reserve in Kenya (the latter being very questionable in terms of their survival to date). A survey carried out on Zanzibar in 1999 suggests 600±45 individuals are remaining on Unguja Island. This small population continues to dwindle as a result of habitat destruction and uncontrolled hunting despite being fully protected by Zanzibar law (Archer 1994). Even in the forest areas where there used to be many Ader's duikers, sightings are becoming low in frequency (Pandu Ame, local hunter from Jambiani village, 2012, pers.comm.).

Therefore, the Department of Forestry under the Ministry of Agriculture and Natural Resources Zanzibar has decided to work on a long-term survival strategy to rescue the remaining individuals by cooperating with national and international organizations, as well as individuals, in taking care of this threaten species. Several management options have been considered and one was to undertake translocation practices with subsequent monitoring of duiker survival (translocation attempts summarized in appendix 2).

1.2 Re-introduction to Chumbe Island

Ader's duikers were also present and common on Chumbe Island prior to the 1980's. However, by 1992 Zanzibaris who regularly came over from Unguja to hunt had hunted them to extinction on the island (MacPherson et al. 2002). Gazetted in 1994 as a protected area by the Government of Zanzibar, privately managed Chumbe Island Coral Park (CHICOP) is now an effective refuge for indigenous and threatened species of Zanzibar.

In 1995 the Department of Forestry in Zanzibar began collaborating with CHICOP towards the establishment of an Ader's duiker sanctuary within Chumbe's fully protected forest reserve. In a pilot study, the first female duiker was brought to Chumbe in February 1998. A botanical survey was carried out in the same year in order to determine the suitability of Chumbe for the re-introduction of a duiker breeding population. Chumbe's coral rag forest was found to provide suitable habitat and sufficient food plants for these duikers (Aplin 1998; Williams et al. 1996).

In February 2000, following much preparation throughout the international conservation community, and with assistance from national and international experts, five animals (three male and two female duikers) were successfully translocated to the island leaving Chumbe with a total number of six Ader's duikers that were color ear tagged.

1.3 Monitoring methods and results since 2000

Following the principles of re-introduction of endangered species, as outlined by IUCN, monitoring procedures needed to be developed and implemented.

Initially, a monitoring system with both automatic cameras and ear tags was established to monitor duiker behavior and habitat use (MacPherson et al 2002). Unfortunately, the camera used to snapshoot mainly untargeted animals (e.g. forest birds such as red eye doves) and provided no information on population number and duiker sex. Since 2002 the camera system has not been in function and the only ongoing monitoring has been direct observations of non-tagged animals (Daniels, 2004).

Since August 2005 rangers have been reporting any sightings of Ader's duikers on Chumbe Island. These records have been ongoing until this date. Up-dated sighting results are summarized in Fig.1, 2, 3 and 4.

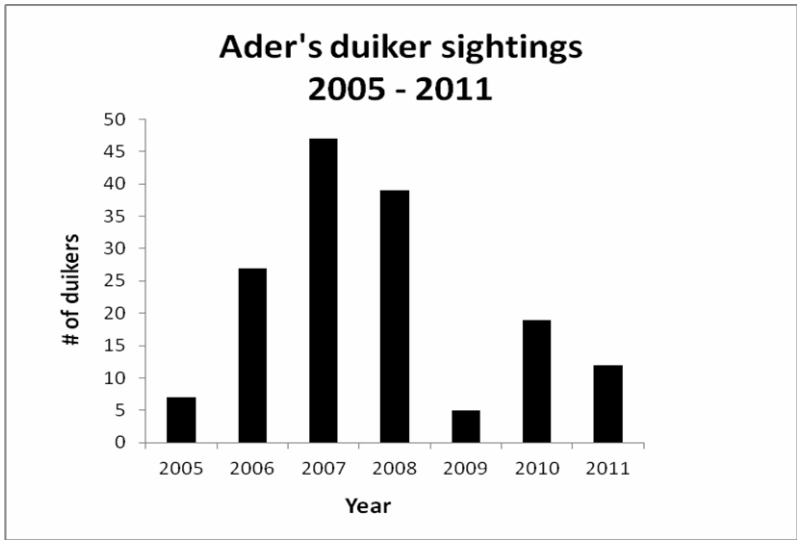

Figure 1. Ader's duiker sightings on Chumbe Island from 2005-2011.
Direct observations do not allow identification of individuals. Therefore, the number of duikers seen does not correspond with number of individuals present on the island.

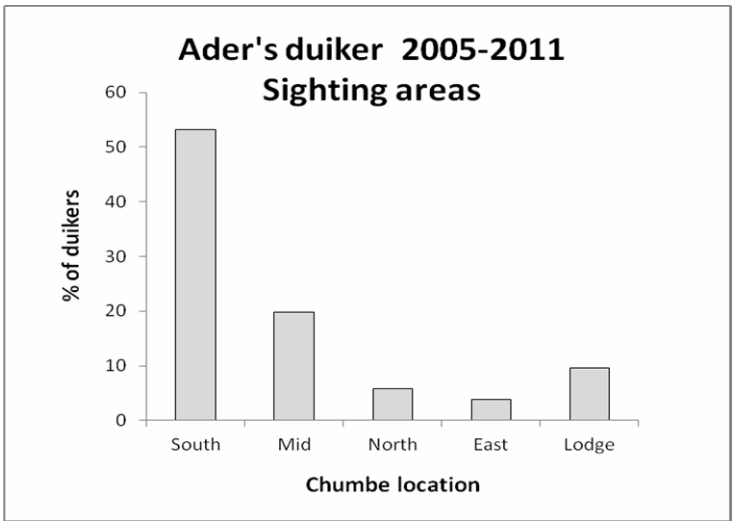

Figure 2. Ader's duiker sightings from 2005-2011 in relation to geographic location on Chumbe Island. Majority of the animals have been seen in the South of Chumbe Island.

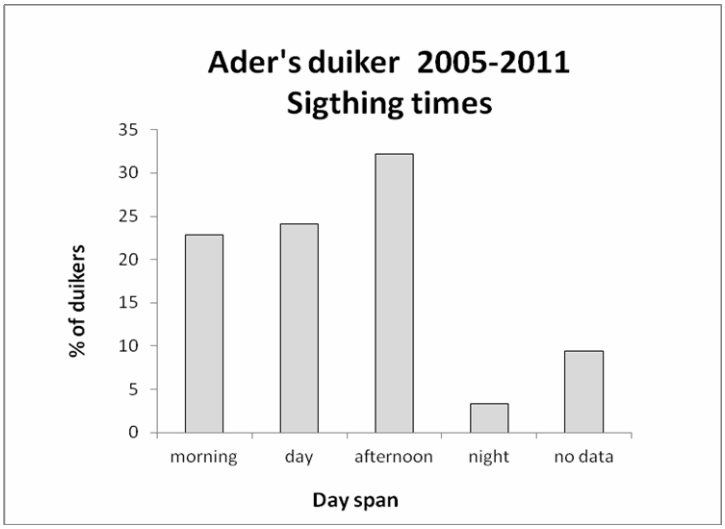

Figure 3. Ader's duiker sigthings on Chumbe Island from 2005-2011 in relation to day span. Majority of the duikers have been observed around dusk and dawn supporting a diurnal rather than nocturnal activity pattern.

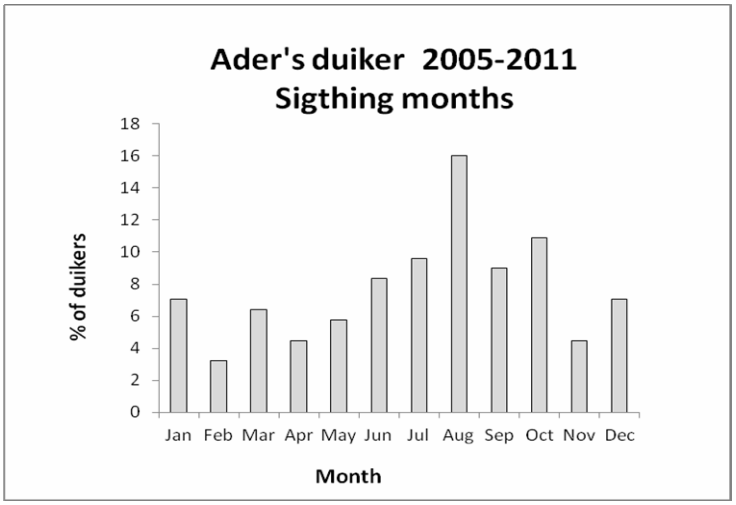

Figure 4. Ader's duiker sigthings on Chumbe Island from 2005-2011 in relation to a year span. Sightings have been made through out the year, peaking in August.

In September 2007 CHICOP management collaborated with the Department of Forestry, Zanzibar to carry out a so called 'animal drive' using experienced local hunters. This method (further described under 'method') has been considered as a good and reliable way to estimate Ader's duiker population size within Chumbe's closed coral rag forest. A team of 12 people (five local hunters from southern part of Unguja and seven CHICOP staff) confirmed four Ader's duiker (two identified males and two individuals of unknown sex) during the drive (Lanshammer 2007).

In February 2008 two new digital monitoring cameras (motion and temperature sensitive), funded by Zoo Munich-Hellbrunn, were installed on the north and south part of Chumbe Island where feces had been found earlier. The ambition was to establish a basis from which different individuals can be identified and distinguished (Lanshammer 2008). Due to difficulties in identification of individuals, the cameras failed to give more information and stopped working at the beginning of 2009 due to water damage.

In June 2009 another 'drive survey' was conducted (Lanshammer 2009). This time a team of 18 people (six trackers and twelve CHICOP staff including volunteers) counted six animals whereas two animals appeared double counts leading to a total number of four individuals (two identified males through observation of testicles, two individuals of unknown sex).

The following report outlines the method and monitoring results of the duiker monitoring survey that was conducted during 1st and 2nd of June 2012.

2) Objectives of survey 2012

- Further improvement of the 'drive method' (based on the recommendations from 2009) in order to estimate the number of Ader's duiker currently living in the Chumbe Island Closed Forest Reserve
- Include additional observations about the presence of faeces and scent marks during the drive
- Combine the results from the drive with the data from random sightings that have been recorded by Chumbe rangers and develop guidelines for an improved management of Ader's duiker on Chumbe Island

3) Method

In general a 'drive' involves a team of people who are divided into a group of trackers and into a group of sitters. The sitters are positioned quietly in a line across the middle of the island where its width is about 100-150 meters. The group of trackers starts at one end of the island and walks in a line through the forest, making noise in order to drive the animals in front of them. Eventually the animals 'driven' in front of the trackers will run through the line of sitters who count all animals passing the line.

Based on the experiences from the drive in 2009: (1) the number of sitters was kept to six people including experience hunters and CHICOP staff (head ranger and conservation manager; (2) the number of trackers was increased to a total of 23 people (dominated by hunters who had experience in the forest and with the method) in order to keep a tight line and increase the chance of animal sightings during the drive; (3) two compasses were given to the tracker team to maintain direction.

The local survey team led by Mr. Ali Mwinyi arrived on Friday evening, 1st of June 2012 in order to discuss logistics, duiker behavior and technical know-how of the drive with CHICOP's new Conservation Manager, guiding rangers and volunteers. In total a team of 29 people would participate in the drive on the 2nd of June 2012 (detailed list of participants is provided in appendix 1).

On 2nd of June 2012, a group of six sitters was positioned in the middle of the island at 8:38 am. A group of 23 trackers started to walk from the Northern tip of the island at 8:47 am, driving the animals in front of them towards the sitters in middle of the island. When the walkers reached the line of sitters results were reported. Three sitters changed their position with trackers and the new tracker team left the forest and walked down the island cliff, by the beach, to the Southern tip of the island. At this point, all animals that exist on Chumbe should be somewhere in the Southern area of the island. To get the final count, the walkers therefore resumed the noisy walk from the Southern tip, heading towards the sitters. It was assumed that the counted number of animals would be higher the second time since then all the animals would be included. The whole drive was finished by 11:40 and took around 3:30 hours in total.

4) Results

During the first drive, which was conducted from north to south, no Ader's duikers were seen. However, the trackers spotted duiker pellets in two separate piles and of different size (Fig. 5) indicating the presence of an adult and sub-adult animal. In addition, two orbital gland marks were found on the trees (Fig. 6).

Figure 5. Ader's duiker pellets for sub adult (in left hand) and adult (in right hand) / Photo @ Ali Mwinyi.

Figure 6. Comparative measurements of two orbital gland marks. The gland mark on the left image was found in a height of 55 cm and the gland mark on the right image in a height of 50cm Photo @ Ali Mwinyi.

During second drive, which was conducted from south to north, five Ader's duikers were seen including one sub-adult animal. Unfortunately, the sitters were not able to identify individual sex of the observed animals.

Other animals observed during the drive included Red Eye Dove, geckos, coconut crabs, honey bees and bats (Fig. 7).

Figure 7. Left image: Egg from red eye dove on the detached forest leave litter inside the protected Chumbe Forest Reserve / Photo @ Ali Mwinyi; right image: Coconut crab / Photo @ Tim Woolven

5) Discussion & Recommendations

Drive

The drive method has been improved by a considerable increased number of experienced trackers (23). However, due to the dense character of the forest reserve it remains a difficult task to keep a tight line all the time. In addition, habituation in terms of duikers getting used to people and hiding instead of running away might also influence the number of duikers recorded.

Population size

The drive shows that at least five individuals (including a sub-adult) are successfully living within the closed coral rag forest on Chumbe Island. Based on that number, however, population size can still be considered fairly low and it remains unclear why the population is not growing.

Based on the local hunters experience with similar translocation work done in Mnemba Island (see appendix 2, 2005) it appears that Ader's duiker survival rate on Chumbe is somehow limited.

Faeces pellets and sighting of a sub-adult animal during this drive indicate that the Chumbe population has been breeding but other factors might slowdown regeneration:

- On Chumbe Island, coconut crabs (*Birgus latro)*, which characteristically find their food by smell rather than sight, might be attracted by special pheromones produced by gravid duiker females. Crabs are believed to be able to attack a helpless, duiker new born This could affect population growth, since a female duiker gives birth only once a year to only one offspring at a time (Mwyini, 2012, pers. comm.). However, Chumbe's head ranger has never seen evidence for this theory.
- Habitat suitability: Chumbe Island's coral rag forest is dominated by fossilized coral rock with deep, open holes. These holes might present 'natural traps' where either juvenile duikers and/or adult duikers during court ship display (females are often chased by males) can jump in accidentally.

In 2010 and 2012 Chumbe Island has facilitated and supported two duiker studies: (1) *Comparative study on adaptability of Ader's Duiker in Chumbe and Unguja Island, Zanzibar* and (2) *'Comparative study on nutritive evaluation of browse tree foliages preferred by Aders Duiker between Mtende-Kibuteni-Kizimkazimunguni Fortest and Chumbe Island Zanzibar'* which have been conducted by students from Dodoma University Tanzania. Unfortunately, results are not available yet but it is expected that the studies will provide further insight into duiker ecology and diet.

Population analysis

The Ader's duiker population on Chumbe Island is of high importance because it could act as a gene bank for this highly endangered species, if population size would increase. More information and research about the sex distribution and the genetic status of the Chumbe population (such as inbreeding) is needed in order to decide on further management steps.

A faeces based DNA survey would be the preferred monitoring option but due to high lab analysis costs external funding is required to start such a project. Alternatively, Chumbe Island could act as a unique study side for international Duiker researchers who have secured own funding.

In conclusion the drive was successful and Chumbe's conservation team will continue to monitor the Ader's duiker population through detailed sighting records. Another drive survey is not recommended within the next year due to the animal's high sensitivity to stress, but international research involving more sophisticated survey methods (such as DNA analysis) is highly requested.

Acknowledgements

This project is managed by CHICOP in collaboration with the Wildlife Section of the Department of Forest and Non Renewable Natural Resources-DFNRNR (formally Department of Commercial Crops, Fruits and Forestry) within the Ministry of Agriculture and Natural Resources (formally the Ministry of Agriculture, Natural Resources, Environment and Co-operatives, Zanzibar). The re-introduction program in 2000 was supervised by Zoo Munich-Hellbrunn, the Mammal Ecology Research Group (MERG) and the Royal Holloway University in London. Local hunters from Zanzibar led by Mr. Ali A. Mwinyi have continuously provided technical support and expertise especially during the survey drives since the year 2000.

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Appendix 1.

Survey team during the Ader's Duiker monitoring drive at Chumbe Island on 2nd June 2012

Shehias/Villages of origin	Names of local hunters
Muyuni C	1. Waziri Soud
Muyuni A	2. Mohammed Rajab
Makunduchi	3. Mussa Hassan Mwambe (Mussa Fundi)
	4. Keya Abdulla
Jambiani	5. Pandu Ame Vuaa
	6. Maulid Haji Ame (Mau)
	7. Mussa Kheri Mwazini
	8. Ame Ali
	9. Hassan Makame Zuma
	10. Abdulla Makame Zuma
Mtende	11. Mpemba Ali Mwinyi
Kibuteni	12. Suleiman Mussa Jecha
	13. Zamiri Kombo
	14. Haroub Makadam Haji
	15. Abdulla Kessi (Kibuno)
	16. Abdulla Gavu
	17. Mwalim Khamis
Kizimkazi	18. Mussa Ibrahim
	19. Haji Khatib
Chumbe Staff	
Head ranger	20. Omari Nyange
Guiding rangers	21. Ali Chaga
	22. Juma Omar
	23. Juma Salum
	24. Ali Harun
Volunteers	25. Pelele
	26. Tim Woolven
	27. Jackie Cook
Conservation manager	28. Ulli Kloiber
Team leader	
	29. Ali A. Mwinyi

Group photo of Ader's duiker survey team 2012 on Chumbe Island / Photo @ Tim Woolven

Appendix 2

ZANZIBAR ADER'S DUIKER *(Cephalophus adersi)* TRANSLOCATION ATTEMPTS AS ONE OF THE PROTECTION/CONSERVATION MEASURES PREVENTING IT FROM GLOBAL EXTINCTION

1st attempt……February, 1996……Kiwengwa forest to Chumbe

This operation involved one pair of adult, opposite sex Ader's duiker to Chumbe Island Coral Park in Zanzibar. The male duiker was captured from Kiwengwa Forest Reserve (now Kiwengwa-Pongwe Forest Reserve) in the Northern part of Unguja Island of Zanzibar and the female was captured from the interconnected forest of Mtule/Kitogani/Muungoni forest in the Southern part of Unguja Island. Both animals were released in a temporary holding ground which was built at Jozani Forest Reserve (now Jozani-Chwaka Bay National Park). Unfortunately, the male died of pneumonia after one year. Six months later, in February 1998 the female widow was taken to Chumbe Island which formed the first translocation attempt well documented by Chumbe Island.

Operation Leader: *Andrew Williams from U.K*
Assisted by: Ali A. Mwinyi from Zanzibar, Tanzania

2nd attempt.....December, 1998……Kiwengwa forest to Chumbe

One male Ader's duiker was captured from Kiwengwa forest, and then taken direct to Chumbe Island. Unfortunately, the animal died few days after its release.
Operation leader: Andrew Williams from U.K
Assisted by Ali A.Mwinyi from Zanzibar, Tanzania

3rd attempt.....April, 1999……Mtende forest to Chumbe

One female Ader's duiker was captured from Mtende forest and kept in a holding ground which was located in the Jozani Forest Reserve on transit to Chumbe Island. The animal was found dead about an hour after its release from the holding ground.
Operation was leader: Adrian Ely from UK
Assisted by: Ali A. Mwinyi from Zanzibar

4th attempt .....February 2000…Mtende/Kizimkazi/Kibuteni forests to Chumbe

Nine Ader's duikers, four males and five females, were captured within the natural forests of: Mtende/ Kizimkazi-Mkunguni and Kibuteni in the South of Unguja and translocated to Chumbe Island. Four animals (3 females and 1 male) died during the translocation process which unlike the previous attempts involved administration of sedative drugs. Three males and two females could successfully be released in Chumbe Island, leading to a total of 3 pairs Ader's duikers of opposite sex since in Chumbe Island since February 2000.
Operation leader: Prof. Wiesner from Hellabrunn Munich Zoo, Germany
Assisted by: Ali A. Mwinyi, from Zanzibar, Tanzania.

5th attempt …….September 2005…..Mtende/Kitogani to Mnemba.
Six Ader's duikers of opposite sex were captured from Mtende and Kitogani forests and translocated to Mnemba Island. Four of them died within two weeks after their release in Mnemba Island and two pregnant females survived.
Operation leader: Ali A. Mwinyi from Zanzibar, Tanzania.
Assisted by: Alawi H. Hija, from Zanzibar, Tanzania.

6th Attempt… September 2006……..Kibuteni, Mtende and Kitogani to Mnemba
Four Ader's duikers of opposite sex were captured from Kibuteni, Mtende and Kitogani forests and brought to Mnemba Island. All animals survived and were successfully released.
Operation leader: Ali A. Mwinyi from Zanzibar, Tanzania.
Assisted by: Alawi H. Hija, from Zanzibar, Tanzania.

7th attempt ……..May 2009 ….. Mtende to Zanzibar Park (Zoo).
Six Ader's duikers of opposite sex were captured from Mtende community natural forest and brought to Zanzibar Park Ltd (Zoo). The translocation was done without administration of tranquilizers.
Operation leader: Ali A. Mwinyi from Zanzibar, Tanzania
Assisted by: Alawi H. Hija, from Zanzibar