Aldabra Research Station
Scientific Coordinator's Annual Report

2011

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Photograph by J. van de Crommenacker

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1. INTRODUCTION

This report comprises a summary and analysis of the research and monitoring activities carried out on Aldabra during 2011. I started as ASC (Aldabra Scientific Coordinator, the newly introduced post title for the formerly used RO; Research Officer) at the end of March, following up after Jock Currie. For the first time a handing over period of one week between the outgoing and incoming ASC could be organised which is especially important to ensure that the monitoring methods are well understood by the new staff. This is a practice which is strongly recommended to continue even though monitoring protocols are in place.

1.1. Research staff

Table 1 shows the people that were working in Aldabra's research department during 2011. Some people changed position during the year and therefore occur in the table more than once. Detailed information about arrival / departure dates can be found in the monthly ASC reports.

Table 1. Research staffing on Aldabra in 2011.

Position	Name	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Notes
ASC / RO	Jock Currie	x	x	x	x									1-week overlap with new ASC
	Janske van de Crommenacker				x	x	x	x	x	x	x		x	Annual leave Oct 22nd – Nov 28th
AASC	Joël Souyave						x	x	x	x	x	x	x	
Ranger	Stan Denis	x	x	x	x	x	x	x	x	x	x			Boatman
	Nella Victor	x	x	x										
	Mike Marianne	x	x	x										
	Andy Gouffé	x	x	x	x	x	x	x	x	x	x	x	x	
	Catherina Onezia						x	x	x	x	x	x		December: Assumption EC Project
	Bevil Narty										x	x	x	
	Jakawan Hoareau											x	x	Relief Ranger
Trainee Ranger	Roland Duval	x	x											
Project Officer	Richard Baxter												x	ZARP
Volunteer	Philip Haupt	x	x	x	x	x	x	x	x	x	x			Starting GEF Project Officer position from April onwards
	Michal Šúr	x	x	x								x	x	Starting GEF Project Officer position from November onwards
	Tessa Hempson	x	x	x										Dive instructor
	Martijn van Dinther				x	x	x	x	x	x	x		x	Annual leave Oct 22nd – Nov 28th Starting GEF Project Officer position from December onwards

1.2. Notable events

In addition to the monitoring results that will be discussed in the report, the year 2011 was marked by the following notable non-research events:

- **February:** An expected visit by the yacht 'Silver Angel' at the end of the month was cancelled.
- **March:** The supply boat visited Aldabra on 1-2 March. Activity on the atoll was largely focused on dive courses taught by volunteer and dive instructor Tessa Hempson. This was the first time that dive training was given on the atoll. Further details are discussed under 'Staff training' (section 8.2). During the last week of the month, a team of technicians arrived, that worked on various installations and issues: automatic weather station trouble-shooting (Hencel Hollanda, SNMS), tidal gauge installation (Jean-Paul Dodin, SNMS), fuel tank installation (Francois Pierre, Seypec) and VHF communication system / DSTV (Philip Jack).
- **April:** A three-person delegation of the Chinese embassy visited Aldabra in the beginning of April.
- **June:** On 12-15 June, the supply boat arrived on Aldabra with supplies and construction materials.
- **September:** On 25-26 September, the supply boat arrived on Aldabra.
- **October**: There were two flights (October 17th and 22nd). During the first plane transport, two SDPF soldiers arrived, who were sent to protect Aldabra staff and property against piracy. SPDF soldiers would stay for the entire NW monsoon. Aldabra was visited by Jaime Cavelier (Sr. Biodiversity Specialist Eastern and Southern Africa & Biosafety and ABS at the Global Environmental Facility (GEF)).
- **November**: From November 11th until November 23rd, the Indian navy ship INS Sarvekshak conducted bathymetric surveys and other survey activities around Aldabra. On November 26th, Aldabra was visited by the cruise ship M.V. Hanseatic. Furthermore, there was a flight on November 28th. From November onwards, a team of contractors (led by Brian Rose) worked on the construction of a power house and other preparations for the solar power installation (EMS project).
- **December:** From November 28th until December 5th, two photographers from iSEYco (Mr. Gilbert Pool and Mr. David Savy) spent eight days filming and photographing on Aldabra. On December 5th there was a flight. The Island Manager Marc Jean-Baptiste finished his contract and left Aldabra. The ASC took over the over-all management duties, while Marcus Pierre (VdM manager) overlooked the logistics department. From December 6th – 14th, the Indian navy ship INS Sarvekshak returned to Aldabra to continue with the bathymetric surveys and other activities. From December 23rd – 27th the supply boat visited Aldabra.

1.3. Notes on monthly schedules

In the months of January until August, the monthly research program was set by the ASC. From September until the end of the year it was the AASC who made the schedule. At times the schedule devised at the beginning of a monthly cycle needed to be slightly amended in the light of interrupting events (see section 'Notable events') and weather constraints. Figure 1 shows a map of Aldabra with all monitoring locations.

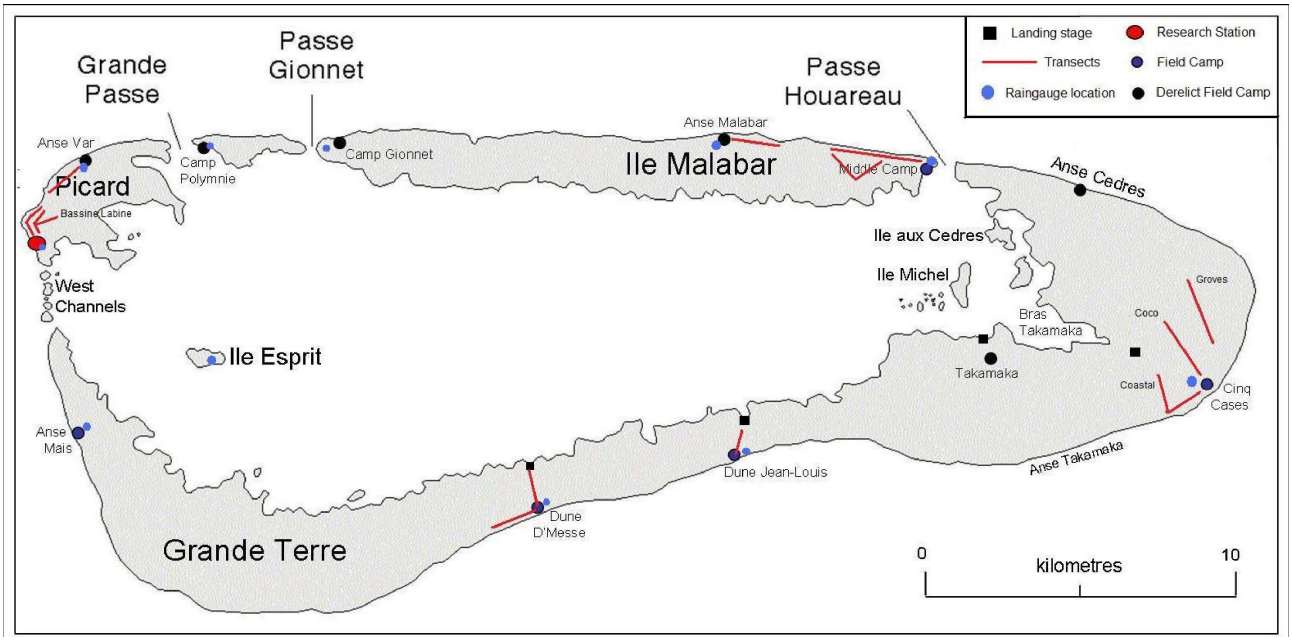


Figure 1. Map of Aldabra Atoll with camps and locations of monitoring transect/activities.

1.4. Data management

From the beginning of April until the end of October, GEF Project Consultant Philip Haupt developed Microsoft Access databases for most of the routine monitoring programmes (i.e., land birds, coconut crabs, subsistence fishing, phenology, waders, and tropicbirds). Until now, most data was entered in Microsoft Excel, which is an appropriate program for data storage but not ideal for analyses. Also the fact that data from different years has been entered in different sub-tabs or documents made analyses very time- consuming and mistakes highly likely. Now, all data are merged into one big database for each monitoring programme. An important advantage of Microsoft Access is that data can be entered in custom-designed forms with built-in error-checking options. For analyses, one can make queries that provide data tables according to the desired set-up, calculations and data filtering. Throughout the year, the new databases have proved to be easy to use. Only few small start-up problems were encountered and those were readily solved by Philip. The databases were a big help when compiling the analyses for this report, and will be extremely valuable for all people that work with Aldabra research data in the future.

It is strongly recommended that the current set-up (of all data per monitoring programme in a single database) is maintained and Microsoft Access databases are well used and kept up to date. For maintenance of the databases the following points are important:

- Compact and repair database: This is a simple button to press in Access (Tools – Database utilities – Compact and repair database) to get rid of any extra space taken up by unnecessary codes. This can drastically reduce database size, and improve speed. Do this at least once a month.
- Link tables: the tables are stored in the back-end database (with extension .mdb), so that when changes are made to data entry forms, or a front-end becomes corrupt, the data is stored safe. If the location of the .mde (front-end) and .mdb (back-end) database are changed, the tables should be re-linked (Tools – Database utilities – Linked Table manager).
- How to split up a database into .mdb and .mde database is explained in \\ALDABRASERVER\fileserver\Monitoring\Databases general info

Also, please back up all data bases from time to time. Save the back-up in the back-up folder of the particular database, with its date.

MONITORING PROGRAMMES

2. CLIMATE

2.1. Picard Station meteorological readings

In the 2010 Annual RO/ASC Report, issues were raised about the historical time series not being complete, due to some of the thermometers being broken or incorrectly used. This caused large gaps of missing or unusable data over periods of months to years in some of the data series. For the current report only the usable data are included in the statistic analyses.

2.2. Dry and wet bulb temperatures

Surface air temperature is measured with dry and wet bulb thermometers. The thermometers are mounted vertically on a wooden stand in the Stevenson screen (a white louvered box at a height of 1.25m above the ground, protecting the thermometers from rain, direct radiation from the sun and providing adequate ventilation so as to indicate the temperature of free-moving air). The dry and wet bulb temperatures are read every morning at 8.00 a.m. As temperatures in the morning are rising rapidly, recording the temperature 30 minutes later than usual – e.g., due to other monitoring activities – can substantially influence the data collected. For this reason, only readings taken until 08.30 a.m. are considered for the analyses.

The dry bulb temperatures in 2011 did not differ from previous years (Figure 2; all $P > 0.49$; one-way ANOVA with Tukey post-hoc comparison), except for 2006 and 2009. The data of 2006 seem reliable, showing that 2006 was a cooler year than most of last decade's years, including 2011 ($P = 0.024$). The difference between 2011 and 2009 can ignored, as 2009 yielded only two months of reliable data due to a broken thermometer.

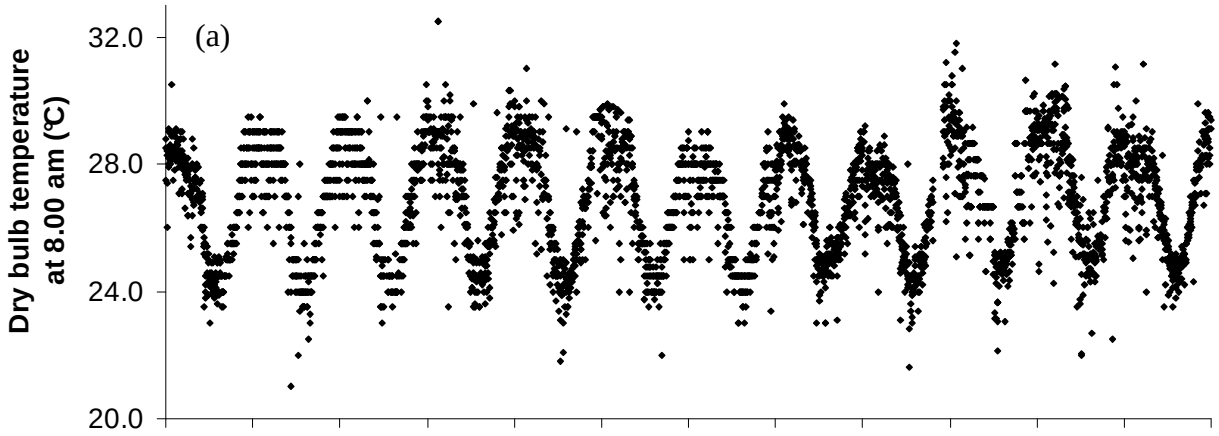


Figure 2. Timeline with daily dry bulb temperatures at the Aldabra Station (8.00 a.m.) during the period 2000-2011.

Wet bulb temperatures are less straightforward to analyse, as most data of previous years is incomplete or faulty (see 2010 Annual RO report). Therefore only the data from May 2010 (when the wet bulb was correctly installed) until the end of 2011 are shown (Figure 3). When comparing the period May – December of 2010 and 2011, there was no yearly difference in wet bulb temperatures measured ($t = -0.48$, d.f. = 456, $P = 0.63$, independent samples t-test).

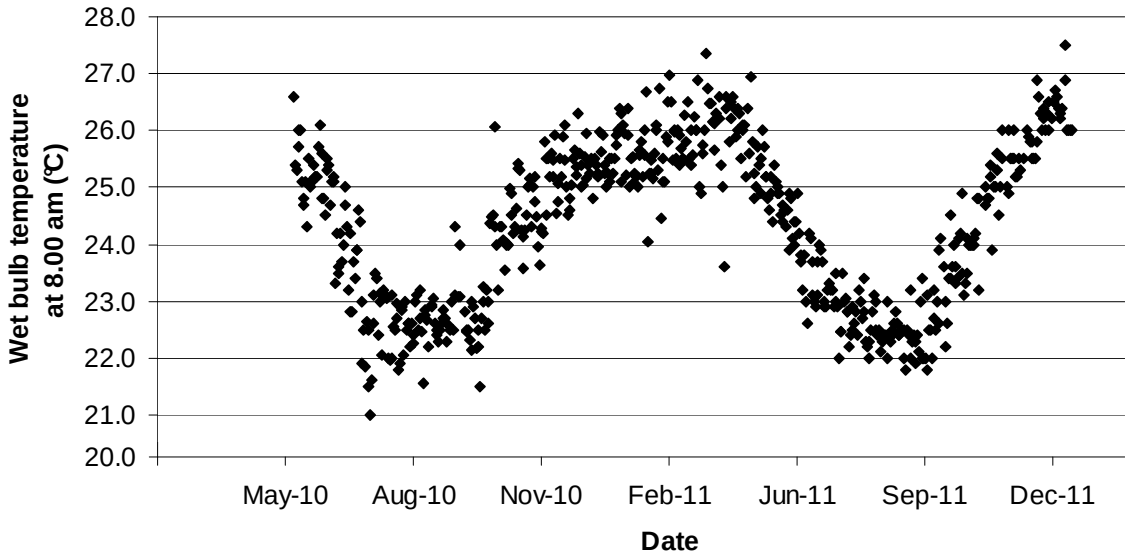


Figure 3. Timeline with daily wet bulb temperatures at the Aldabra Station (8.00 a.m.) during the period May 2010-December 2011.

The difference between the dry and wet bulb temperatures provides information for calculating the dew point, vapour pressure and relative humidity. The temperature of the wet bulb will always be lower than that of the dry bulb, unless the air is 100% saturated, in which case it will be equal. Relative humidity typically increases during the NW season, as shown in Figure 4.

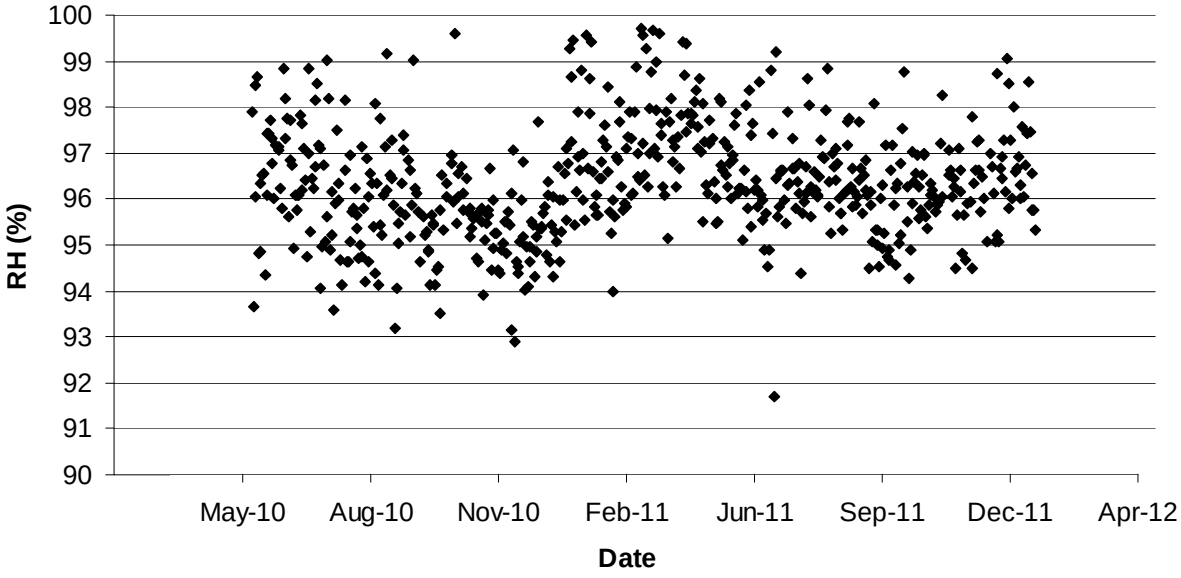


Figure 4. Relative humidity data at the Aldabra Station during the period May 2010-December 2011, as calculated from the daily wet bulb and dry bulb temperature records.

2.3. Maximum and minimum temperatures

As explained in last year's Annual RO/ASC report, a common problem during the last decade was that the maximum and minimum thermometers were not properly reset. For example, due to the lack of resetting, the maximum temperature dataset comprises long periods of consistently the same maximum temperatures with occasional upward steps. Due to the reasons mentioned above, only the maximum and minimum temperature data from May 2010 until the end of 2011 are shown (Figure 5). Only the period of May – December of 2010 and 2011 could be statistically compared. In this period, maximum temperatures of 2010 and 2011 did not differ (t = -0.49, d.f. = 416, P = 0.63, independent samples t-test), but 2011 had significantly lower minimum temperatures than 2010 (t = 9.94, d.f. = 404, $P < 0.001$).

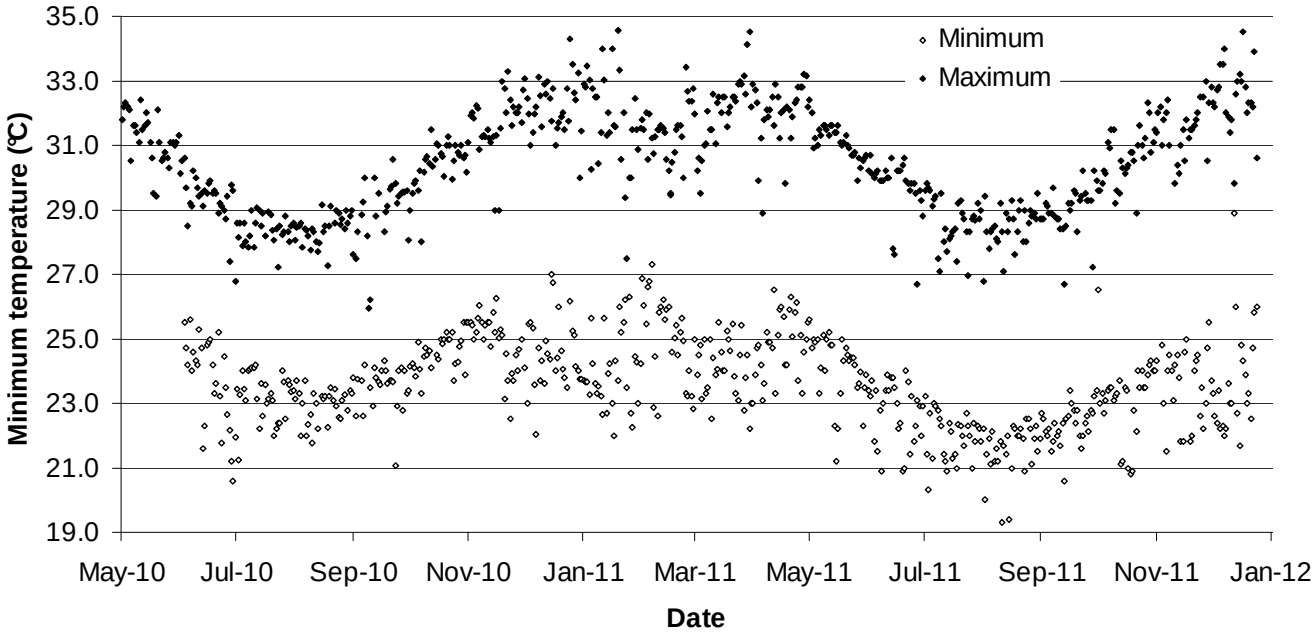


Figure 5. Timeline with daily maximum and minimum temperatures at the Aldabra Station during the period May 2010 - December 2011.

2.4. Rainfall at Picard Station

Over-all, rainfall of 2011 did not differ from the 2000-2010 average (Figure 6; t = 1.27, d.f. = 11, P = 0.23, paired samples t-test). During some months the 2011 rainfall deviated from the historical averages. Particularly February, April and May 2011 were wetter than their 2000-2010 averages, whereas July and December 2011 were notably drier.

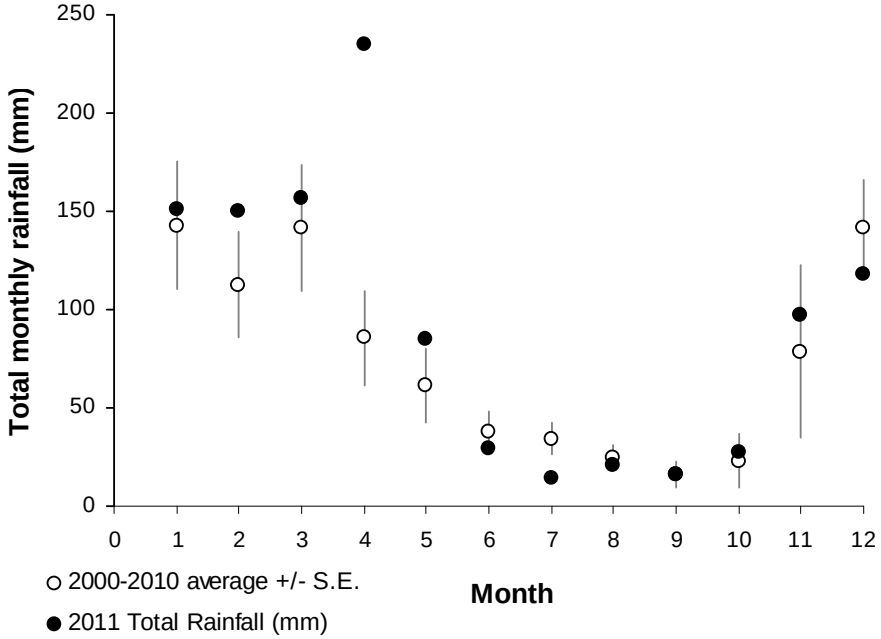


Figure 6. Total monthly rainfall measured at Aldabra Station on Picard during each month of 2011, compared to the average annual cycle of 2000–2010.

2.5. Rain gauges around the atoll

Accumulative annual rainfall data from the atoll rain gauges shows that 2011 was wetter than the last decade at most places (Figure 7). However when comparing 2011 with all previous years separately there was no difference for either rain gauge location (all $P > 0.82$, one-way ANOVA with Tukey post-hoc comparison).

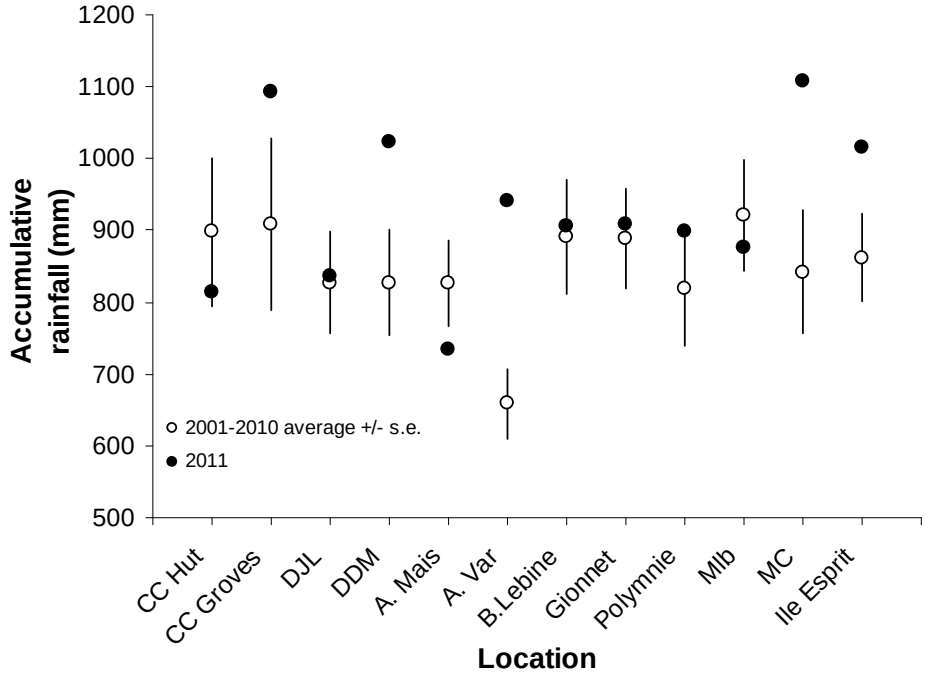
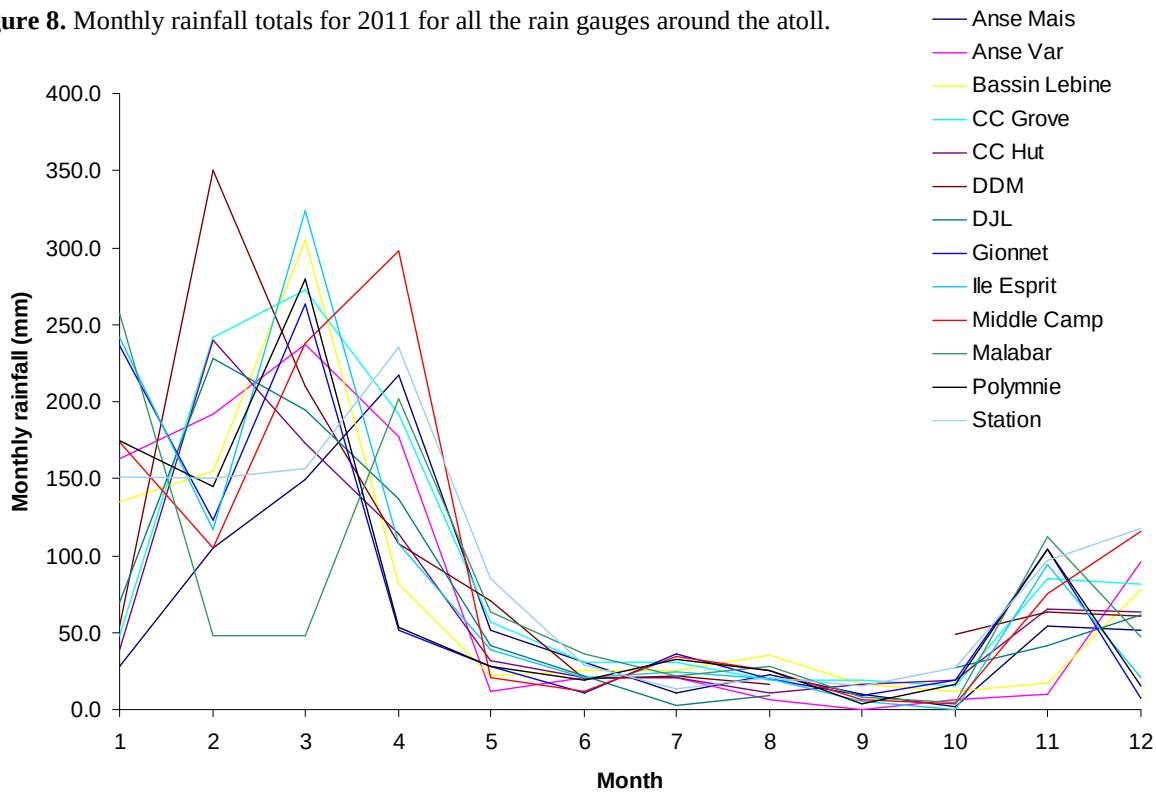


Figure 7. Annual rainfall totals for 2001-2010 (± s.e.) and 2011 for the rain gauges around the atoll.

Figure 8 shows the seasonal patterns with a clear distinction between wet and dry monsoon.

Figure 8. Monthly rainfall totals for 2011 for all the rain gauges around the atoll.



2.6. Automatic Weather Station

Figure 9. Automatic Weather Station on Picard

History

Unfortunately, the AWS has been an ongoing 'problem child'. In November 2010 the automatic weather station (Figure 9) with satellite link-up was installed on Aldabra by a team of two employees from Seychelles National Meteorological Services (SNMS; Patrick Alcindor and Hencel Hollanda). When they left, the satellite transmission device which was supposed to send the weather data to a central database, before it is disseminated to SNMS, was unfortunately not working. Also they promised to send a new CompactFlash card to the atoll on the next flight, as the one that they had was not suitable for use in the data logger. This card would allow Aldabra staff to download the daily data files at the station, although it was explained to Aldabra staff that these would be encoded in CREX format that should be converted with appropriate software. CREX format data can be decoded manually (see Appendix 1), but this is a very time-consuming job.

The appropriate CompactFlash card was received in the beginning of December 2010 and promptly inserted into the data logger. Initially it did not record any data, but after installing the appropriate software, the RO managed to connect a laptop to the data logger and download the weather data. During this time multiple disappointing realizations were made:

1) The data logger seemed to not have been configured to save to the external (CompactFlash) card. This can only be remedied by manipulating a setup file for the data logger and loading it onto the data logger, which would need some expert supervision.
2) The data logger seemed to be configured to only record seven days of weather data before deleting the previous files, despite being able to save far more (about 4 months according to the manual). This is again a setting manipulated in the setup file and requires expert assistance. As a result, all data before 21 December have been lost and the RO had to manually attach a laptop and download the data files at least once a week in order to avoid losing more data.
3) The files that were saved contained variables with strange column names and units, which did not make immediate sense. As a result, Aldabra staff could not judge (again without expert assistance) whether the weather variables are being correctly recorded. Worryingly, there seemed to be no variables that looked like temperature measurements.

In March 2011, Hencel Hollanda arrived to work on the problems of the AWS, but did not manage to fix either of these problems. He removed the satellite transmitter to be able and took it back to Mahé to send it back to Vaisala (the AWS manufacturer). He attempted to install a temporary USB cable which could be connected to a computer in the library and would allow capture of data from the transmitters. This temporary solution was explained to the incoming RO and a report detailing his work was to be provided at a later stage.

In the months afterwards, the AWS was recording data but occasionally stopped for some days without clear reasons. Furthermore there were some other issues that arose:

1) The logs are saved in text files (one each day) that have to be converted manually into Excel tables. Although the text files were easier to edit than the CREX files, it was still fairly labour-intensive. Hencel Hollanda was not able to provide a converter program or other solution, and thus Aldabra staff (Martijn van Dinther) contacted Vaisala to see if they have a solution for this. Vaisala pointed out that the program is basically not intended to log the data but is used to monitor the AWS functioning (i.e., to check whether it records data but not to save / edit it). For the AWS device type we were using on Aldabra, they (currently) have no program that can do what we want.
2) The program automatically turned off when the computer was shut down or switched user. When the computer was started up again, it was not possible to have the Vaisala program automatically started up (as it is not possible to install it in the start-up menu, so that it automatically starts when the computer is turned on).
3) It was not possible to set the logging start time, thus, when one wanted the program to log at every whole hour (e.g., at 8.00), one had to turn on the program at exactly the whole hour. It was thus very inconvenient to connect the AWS to one of the normal (multiple-user) computers.

To solve problem 2 and 3, the AWS was connected to the logistics server, but the problem of the occasional logging interruptions was still occurring.

After the AWS had once more stopped again recording in June, Aldabra staff were not able to restart communication between the computer and the AWS using the USB-connection. Reinstalling the same logging program and proper driver for the USB on the computer did not solve the problem. The same procedure was then applied on two different computers with same result. Around the time of the failure there were some heavy rains, which possibly led to a loose connection. To check the connection, the AWS had to be taken down from the pole. After this, the AWS was put on hold until SNMS technicians would come again to Aldabra.

In November 2011, Martijn van Dinther attended an AWS workshop from Vaisala on Mahé, which was organised by and for SMNS staff. The course dealt with installation and setting up software, obtaining remote access to AWS data, and AWS troubleshooting. It turned out that, to properly connect the AWS to a computer, an interface module would be needed to be placed in the data logger. There were two options:

1. RS232 module connects directly to a PC and will allow communications between AWS and PC. Data can be forwarded over the internet via a server automatically (€924).
2. Ethernet module connects via a hub and a server to the internet. This will allow remote access and communications with the AWS from any PC with the proper security clearance (€1005).

To be able to use the AWS properly SIF would have to purchase one of the two modules and the proper software. For full details on the course and more AWS info see the report (Aldabra fileserver\Monitoring\Climate\\Automatic Weather Station\Technical details and reports\Vaisala weather station training Nov. 2011.docx)
Martijn received a working version of the Observation Console Software via SMNS, but he did not manage to set it in a proper running mode until the AWS is fitted with one of the two modules.

In November 2011 Martijn also brought the repaired transmitter back to Aldabra. However, this could only be installed by SMNS staff and thus had to be stored until later use. Unfortunately no SNMS staff came with the November planes.

Data

For the few records that were collected by the AWS, the manual data and AWS data were compared. The dry bulb temperatures collected at 8.00 a.m. visually showed fairly similar patterns (Figure 10), but were statistically different with the AWS measuring on average 0.3 degrees cooler temperatures than the manual dry bulb (t = 4.09, d.f. = 37, $P < 0.001$).

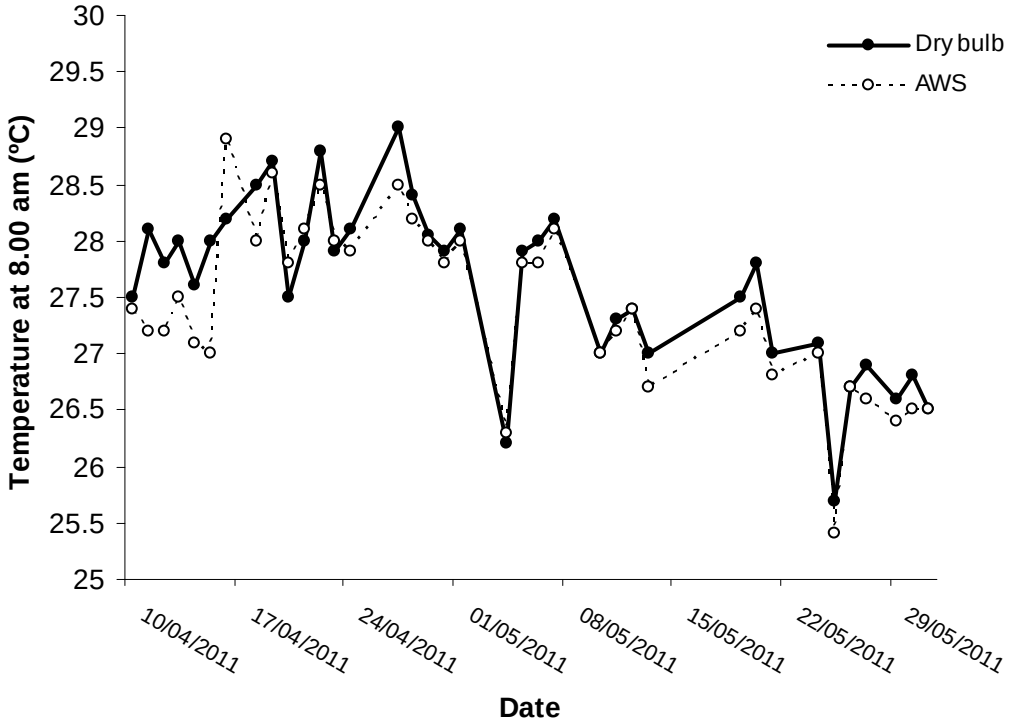


Figure 10. Comparison of morning temperatures (at 8.00 a.m.) between the manually measured dry bulb and the AWS.

Wind direction showed strong disagreements between the manual recordings and AWS. Wind direction is very changeable, and the direction measured might not always be representative for the general wind direction during that day. Mismatches did not show any link with the observer manually estimating the wind direction, or with the wind speed. It was proposed to include average wind direction for the whole hour (7.30 – 8.30 am) as measured by the AWS, but doing this did not result in less dissimilarity.

Rainfall was never properly measured by the AWS as this parameter comprises an accumulation of rain until it is reset to 0. To collect daily rainfall, it needed to be reset daily and we could not get this to work.

3. MARINE ENVIRONMENT

3.1. Turtles

Track counts of green and hawksbill turtles are conducted on a selection of beaches (Figure 11).

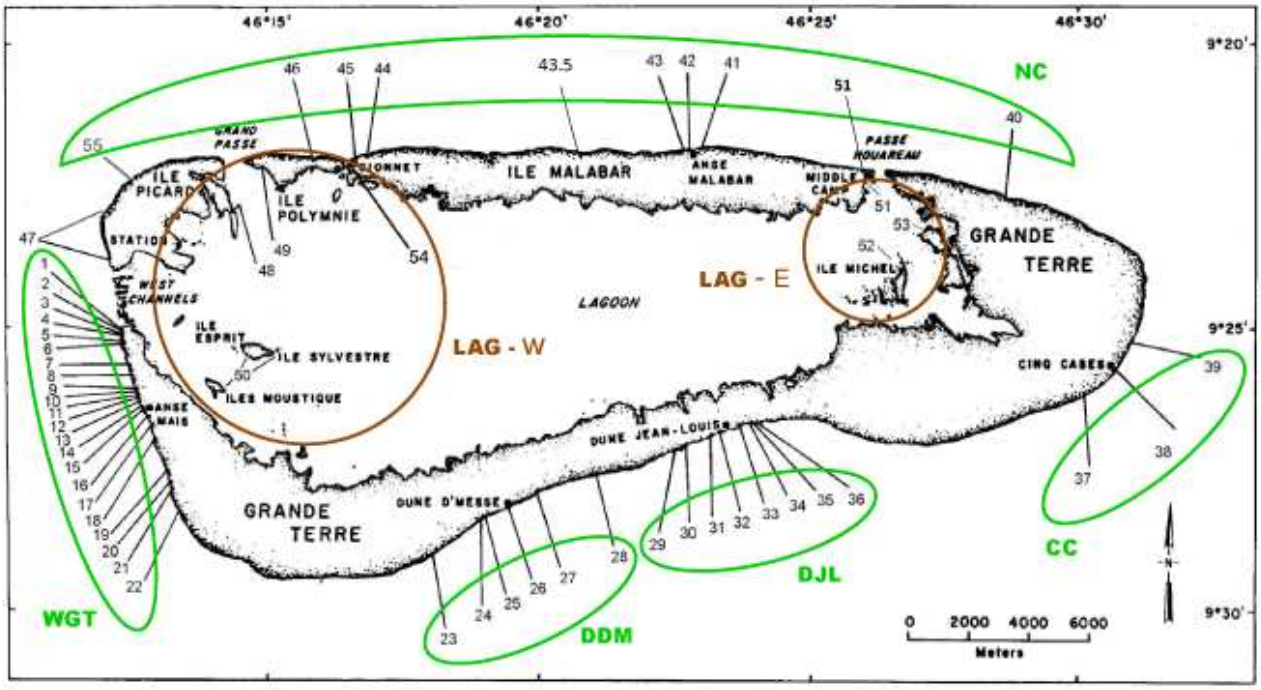


Figure 11. Numbered beaches on which turtle track counts are conducted (derived from turtle track count field protocol by Mortimer 2009).

3.1.1. Track counts green turtles

The green turtle track surveys conducted during 2011 are summarized in Table 2.

Table 2. Number of turtle track surveys conducted on the various beach groups during 2011.

Location	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
SB	31	28	31	26	30	31	31	31	30	30	30	31	**360**
WGT	3	3	4	3	3	3	4	4	4	3	4	2	**40**
DDM	2	2	2	2	2	2	2	2	2	2	2	0	**22**
DJL	2	2	2	2	2	2	2	2	0	2	2	0	**20**
CC	3	3	2	2	1	0	2	2	2	2	2	2	**23**
NC	2	3	4	1	0	1	2	2	1	1	2	1	**20**
Lagoon	1	2	2	n/a	n/a	n/a	n/a	n/a	0	1	2	1	**9**
A.Var	1	1	1	1	1	1	1	1	1	1	1	1	**12**

* Only surveyed between September and March

Table 3 shows the number of track counts done in 2011 with previous years (starting with 2007 as older data is stored in older FileMaker Pro versions and therefore not accessible).

Table 3. Number of turtle track surveys conducted on the various beach groups during 2011 compared to earlier years.

Location	2007	2008	2009	2010	2011
SB	353	354	365	365	**360**
WGT	50	27	35	41	**40**
DDM	19	14	16	16	**22**
DJL	20	12	13	16	**20**
CC	15	10	16	10	**23**
NC	20	15	21	19	**20**
Lagoon	5	3	12	10	**9**
A.Var	18	16	12	14	**12**

Settlement Beach

As in 2010, data collected on Settlement Beach included GPS coordinates of each individual track and an assessment whether the turtle was likely successful or not in laying eggs during her emergence. To import the GPS coordinates from the GPS device to the computer, a single-user license of the program GPSExpert was purchased in August and installed on the ASC laptop. This is a great gain compared to the manual entering that was done before.

In Figure 12 the monthly totals of emergences and the totals for each type are shown. The 'nest' category is only differentiated on SB as this is the only beach that is recorded daily. Nests are only recognizable when the track is fresh. On all other beaches, the ‘nest’ category is therefore included in the 'VF' category. Note that in January, February and March some ‘nest’ data was missing, and therefore the proportion of nests is an underestimation.

In March and April 2011 the nesting peak was highest, with on average 28 emergences per day.

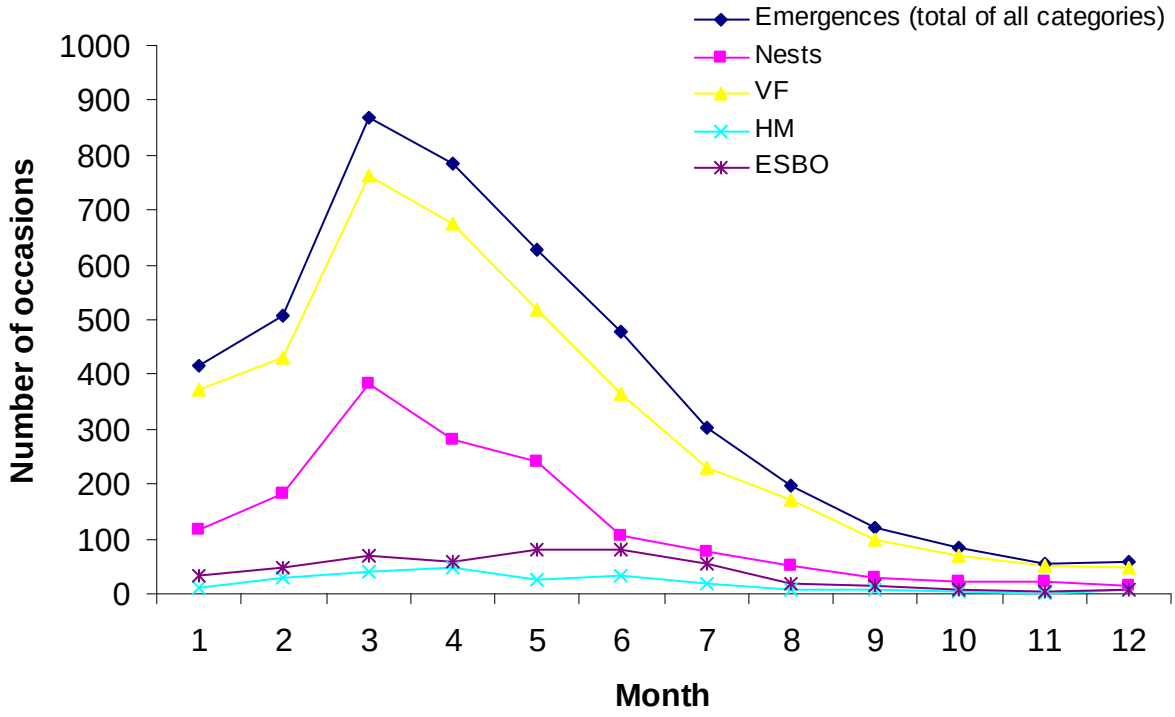


Figure 12. Annual patterns of green turtle emergence types encountered on SB during 2011 (Nest = visually judged to be a successful nest, ESBO = 'emergence stopped by obstacle', HM = 'half-moon' track (no digging), VF = 'very fresh' - emergence from previous night, which involved digging attempts).

When comparing this year's data with those of previous years (Figure 13), it appears that 2011 was a good year in terms of green turtle nesting on Settlement Beach. The daily emergence averages were the highest measured to date, and showed a peak similarly timed as the peak in 2007. At the end of 2011 though, the daily emergence averages were notably lower than in 2010. Table 4 shows total numbers of emergences for each of the years plotted in Figure 13, and reveals that in the last five years where daily track counts are done on Settlement Beach (in bold), 2011 was – after 2010 – the second best year in terms of total emergences.

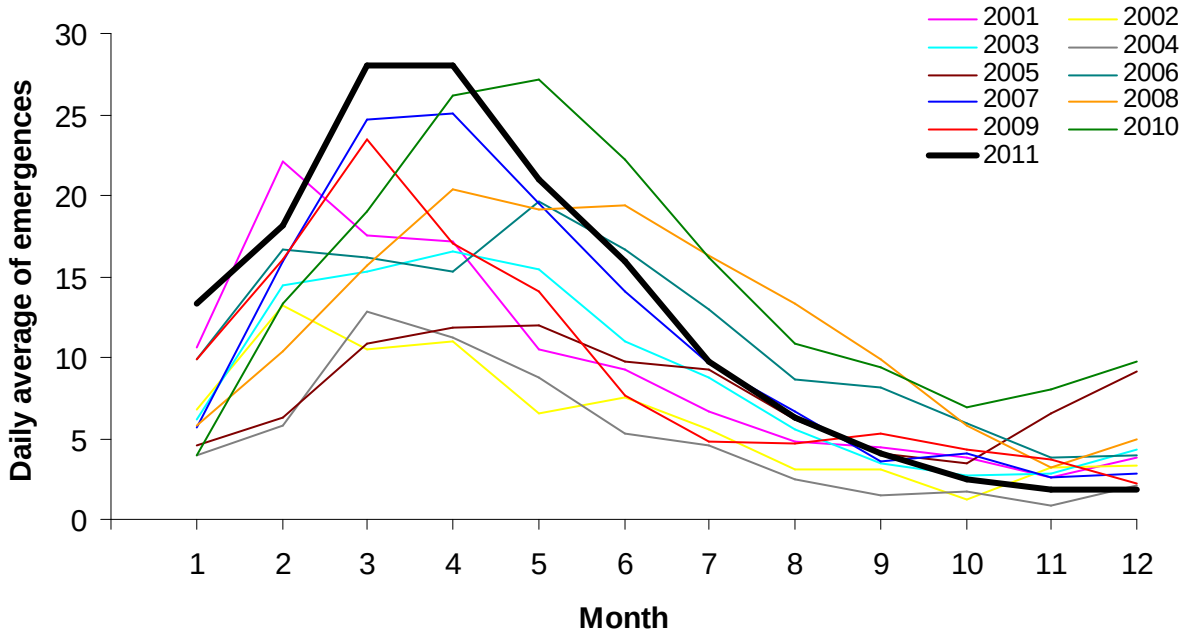


Figure 13. Daily averages of green turtle emergences throughout the year on Settlement Beach, for the period 2001-2011. The graph shows the timing and height of the nesting peak. As turtle tracks counts on SB were not conducted on daily basis before 2006, daily averages instead of monthly totals are taken.

Table 4. Total number of emergences on Settlement Beach for each year in the period 2000-2011.

Year	Total # track counts done	Total # emergences	Total # VF	Total # HM	Total # ESBO
2000	116	444	375	23	46
2001	134	1181	1021	60	100
2002	136	801	653	57	91
2003	167	1452	1254	76	122
2004	178	894	801	34	59
2005	206	1649	1435	61	153
2006	274	3010	2599	161	250
2007	**353**	**3937**	**3393**	**213**	**331**
2008	**354**	**4189**	**3547**	**211**	**431**
2009	**365**	**3407**	**2774**	**209**	**424**
2010	**365**	**5211**	**4627**	**199**	**385**
2011	**360**	**4500**	**3789**	**232**	**479**

West Grand Terre

Turtle track counts on West Grand Terre are normally done twice per month, either by foot or – when seas are rough – by boat. In previous years the nesting peak at WGT seemed to be timed later than the peak at SB, occurring between May and July instead of March - April. In 2011 however,

the WGT nesting peak seemed to be times earlier than the SB peak, namely in February (Figure 14). A reason for the spatial dissimilarity in nesting peak might be related with differences in beach erosion patterns, which is currently investigated by Jeanne Mortimer.

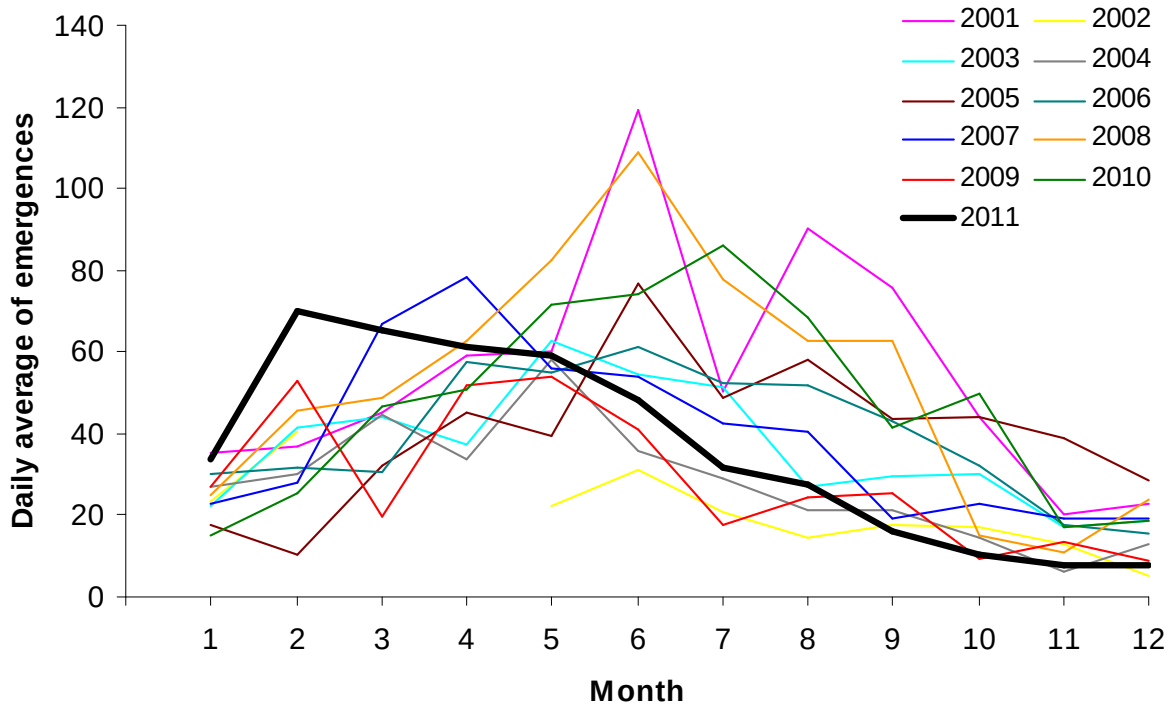


Figure 14. Daily averages of green turtle emergences throughout the year on WGT, for the period 2001-2011.

3.1.2. Track counts of hawksbill turtles

During the period September–March, track counts of hawksbill turtles are conducted every two weeks on the beaches in the inside of the lagoon. According to Mortimer (see Turtle track count Field Protocol 2009), probably less than 30 hawksbill females emerge yearly on Aldabra. With the current efforts there are too few data to reliably interpret the results (Table 5). More surveys should be done on a regular basis to get more insight in daily patterns, but this is only possible on the days that the morning tide is sufficiently high to access the lagoon. During these high (spring) tide circumstances, surveys are however problematic because the water level nearly reaches the top of the beaches and tracks may be washed away. If more information is to be gained on hawksbill nesting, more camping trips to these beaches, in combination with regular surveys (more often than twice a month) should be conducted.

Table 5. Monthly totals of hawksbill turtle emergences on the lagoon beaches in 2010 and 2011, with in brackets the number of surveys conducted.

Month	Total number of hawksbill emergences (# surveys)	
	2010	2011
January	n/a	2 (1)
February	n/a	5 (2)
March	1 (2)	0 (2)
September	0 (2)	n/a
October	3 (2)	4 (2)
November	2 (2)	4 (3)
December	11 (2)	2 (1)
Total	**17 (10)**	**16 (11)**

3.1.3. Turtle tagging

In 2011 a total of 148 nesting green turtles were encountered during tagging missions. The majority was newly tagged, but there were also many re-sightings (Table 6). During in-water tagging mission ('rodeo') in the lagoon, 61 turtles were captured, of which most were green turtles. The Table also provides a comparison of 2011's catch with earlier years.

Table 6. Summary of turtles encountered during tagging operations in 2007-2011.

		Year	2007	2008	2009	2010	2011
Green turtles							
	nesting	encountered	346	378	126	126	148
		newly tagged	231	219	56	71	85
		re-sighted	115	159	70	55	63
	in-water	encountered	106	66	33	12	41
		newly tagged	97	62	27	9	34
		re-sighted	9	4	6	3	7
Hawksbill turtles							
	in-water	encountered	42	38	17	7	20
		newly tagged	30	20	10	2	11
		re-sighted	12	18	7	5	9

The 'tag search database' can be used to look up the re-sighted turtles. Figure 15 shows all re-sightings (excluding re-sighted turtles that were first tagged in 2011 and turtles that were re-sighted in the same year as in which they were tagged). The 'oldest re-sightings' were three turtles that were first tagged in 1997. Note that no turtles that were first tagged in 2009 and 2010 were encountered, but this agrees with literature reporting that female green turtles may return repeatedly to the same nesting grounds after intervals of only two, three, four or more years spent at their feeding grounds (Carr *et al*. 1978, Hughes 1982, Mortimer 1988). A few turtles were re-sighted between the year of first tagging and 2011 (Figure 15, Table 7). It seems that mainly turtles tagged / re-sighted in 2005, 2006, 2007 and 2008 were returning in 2011. However, it is delicate to interpret these data, e.g., as tagging is not done every (full) night many emergences have been missed and the dataset does thus not entail the full number of emergences.

Almost all turtles were tagged or at least re-sighted on Settlement Beach, however one turtle was both tagged and re-sighted on WGT (but not on the same beach; it was tagged on beach #5 (in 2001) and re-sighted on beach #19).

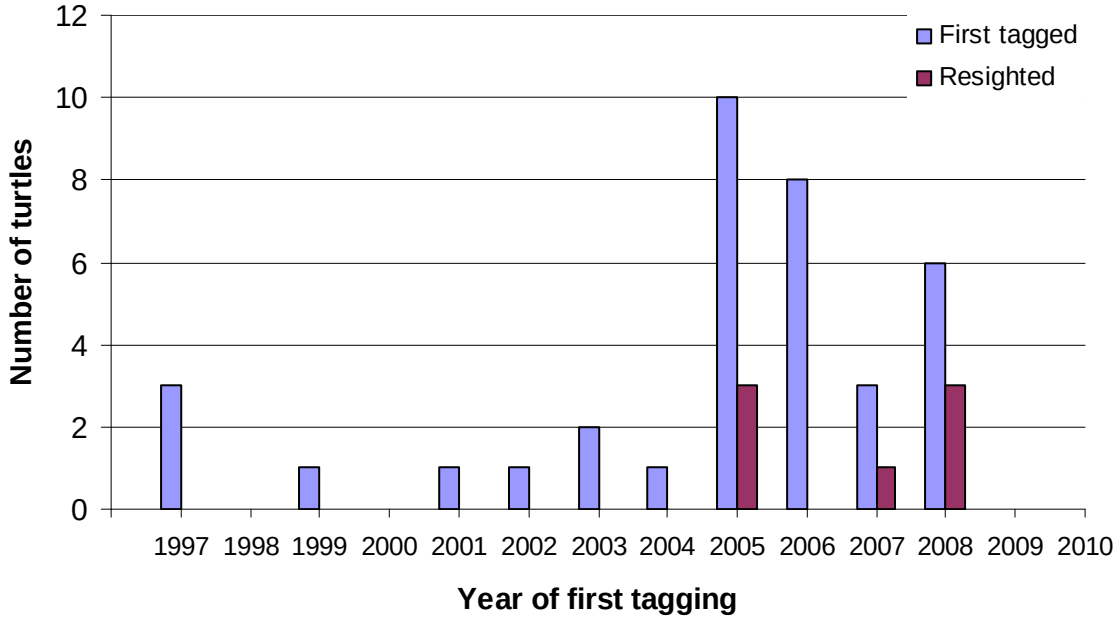


Figure 15. Turtles captured in 2011 and first tagged or re-sighted in previous years. All these turtles were first tagged in daily averages of green turtle emergences throughout the year on WGT, for the period of 2001-2011.

Table 7. Green turtles captured in 2011 with one or more re-sightings in previous years.

Date	Right tag	Left tag	First tagged	Resighting1	Resighting2
20/01/2011	SEY9259	SEY9260	2006	2007	
30/04/2011	SEY7241	SCA3017	2005	2005	
12/05/2011	SEY1924	SEY1925	1997	2005	2008
15/05/2011	SEY5450	SCA1827	2002	2008	
03/06/2011	SEY1942	SEY1943	1997	2005	
02/07/2011	SEY8084	SCA0700	2005	2008	

3.1.4. Green turtle satellite tagging

Background

In the beginning of 2011, a grant from ISSF was received that made it possible to establish a new direction to Aldabra's turtle monitoring programme: the satellite tracking of a number of female green turtles to identify areas they migrate to forage. The data will help improve understanding of which threats these turtles are exposed to away from Aldabra and how these can be addressed.

A successful atoll-wide monitoring and flipper-tagging programme on the turtles has been operating for over 40 years and is producing important data. However, despite being such a significant site and thousands of tagged turtles, satellite telemetry has never been used on turtles from Aldabra and it is not known to where these breeding turtles migrate. This is essential to understand the threats they are exposed to when away from Aldabra either within the Seychelles or further afield.

Since turtles are highly migratory species, to effectively conserve them it is vital to understand the linkages between breeding and foraging sites. Potential trans-boundary issues can only be identified and addressed using such a holistic approach. Tagging returns have produced some data but, even after decades, such findings are limited and labour intensive, with up to several hundred tagged turtles required for a single tag return (elsewhere) and indicative of only a single location of the turtle. Satellite tracking therefore has clear additional benefits to the long-term tagging programme.

Methods
After thorough investigations by the ASC and Nancy Bunbury, eight KiwiSat Argos 101 Position Tracking Terminals (PTT) were ordered with Sirtrack (www.sirtrack.com), and they were received with the September 2011 supply boat. In October, all eight PTTs were unpacked and tested. Two PTTs were left turned 'on' for 24 hours to establish contact with Argos satellites. Using the Argos website (www.argos-system.cls.fr), we confirmed that the location of the two PTTs was shifted from New Zealand (manufacturer) to Aldabra. Concluded was that the tags were working, sending signals to the Argos satellites.

A containment box out of ply-wood was constructed, and a "base-camp" was set up in one of the buildings of the old settlement. All necessary material to tag two turtles was placed at the base-camp, i.e.:

- Containment box
- Tags (PTTs)
- Water
- Cleaning detergent
- Nail polish remover
- Sanding paper
- Epoxy
- Rags

It was decided to spread out the satellite tagging into two to three periods in case the turtles nesting at different times are migrating to different places (Rees *et al*. 2010; Witt *et al*. 2011). The aim was to tag two turtles in Oct-Dec 2011, then another three in Jan-March 2012 and the last three in May-June 2012.

Turtles would only be considered a candidate when caught towards the end of the breeding season (rather than during the first attempt). During the breeding season, the female turtles reside around the atoll; during this time the risk that the tag would be knocked off due to mating behaviour or hiding underneath rock/coral is high. Data investigation of Aldabra green turtle re-sightings over the period 2007-2011 (by AASC Joel Souyave) indicated that on average the frequency at which a female green turtle is recorded to return to nest within a nesting season is 2.59 times. The average time interval between these recorded attempts is 22.3 days. To increase the chance of the turtle leaving Aldabra waters quickly and reduce the likelihood of mating knocking off the transmitters it was decided that only turtles that have resided around Aldabra for a minimum of one month (with records of laying eggs) would be eligible for tagging.

At the beginning of October, attempts were started to find a suitable candidate through extra beach patrols along Settlement Beach. On the 17th of October, a suitable candidate was found (SCA3123/SCA3155) in zone 2. She had been tagged five weeks earlier while nesting on the 13th of September. The containment box and tagging material were easily retrieved from the "base camp" at the Old Settlement. The turtle was contained within the box and a cloth was used to cover the head to try and keep her docile. At all times there was at least one person holding a cloth over the turtle's head.

Figure 16. Cleaning the carapace and placing epoxy on the PTT.

Following the protocol, the carapace was rinsed with water and soap and sanded with fine sanding paper (Figure 16). After sanding the carapace was degreased with acetone. A similar process was repeated on the transmitter after switching it on. Epoxy adhesive was applied on the bottom of the transmitter and this was firmly pressed on the carapace of the GT. After 15 minutes a first thin layer of epoxy was placed on the carapace around the PTT and on the sides of the PTT (Figure 16). After 15 minutes a thin layer of epoxy was placed all over the PTT (except the front and back contact points) and spread towards the carapace. After another 15 minutes a last thin layer of epoxy was spread across all visible epoxy layers. After approximately 20 minutes a thin layer of anti fouling paint (Figure 17) was applied on all visible epoxy layers. The paint was left to dry for 20 minutes.

At 22:15 pm our first tagged green turtle was released in the waters of Aldabra. Following the suggestion of Jaime Cavelier (Sr. Biodiversity Specialist Eastern and Southern Africa & Biosafety and ABS at the Global Environmental Facility (GEF)), who was present during the tagging, the turtle was named ‘Monique’.

Figure 17. Applying anti-fouling paint and the release of ‘Monique’.

Data transmission and results
On the Argos website, results are shown in classes according to accuracy. Classes G, 3 and 2 show the most accurate results (Table 8).

Table 8. Signal strength classes on the Argos website.

Class	Type	Estimated error	Number of messages received per satellite pass
G	GPS	< 100m	1 message or more
3	Argos	< 250m	4 messages or more
2	Argos	250m < < 500m	4 messages or more
1	Argos	500m < < 1500m	4 messages or more
0	Argos	> 1500m	4 messages or more

After a period of swimming in the Aldabra's waters close to the Settlement and WGT, Monique moved away from Aldabra in a NNE direction. The first point that was received of her going away from Aldabra was on November 7th, located 140 km NNE of Aldabra. After her first point was recorded, she started coming close to the large seamount (Figure 18; coordinates data stored on fileserver), when she turned slightly more east, coming within 20 km of the seamount. Interesting to note is that there was quite some variation in the distance swum per time unit. It seems that sometimes she moved slowly, and then suddenly she covered substantial distances. Since our main interest is in long-distance migration routes and general location of the turtles, our transmitters were programmed to collect and transmit data for a 24 hour period every 5 days, a setting which was also intended to maximise battery life, potentially for the entire inter-nesting period.

From the 22nd of November onwards, Monique seemed to be residing in the Amirantes Group, moving between St. Joseph Atoll and Remire. Unfortunately, from the 7th of December onwards, no signal from Monique was received anymore. Several scenarios could be possible: the tag might have stopped working or has been knocked off by mating or hiding (as she was residing in shallow areas), or something has happened to Monique herself which we don't hope for. However, in the beginning of 2012, while tagging a second turtle, problems with the epoxy were encountered. After contacting the manufacturer it turned out that the epoxy that we used exceeded the shelf-life by two years and its quality may have been impaired. This may well be the reason for loosing Monique's tag.

Due to the low nesting frequency of the green turtles in the end of 2011, no more suitable candidates were found. The next turtle would be tagged only on February 24th of 2012.

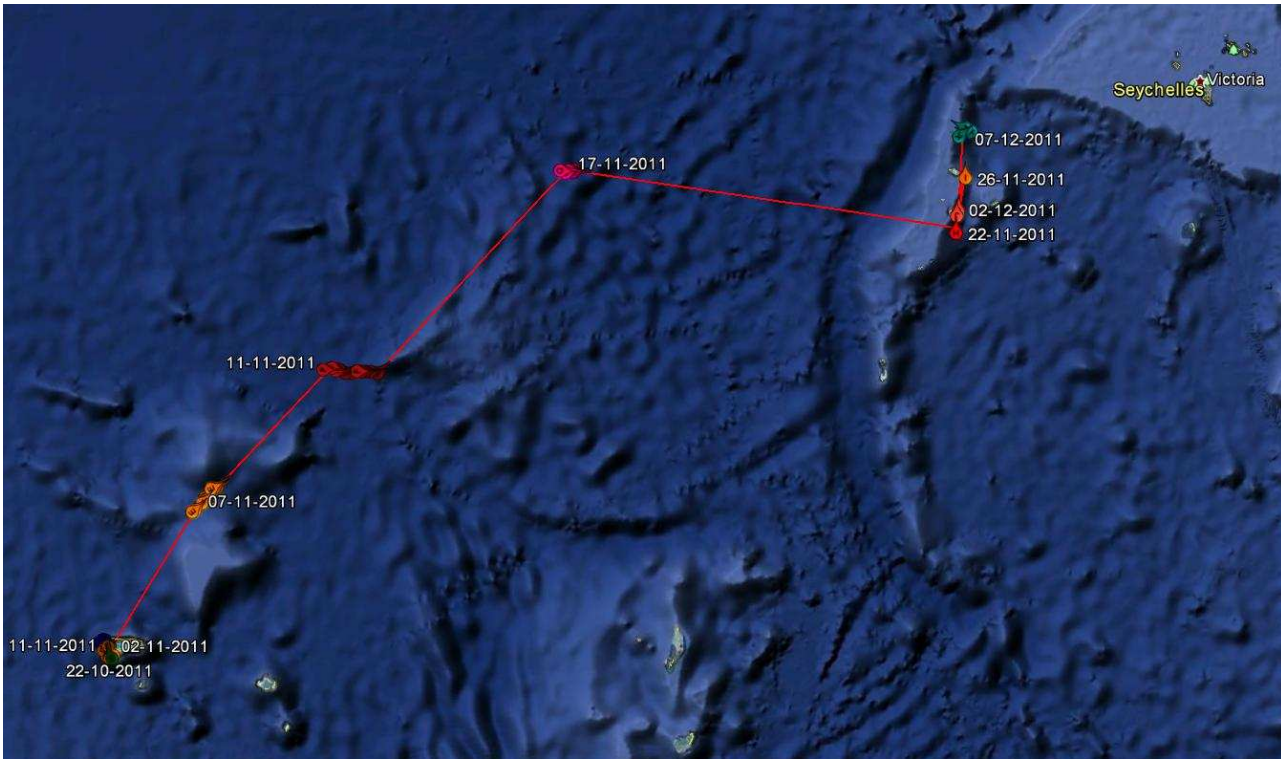


Figure 18. Monique's travels before transmissions ended on 07/12/11.

All transmission data from the PTT have been downloaded from the Argos website and saved in a designated folder on the fileserver:
ALDABRASERVER\fileserver\Monitoring\Reptiles\Turtles\Green turtle satellite tracking - project 2011\Argos\Argos data

Seaturtle.org
An account was made on www.seaturtle.org. The website provides us with an automated daily downloading of all the new data from the ARGOS satellite. The advantages of this website are that their online STAT program can be used to produce maps and analyse the data from the satellite tags. The website also provides the possibility to create an outreach for showing the work being done on Aldabra. In this initial stage of the project, this has not been set up yet as we should carefully look at how and what to present (and first need to fine-tune the process and tag more turtles). To access STAT, log in to seaturtle.org and go to the following URL: http://www.seaturtle.org/cgi-bin/argos/index.pl.

3.1.5. Hawksbill turtle DNA sampling

SIF received a request from PhD student Karl Philips (University of East Anglia, UK, supervised by Dr. David Richardson) to collect tissue samples of nesting hawksbill females. Collection of such samples was logistically difficult as they nest only on the lagoon beaches in low frequencies.

For the PhD project the connectivity between hawksbill populations breeding across the Seychelles is being investigated. The population connectivity work will allow for studying movements and migrations, assess genetic variability within and between populations, and define genetically distinct populations that may require separate management. This information is important knowledge that will assist the conservation of this critically endangered species in the Seychelles and beyond.

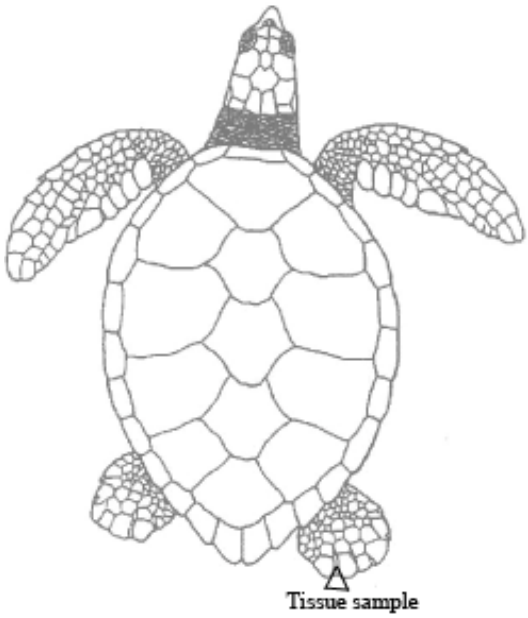


Figure 19. Location on flipper suitable for turtle tissue sampling.

Tissue samples from turtles are best taken from the trailing edge of one of the (hind) flippers. A triangle of flesh 3-4mm in length and breadth is removed (Figure 19). It should be taken close to the body, ideally from one of the big scales (it is easier to get a good clean cut where the tissue is slightly harder, but the sample needs to include flesh as well as scale). Logically, the scalpel needs to be disinfected (ethanol if available) and sterilised (heat) the scalpel before and after use. We managed to collect 16 tissue samples of sub-adult hawksbill turtles during the in-water tagging sessions.

3.2. Subsistence fishing

For this monitoring programme, a much-improved new database was created by Philip Haupt (see introduction), which greatly facilitated data analyses. In the new database, both length and weight measurements are entered from each individual fish caught. Both length and weight measurements of every fish have been taken for several years, but the previous database did not allow individual length measurements to be entered and only allowed the summed weight of each species (rather than individual weights). As a result, much data resolution was lost during data entry. All these historical data have now been manually entered so that individual length and weight measurements are present wherever possible.

In 2011, Aldabra staff conducted 55 subsistence fishing trips, of which 34 trips involved both bottom fishing and trolling, 14 trips involved only trolling and seven trips involved only bottom-fishing. A total of 1316 fish were caught that weighed in total 3807 kg. Note that this is over double as much as in 2010 (when 37 trips yielded 567 fish with a total weight of 1742 kg). The larger may be partly due to large staff presence particularly in the end of the year, when a team of contractors was present to build the power house for the solar power system. Also, from October onwards, SIF staff were working on Assumption (EC invasive bird eradication project). For this staff fish was regularly brought to Assumption during crossings, which required extra fishing efforts.
However, Figure 20 shows that efforts were high throughout the whole year. It is therefore wise to evaluate the fish consumption rate and quantities served particularly during communal dinners (and not wasted). This should in particular be regularly discussed with the Station Cook, who should carefully consider a serving quantity that is sufficient but no surplus. Only if the fish is actually consumed and not wasted can large catches be justified.

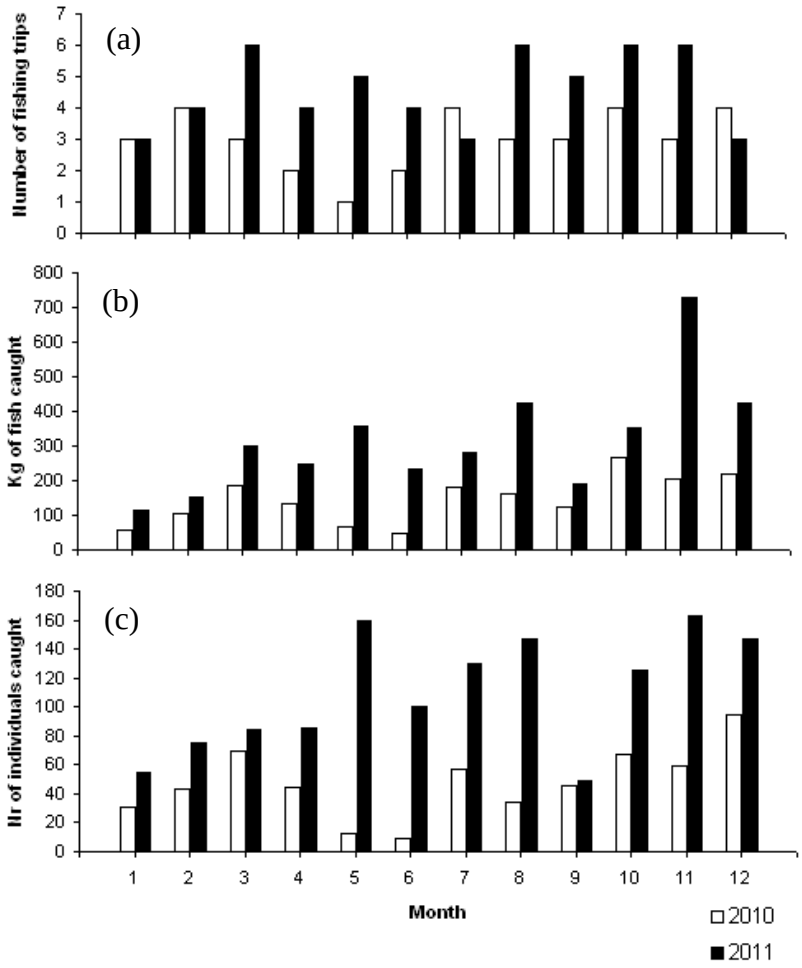


Figure 20. (a) Monthly subsistence fishing efforts in 2011 and 2010, along with (b) monthly numbers of individuals and (c) kg of fish caught.

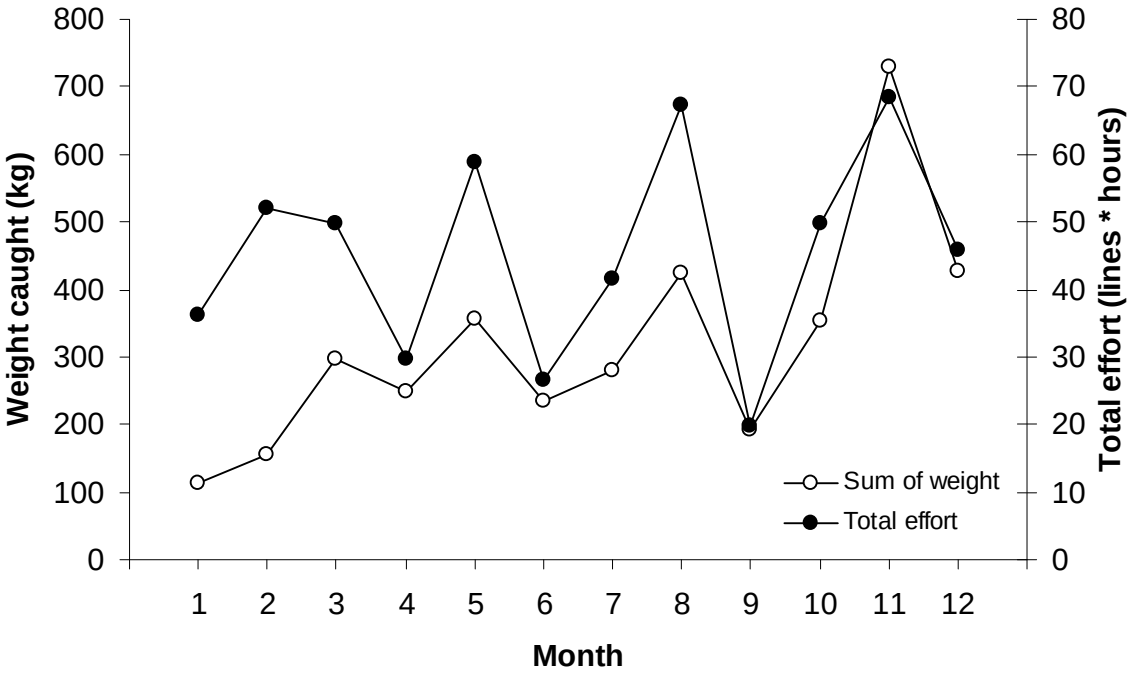


Figure 21. Monthly totals of the weight of fish caught and fishing effort (calculated as number of fishing lines*number of hours).

Table 9 shows a list of all fish caught. Nearly half of the total weight was made up by demersal fish.

Table 9. Summary of measurements of all the fish caught during subsistence fishing trips in 2011.

Species	*Species (Latin)*	Nr. of indivi-duals caught	Total weight (kg)	Average weight (kg) ± s.e.	Average length (cm) ± s.e.
Demersal fish					
Potato bass / Vyey toukoula	*Ephinaphilus tukula*	7	100.5	14.4 ± 1.6	93.1 ± 2.9
Blacktip grouper / Madanm dilo	*Ephinephelus fasciatus*	16	4.6	0.3 ± 0.03	26.8 ± 0.5
Brown marbled grouper / Vyey goni	*Ephinephelus fuscoguttatus*	39	126.9	3.3 ± 0.3	55.4 ± 1.3
Camouflage grouper / Vyey masata	*Ephinephelus polyphekadion*	82	230.9	2.9 ± 0.1	53.3 ± 0.8
Coral hind / Vyey zannannan	*Cephalopholus miniata*	38	23.6	0.6 ± 0.04	33 ± 0.6
Giant grouper / Vyey krab	*Ephinephelus lanceolatus*	2	38.5	19.23 ± 5.3	98.8 ± 5.3
Humpback red snapper / Terez	*Lutjanus gibbus*	5	4.4	0.9 ± 0.3	32.5 ± 1.5
Marbled coral grouper / Vyey babonn	*Plectropomus punctatus*	7	54.1	7.7 ± 1.2	76.7 ± 4.2
Moontail seabass / Kwasan	*Variola louti*	178	383.0	2.2 ± 0.1	47.9 ± 0.4
Napoleon fish / Babonn Sesil	*Cheilenus undulatus*	1	3.6	3.6	58
Onespot snapper / Semiz	*Lutganus monostigma*	1	0.6	0.6	35
Peacock grouper / Vyey kwizinyen	*Cephalopholis argus*	1	1.6	1.6	41
Yellowlip emperor / Bawa	*Thunnus albacares*	1	1.5	1.5	46.6
Red mouth grouper / Vyey galfa	*Aethaloperca roggea*	2	3.6	1.8 ± 0	42.6 ± 2.3
Tomato hind / Msye angar	*Cephalopholis sonnerati*	6	9.9	1.7 ± 0.1	44.2 ± 1
Rovin coral grouper / Babonn zannannan	*Plectropomus pessuliferus*	4	22.1	5.5 ± 1.3	69.9 ± 5.3
Scribbled snapper / Bourzwa dezil	*Lutjanus rivulatus*	1	5.4	5.4	58
Smalltooth emperor / Bek long	*Lethrinus concyliatus*	2	8.3	4.1 ± 1.7	64.60 ± 9.4
Snubnose grouper / Vyey sat	*Lethrinus borbonicus*	13	28.4	2.2 ± 0.4	48.0 ± 2.6
Spangled emperor / Kaptenn rouz	*Lethrinus nebulosus*	141	370.6	2.7 ± 0.1	52.2 ± 0.6
Whiteblotched grouper / Vyey plat	*Ephinephelus multinotatus*	227	457.2	2.0 ± 0.1	49.4 ± 0.4
Squirrelfish / Lyon	*Holocentrus rufus*	4	23.8	6.0 ± 2.7	67.5 ± 12.9
Redgill emperor / Baksou	*Lethrinus lentjan*	15	14.7	1.0 ± 0.1	35.0 ± 1.2
Twinspotted red snapper / Varavara	*Lutjanus bohar*	288	464.56	1.6 ± 0.1	41.6 ± 0.5
Trigger fish / Bours	*Balistidae*	4	12.4	3.1 ± 0.6	43.6 ± 2.4
Total demersal fish		**1085**	**2394.5**		

Pelagic fish					
Yellowfin tuna / Ton zonn	*Thunnus albacares*	20	186.3	9.3 ± 1	77.4 ± 3.4
Bluefin trevally / Karang ver	*Caranx Melampygus*	43	129	3.0 ± 0.2	54.6 ± 1.1
Wahoo / Kin fis	*Canthrocybium solandri*	16	184.6	11.5 ± 0.9	120.6 ± 2.3
Dogtooth tuna / Ton ledan	*Gymnosarda unicolor*	15	169.6	11.3 ± 2.2	85.2 ± 6.2
Giant trevally / Karang ledan	*Ephinephelus lanceolatus*	80	601.2	7.5 ± 0.6	69.6 ± 1.6
Green jobfish / Zob gri	*Aprion virescens*	19	61.2	3.4 ± 0.5	60.7 ± 2.4
spotted saddleback grouper / vyey	*Plectropomus areolatus*	16	27.7	1.7 ± 0.2	51.4 ± 6.2
Big-eye tuna / Big-eye tuna	*Thunnus obesus*	1	3.2	3.2	61
Rainbow runner / Galate	*Elagatis bipinnulata*	10	28.3	2.8 ± 0.3	64.7 ± 2.1
Great barracuda / Tazar	*Shyraena barracuda*	11	21.1	3.5 ± 0.4	80.6 ± 2.6
Total pelagic fish		**231**	**1412.1**		
Grand total		**1316**	**3806.6**		

3.3. Marine mammals

3.3.1. Cetaceans

The humpback whale season started this year with the first observations on 9th July and lasted until 3rd November. In this period, 66 sightings of humpback whales were recorded (Figure 22; compared to 26 sightings in 2010). Of the 2011 sightings, 31 sightings included one individual, 30 sightings included two individuals, three sightings included three individuals, one sighting included four and there was one sighting of five individuals. The pairs or groups often included young calves, and adults were seen practicing with the calves how to breach. In some occasions the management meeting in the mess was put on hold for some minutes as the whales were 'putting on a show' in front of the settlement.

Staff practiced the crossbow for the tissue sampling on land under supervision of the ASC, but the trigger mechanism failed. The crossbow was sent back to Mahé. In December another, well-functioning, crossbow (from David Rowat) was sent to Aldabra.

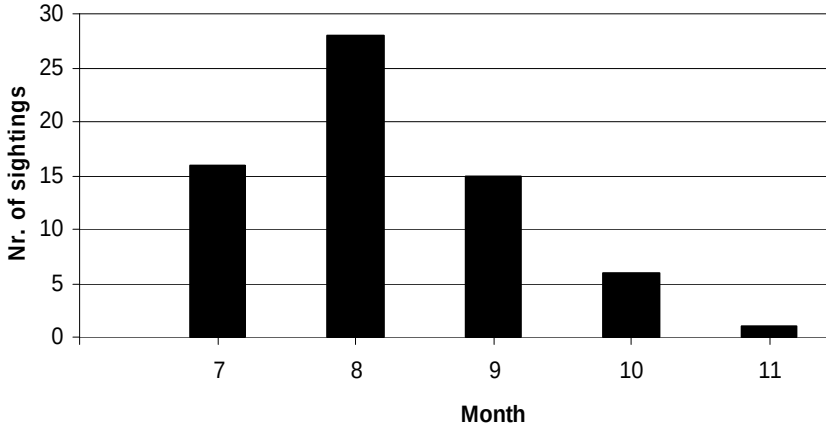


Figure 22. Monthly distribution of humpback whale sightings in the 2011 season.

Throughout the year, 15 sightings of spinner dolphins were recorded, ranging from five to 150 individuals per sighting. It was attempted to make hydrophonic recordings, but the device was not functioning.

3.3.2. Dugongs

Unfortunately no dugongs were seen in 2011.

4. TERRESTRIAL ENVIRONMENT

4.1. Giant tortoises

4.1.1. Regular transect monitoring

The currently used long-term database contains monitoring data of 12 tortoise transects around the atoll at monthly intervals, in the period from 1998 until present. The database includes data on the sizes of tortoises in the form of the widths of their third dorsal scute.

On a number of locations (generally Picard and Malabar) the average scute widths recorded during 2011 agreed well with historical (1998-2010) averages (Figure 23). On Grand Terre, female sizes in 2011 were generally smaller than the historical margins. For males this was only the case on CC Grove, CC Coast and the DDM transects. Largest sex differences in scute size were found on Malabar and Picard. It is striking that on CC Coast size differences between sexes were larger than on the other CC transects. With the ever-changing team of research staff conducting the transects, it is important that everyone is well trained in how to measure the third scute and to look out for baby tortoises as well. These factors are important in keeping the data consistent over time.

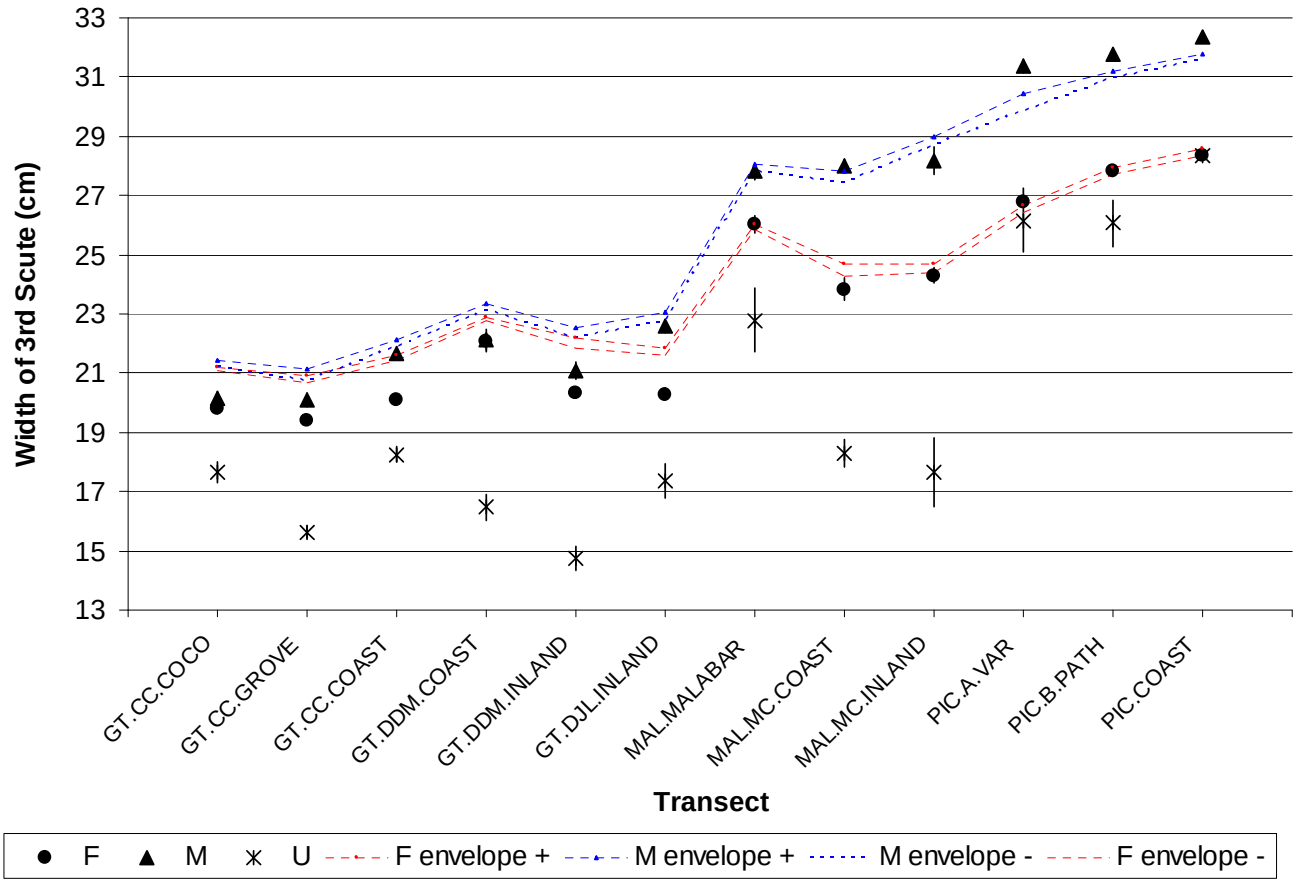


Figure 23. Average (± standard error) scute widths of tortoises encountered on the 12 transects in 2011. The estimated 95% confidence intervals (2*standard error either side of the mean) from the 'long-term' averages of males (blue, with + and – confidence interval 'envelope') and females (red with + and – confidence interval 'envelope') for the years 1998-2010 are provided as dotted lines.

4.1.2. ZARP project (Zurich-Aldabra Research Platform)

Background
In September 2011, a long-term study of the Aldabra giant tortoises was initiated. The project is a collaboration led by SIF and four post-doctoral researchers from the Institute of Evolutionary Biology and Environmental Studies of the University of Zurich that have complimentary skills and expertise (i.e., Dr. Dennis Hansen (islands and interactions specialist), Dr. Erik Postma (evolutionary geneticist), Dr. Gabriela Schaepman-Strub (remote sensing expert) and Dr. Lindsay Turnbull (plant community ecologist)). Within the project, several key questions concerning tortoise conservation and genetics are being addressed. These questions are to be answered using a combination of disciplines, such as population genetics, population dynamics, remote sensing, climate and vegetation analysis, and behavioural ecology. Aldabra benefits from a long history of research and important long-term databases will be made available for the project.

The initial aims of the project are as follows:

1) *Marking, measuring and sampling a large proportion of the Picard island tortoise population to provide 'baseline' data for the majority of an island's wild tortoise population.* Current data indicates that the population of tortoises on Picard is at least 2000 and the research will begin by starting to mark, measure and collect a number of samples from as many of these animals as possible. Such intensive marking and measuring has not been done for decades on Aldabra and never with the aim to be able to individually identify most of the individuals on an island. Recent technology makes it possible to assess factors such as health and disease status, blood chemistry and parasite prevalence which were not previously possible, particularly at the population level. Marking and measuring the animals will also provide data for an in depth study of population dynamics which is important for understanding threats to the population and past and future changes to, e.g. age structure, population recruitment, sex ration and mortality. This part of the project will be the foundation for other research and enable a number of research avenues to be pursued.

2) *Giant tortoise population dynamics and genetics*. The tortoises passed through a population bottleneck of unknown magnitude around 120–150 years ago and the current population of around 100 000 tortoises is probably descended from only a small number of founders, some of which potentially survive to this day. However, it is still unknown whether today's genetic diversity is greatly reduced compared to the recent past. In addition, although current restoration programs use captive-bred Aldabra giant tortoises as substitutes for extinct species, nothing is known about how genetic diversity in the captive populations compares to the genetic variation pre- and post-bottleneck. Molecular markers will be used to assess the diversity present in different age classes, and to compare this with museum specimens and captive populations. In addition, family relationships will be reconstructed among individuals, thereby inferring the degree of inbreeding on an individual level. The latter can be related to putative fitness-related traits (e.g. size, parasite load) to test for the existence of inbreeding depression in the modern population. Throughout, the unique life-history of this species will be exploited, which allows the researchers to sample within a few years a large range of cohorts, potentially even including some of the founder individuals. This, together with individual-based longitudinal data, can provide a unique insight into the genetics of this species.

3) *Linking tortoise densities and behaviour to vegetation dynamics*. Tortoise densities on Aldabra are extremely high and herbivore biomass per unit area thus generally exceeds that typically found in ecosystems dominated by large mammalian herbivores.

Their density, coupled with their generalist feeding habits, makes it likely that tortoises heavily influence the vegetation on the atoll, and yet the links between vegetation dynamics and tortoise numbers are poorly understood. To directly measure the impact of tortoise feeding on vegetation the project will establish a number of tortoise exclusion plots around the atoll. In addition, faecal samples will be analyzed to quantify tortoise diets as a function of age, size, and season.

4) *Linking vegetation dynamics to climate variability and trends.* A database will be set up with all available data on climate, vegetation and tortoise numbers on Aldabra. This will involve contacting past researchers, assessing the quality and suitability of data collected by SIF over the last 16 years for our research purposes and collecting available airborne and satellite imagery. Finally a small number of tree cores will be taken from several potential species to evaluate the feasibility of tree ring analysis to make direct links between climate and vegetation productivity. The data will be combined in order to assess how best to evaluate the links between tortoise numbers, climate and vegetation dynamics.

The ZARP project will hopefully lead to a number of valuable results and benefits in the short and long term. The project is expected to lead to a detailed understanding of the genetic and population structure of the population of Aldabra tortoises. The diversity found on Aldabra can be used to make comparisons with captive herds destined for restoration projects, thereby making urgently needed recommendations about the management of these herds. The detailed population study on Picard will allow for an estimation of the time and size of the genetic bottleneck caused by over-exploitation of the tortoise population on Aldabra in the past. The nature of the parasite community found in the tortoises can be assessed, and compared with those in captive populations. This may pave the way for more detailed studies on how parasite communities evolve within individuals. Exclusion plots will reveal for the first time how a population of tortoises at a natural high density affects vegetation, which can be related to changes in vegetation and tortoise densities over the last fifty years. By marking, aging and measuring the population of tortoises, many outstanding questions about breeding systems, behaviour, and ecology will be addressed. The data could also be used to develop predictive models, for example of climate change effects on Aldabra.

ZARP Project Officer

Richard Baxter was engaged as ZARP Project Officer, starting the fieldwork on Aldabra from the end of November onwards. In the first month – the last month of 2011 -, he started mainly with the marking, measuring and sampling animals on Picard. After thorough trialling to test the feasibility of the TOASTing (brand marking) method in the lab, the method was applied in the field. In December, 14 animals were branded using the toasting technique (Old Settlement area). The animals were located after 10.00 a.m. as they rest during the heat of the day. Measurements were recorded and photographs were taken of all animals as well as identifiable features such as deformed scutes, missing nuchal scutes and facial deformities. Processing a tortoise took 30 minutes on average mainly due to heating up of the toaster. The measuring and toasting work can be carried out by one person. A number of faecal samples were collected in order to trial methods used for calculating parasite prevalence and moisture content. Fresh faecal samples were collected opportunistically around the settlement area.

Figure 22. Toasted scute.

Preliminary tortoise data investigation

Dr. Lindsay Turnbull, one of the ZARP collaborators, performed a provisional analysis of Aldabra's long-term tortoise dataset. This yielded a number of interesting and encouraging findings that need further investigation.

1. *Population trends*

Contrary to earlier speculations about decreasing population sizes (see Annual RO/ASC report 2010), the current analyses indicate that the Aldabra tortoise population has been stable on all islands over the past 13 years (1998-2011) (Figure 24; showing horizontal, stable trends in all transects). From the annual density patterns it seems that the twelve transects are not a random sample of the island, but that they are generally placed at locations where tortoises congregate during the wet season.

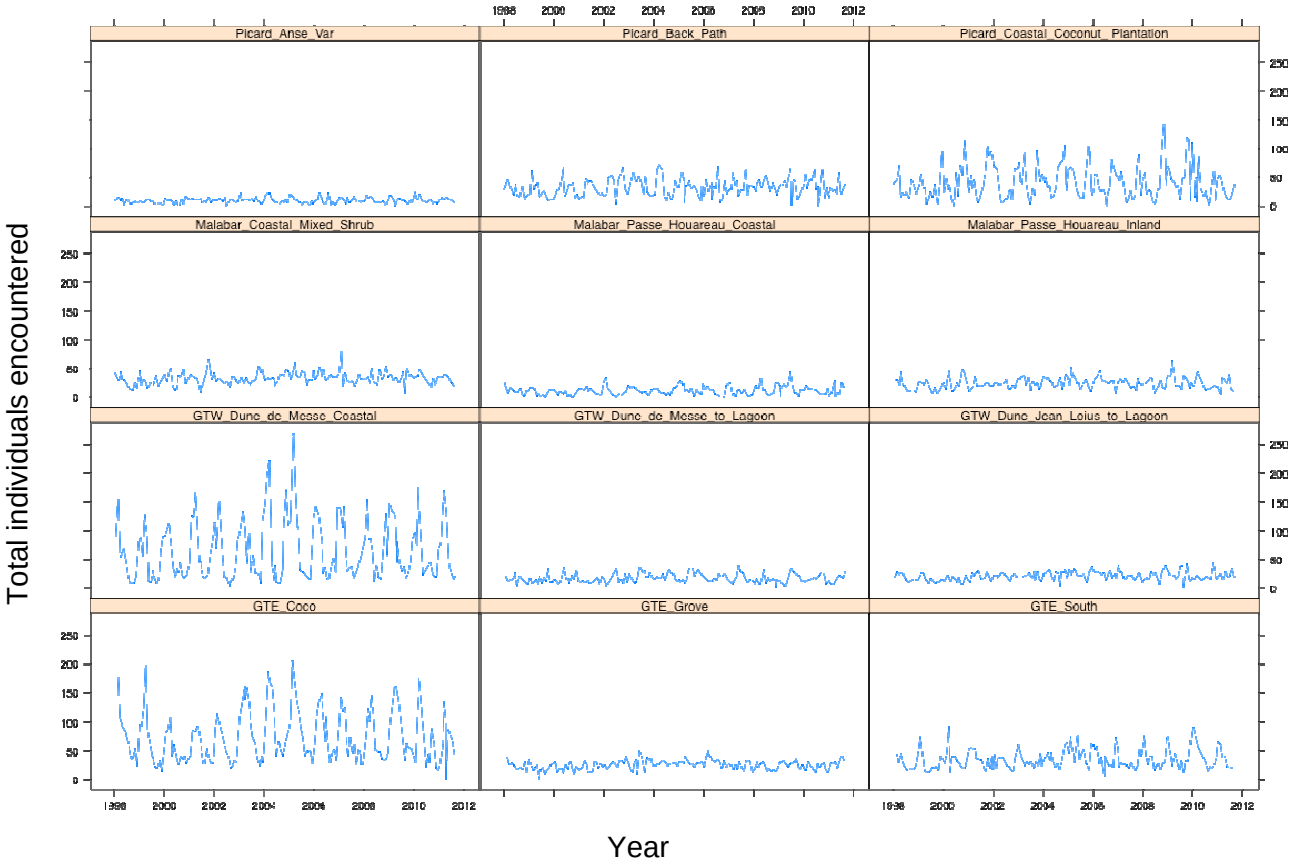


Figure 24. Timeline showing the number of tortoises encountered on each of the 12 transects over the period 1998-2012.

2. *Inter-island size differences*

Plotting frequency distributions of size classes of transect on the different islands (Figure 25) reveals that there are large inter-island size structures differences, with larger tortoises living on Picard and smaller individuals on (East) Grand Terre. This is a confirmation of what has been noticed before. The analyses also revealed that this pattern was apparent over a long period since the 1970s, despite of large changes in population density since those times.

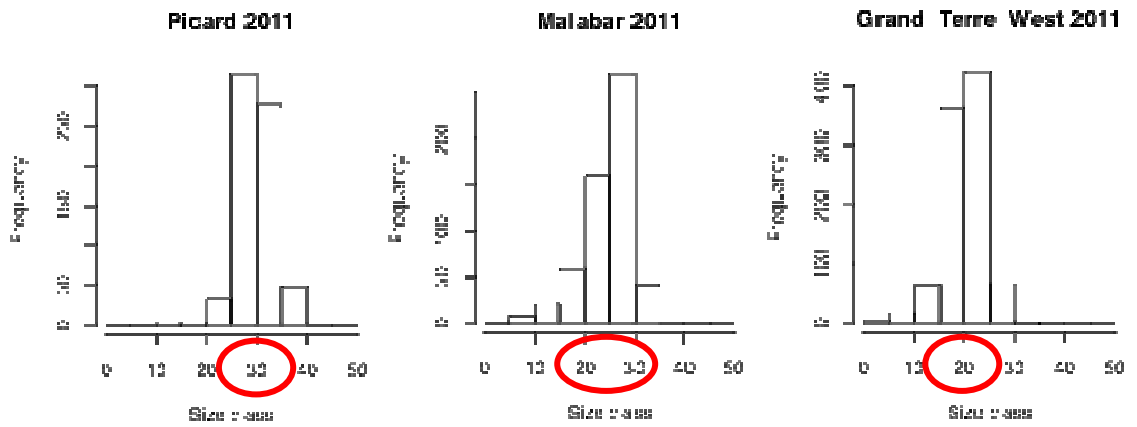


Figure 25. Frequency distributions of tortoise size classes on three different transects in 2011. The most frequent occuring size class is encircled.

3. *Marked tortoise re-sightings*

In the early 1970s about 6000 tortoises were tagged with numbered discs by researchers from the Royal Society. Over time, these animals are still regularly encountered and the sightings have been recorded in the long-term database. Analysis of these data reveals that, until present, 320 numbered animals have been seen more than once. Eighteen tortoises have been seen on more than one transect, but no animals have been seen on more than one island. This suggests that tortoises do not migrate among islands and that even movement around Grand Terre is limited. Plotting the third scute size (i.e., growth lines) over time separately for the repeatedly measured individuals, suggest that there is mortality, but not much growth of adults (Figure 26).

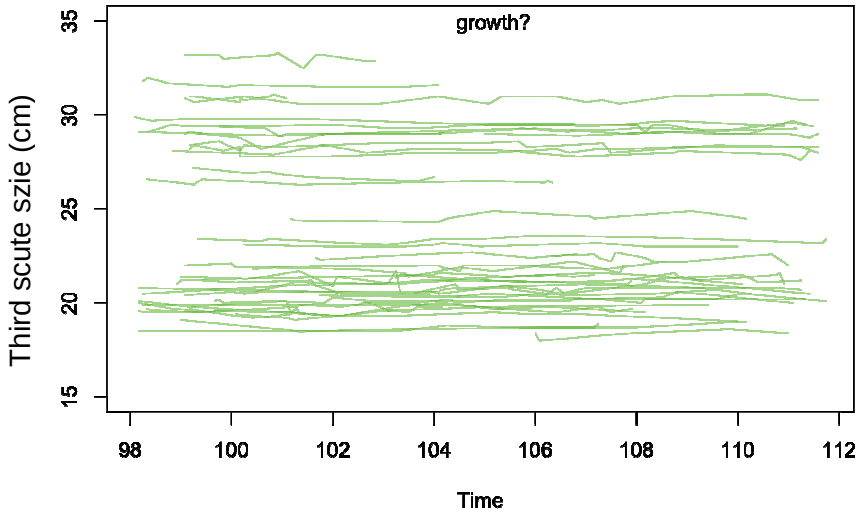


Figure 26. Growth lines over time for marked individuals with multiple captures.

4. *Sex ratio differences between islands*

The data also suggest that the sex ratios differ between transects and islands (Figure 27). For example, slightly more males than females are found on Picard, but on Grand Terre this is the other way round and far more females than males are found. These results may be biased due to the difficulty of sexing animals in the field. On Grand Terre, tortoises are smaller and differences between males and females are less apparent (this is the reason why there are more individuals with 'unknown sex' on Grand Terre. It is important to investigate whether these results are reliable, or for instance, whether some sizes are just being missed. The method of sexing should be discussed and in general it is important to assess how well the transects represent the populations on the different islands.

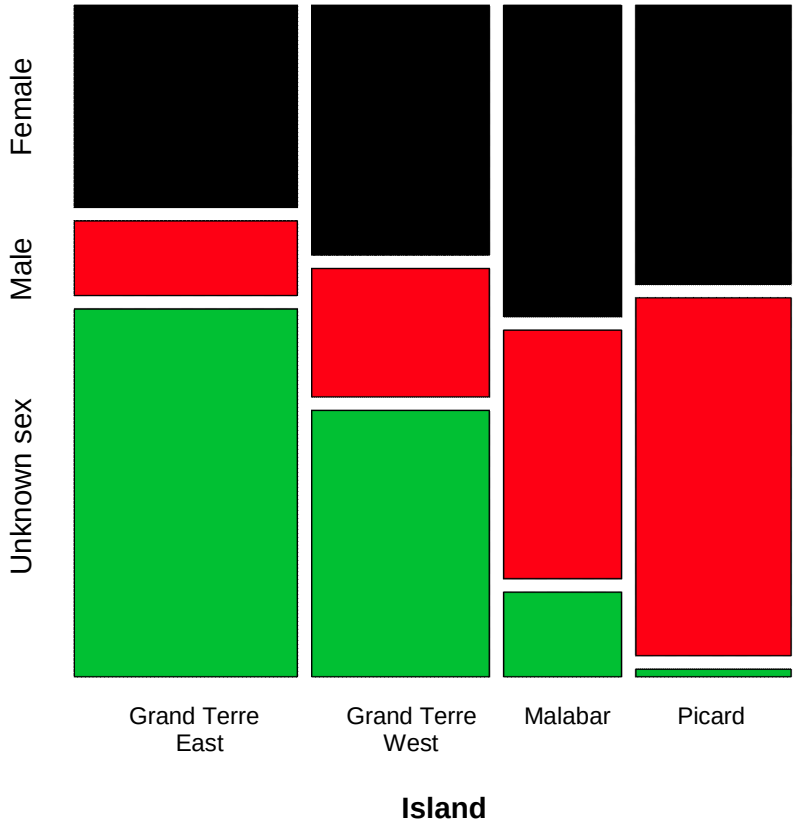


Figure 27. Sex ratio of tortoises encountered on the different transects / islands, averaged over the period 1998-2011.

Tree core sample collection

One of the project aims was to collect a small number of tree cores from several tree species to evaluate the feasibility of tree ring analysis. This analysis would help to make direct links between climate and vegetation productivity. There were two occasions in which vegetation needed to be trimmed / removed (i.e. for a shortcut between walking trails and for the installation of a renewable energy system), and these opportunities were used to collect tree stem samples by cutting off a piece of the stem at knee-height. In September a shortcut was made between the Old Settlement and the Back Path to provide an alternative route to visitors on guided tours. Seven species were sampled and photographed (Figure 28).

In November another batch of tree stem samples was collected when the site to the shop and engine room had to be cleared in preparation for the construction of new power house under the EMS project. Samples were collected from *Euphorbia pyrifolia, Mystroxylon aethiopium, Polyspheraeria multiflora, Ochna ciliata, Gagnebenia commersoniana var aldabrensis, Clerodendrum glabrum var. minutiflorum, Allophylus aldabricus, Ficus reflexa, Maytenus senegalensis* and *Sideroxylon ineme subsp. cryptophebium.*

All samples were placed in labelled zip-lock bags and were taken to Zurich by Dr. Lindsay Turnbull in January 2012 and stored at the research laboratory for future references.

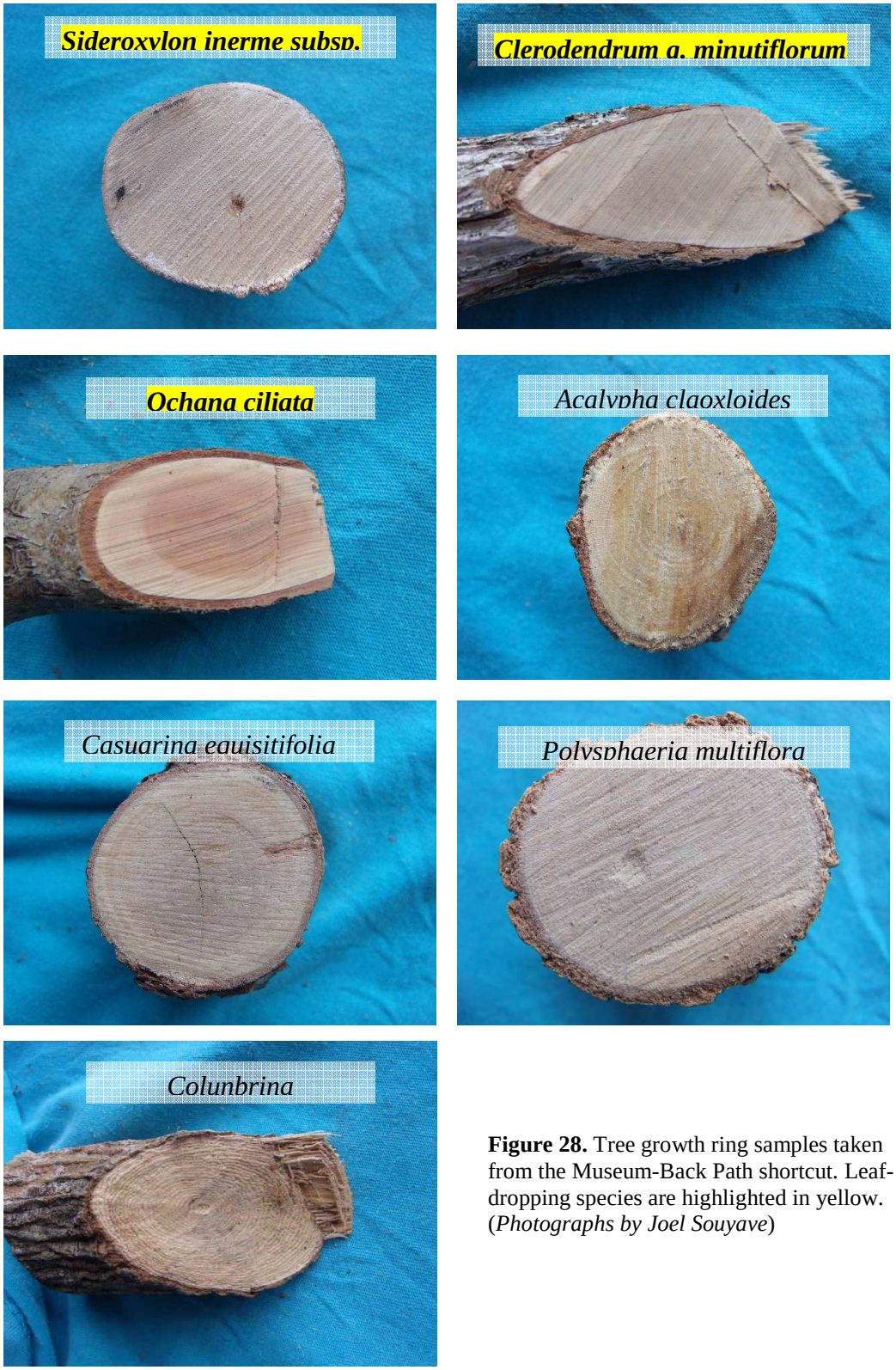


Figure 28. Tree growth ring samples taken from the Museum-Back Path shortcut. Leaf-dropping species are highlighted in yellow. (*Photographs by Joel Souyave*)

Old data present in library
Upon request of the ZARP researchers it was checked which old data cards were present in the library. The following boxes with original data cards were found (Table 10). Each box contains between 1000 and 1400 record cards, which means that in total there are approximately 10,000 to 14,000 record cards present in the Aldabra library. The cards are sorted by recording day and in each box the first card contains the following data: (front) date, recorder, time of day, locality, grid ref, abundance, collecting method (recapture, unmarked, death) with an summary of the recording, and cover type of vegetation; (back) geomorphological type, weather, and present plant species. The following cards are the individual records of the measured tortoises with collection method, disc number, locality (grid number), length over curve, weight, width 3rd dorsal scute, sex and notes. The individual recording cards do not have a date, but do have the same CT-number. There is also a copy of all recording cards of the tortoises disked and measured by Gaymer, including some re-sightings of 1971-1972 and 1973 -1974.

Table 10. Details of old tortoise record cards present in Aldabra library.

Box	Census record	Discs	Date from	Date to	Notes
Ald 08	TC01 - TC36	00703 - 01830	15/01/1973	09/03/1973	
Ald 05	TC37 - TC61	01831- 02887	09/03/1973	28/04/1973	
Ald 07	TC62 - TC98	02888 - 03372	30/05/1973	12/06/1973	
Ald 09	TC99 - TC143	03873 - 04856	01/07/1973	01/11/1973	
Ald 11	TC144 - TC179	04857 - 05538	22/11/1973	05/01/1974	
Ald 04	TC180 - TC234		05/01/1974	07/02/1974	
Ald 10	TC235 - TC279	05539 - 05877	09/02/1974	12/03/1974	
Ald 06	TC343 - TC350		07/03/1974	11/05/1974	
Ald 03	TC280 –TC310		25/03/1974	24/04/1974	
Ald 12	TC311 - TC395		30/04/1974	16/09/1974	
Ald 06	TT1 - TT12		18/06/1974	28/06/1974	Tortoise traverses
Ald 06	Exported tortoise		01/03/1978	01/03/1980	Tortoises exported to Curieuse: total of 200 transported individuals (100 in 1978 and 100 in 1980)

4.2. Coconut crabs

The coconut crab (*Birgus latro*) is found on numerous oceanic islands and atolls in the Indo-Pacific region. Coconut crabs play an important part in island ecosystems. For example, as scavengers they remove rotting material and so reduce the number of carrion breeding flies, they help to decompose leaf litter, distribute seeds, provide a food source for birds in the juvenile stage and in turn influence the populations of crab species upon which they prey. They also contribute to soil aeration and erosion through their burrowing activity (Alexander 1976).

However, as a result of over-exploitation and habitat degradation numbers of coconut crabs are declining, with the Indian Ocean being the worst hit. Coconut crabs are now largely confined to three populations centred on the Aldabra group, the Chagos Archipelago and Christmas Island (Lavery *et al*. 1996). On Aldabra Atoll the coconut crab benefits from complete protection, a situation which could provide important baseline data for management plans developed to ensure a sustainable harvesting in areas where the crab is exploited. The IUCN lists the coconut crab as Data Deficient, i.e. data on abundance and/or distribution is lacking (Eldredge 1996). The data collected on Aldabra provide therefore an excellent opportunity to broaden our understanding of the ecology of this species.

Coconut crabs have been monitored since 2006, and were surveyed twice per month on each of the Back Path (BP) and Coastal Path (CP) throughout 2011. On the transects, individuals within a 10-m wide transect are recorded. For this monitoring programme, a new database was created by Philip Haupt (see introduction). Data includes carapace length, colour morph, moult stage and sex. Also the weather circumstances and moon stage (the surveys are done in the evening after sunset) are recorded. The weather circumstances may influence the numbers of crabs encountered, as well as the sex ratios. For example, Figure 29 shows the relationship between moon stage and number of individuals of each sex encountered. It appears that there is a higher chance of encountering male crabs when there is less moonlight, whereas for females there seems to be no relationship. However, this result should be more thoroughly investigated and interpreted with caution: during cloudy evenings, a full moon may be shaded and perceived as 'no moon'. One should confirm whether it is the light intensity or the moon cycle that actually plays a role by gathering the retrospective moon phase data from the internet.

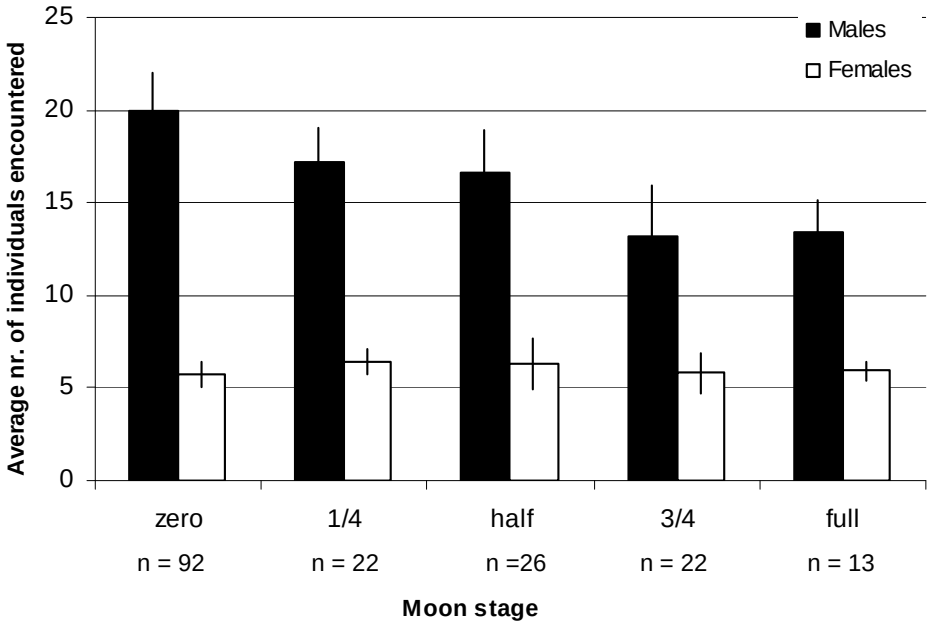


Figure 29. Relationship between moon stage and coconut crabs of each sex encountered (2006-2011)**.**

Numbers of individuals for each sex encountered do also show seasonal patterns, which differ per location (Figure 30). On Back Path there is a strong seasonal pattern in which more males are seen during February and March. On Coastal Path, some of the same peaks occur, but less pronounced. In general, more males are seen than females and fewest crabs are encountered at the end of the dry season. The latter could be expected as the coconut crabs need a humid environment for their breathing organs to function.

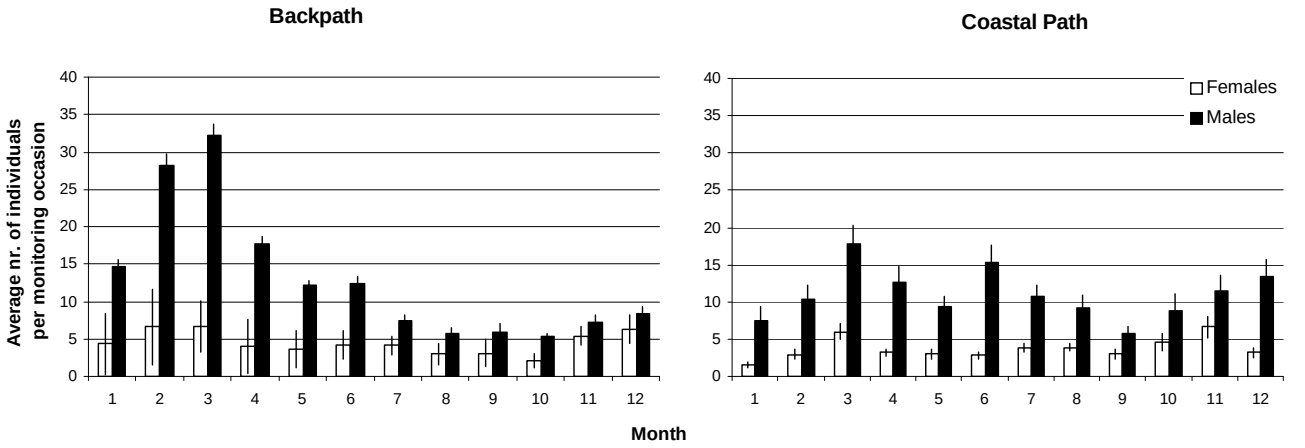


Figure 30. Seasonal patterns of coconut crab encountering rates (separated per sex), based on 2006-2011data.

The thoracic length in millimetres is measured as a reliable proxy for weight (see coconut crab protocol). In general, males are on average larger than females (males: 41.08 ± 0.23 mm, females: 30.68 ± 0.23 mm). There is an interaction effect in which the average sizes per sex differ per location: with larger females are encountered on the Coastal Path whereas larger males are encountered on Back Path (Figure 31; Back Path: females: 29.19 ± 0.28 mm and males 43.11 ± 0.33 mm, Coastal Path: females: 32.5 ± 0.33 mm and males 39.55 ± 0.27 mm).

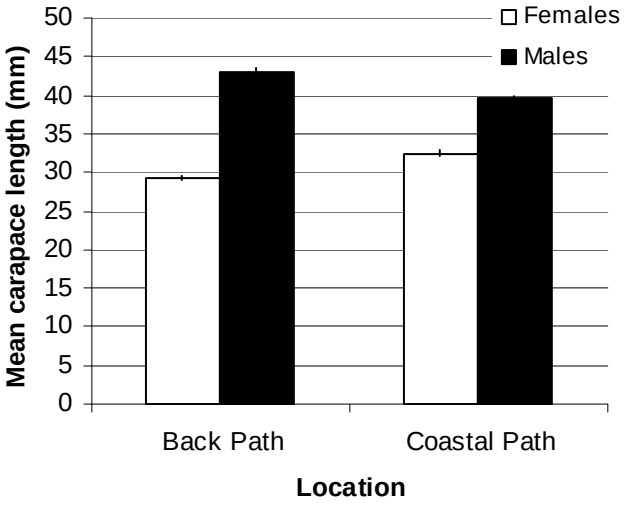


Figure 31. Mean carapace length for male and female coconut crabs encountered on Back Path and Coastal Path, based on data from 2006-2011.

The higher occurrence of larger females on the Coastal Path may be related with the deposition of eggs by large adult females. Females that carry eggs usually remain in crevices and burrows within 100 m of the shore, often at higher than normal densities. When the larvae in the eggs are fully developed the female deposits them in the sea. If this hypothesis is true, larger females would be expected to be seen on the Coastal Path in their egg-carrying period, which is timed on Aldabra between December and February (known from our observations). Figure 32 suggests that there may indeed be a movement of larger females towards the coastal zone, as female carapace sizes found on Coastal Path tend to be largest in December, whereas females on Back Path are smallest around that time. However, this analysis should be repeated using 'distance from sea' rather than transect location, as the Back Path is starting close to the sea, and some females with eggs have been found there.

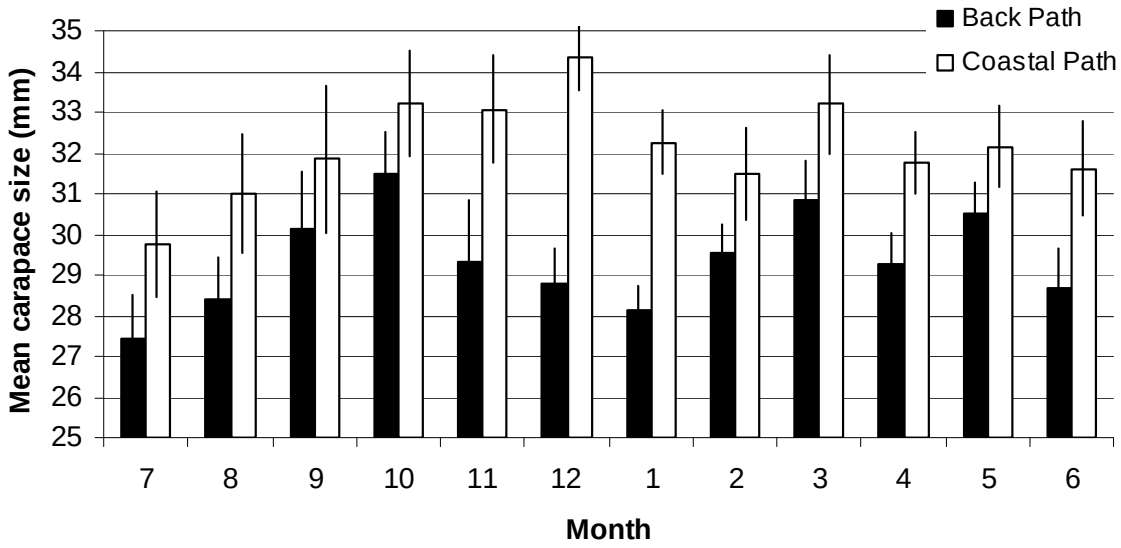


Figure 32. Seasonal patterns of female carapace size on the Back Path and Coastal Path. The egg-laying period, that ranges from December until February is placed in the middle of the timeline. The figure is based on 2006-2011 data.

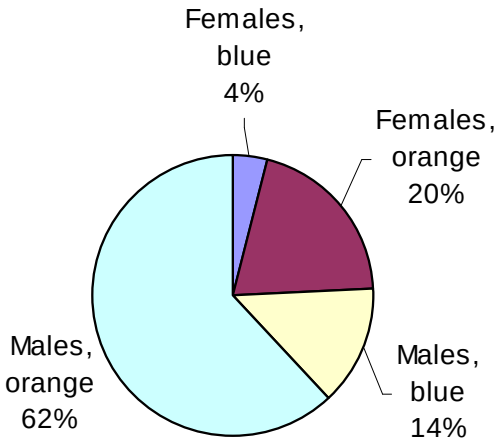


Figure 33. Relative proportions of each sex and colour morph within the Picard coconut crab population, (averaged over 2006 – 2011).

Figure 33 shows the uneven sex ratio and the uneven proportion of blue and orange colour morphs in the Picard coconut crab population. The male:female sex ratio of the 2006-2011 dataset is 3.15:1, while there are on average 4.7 orange crabs recorded for every blue colour morph encountered. Both the uneven sex and colour morph ratio, biased towards males and red respectively, were already noticed in the early 1970s by Grubb (1971) in a small sample, which was explained by the author as a simple mode of colour inheritance with red being dominant over blue. The fact that we find the same bias in a large sample size suggests that this may be representative for at least Picard's population.

Figure 34a shows that the average number of individuals encountered during monitoring trips was rather high in 2011 compared to earlier years, particularly on Coastal Path. The figure suggests an overall increasing population trend over time, yet this has to be further investigated in more detail. The average size of the individuals encountered in 2011 did not differ between both transects, but in comparison with previous years their size on Back Path was rather low and on Coastal Path rather large (Figure 34b).

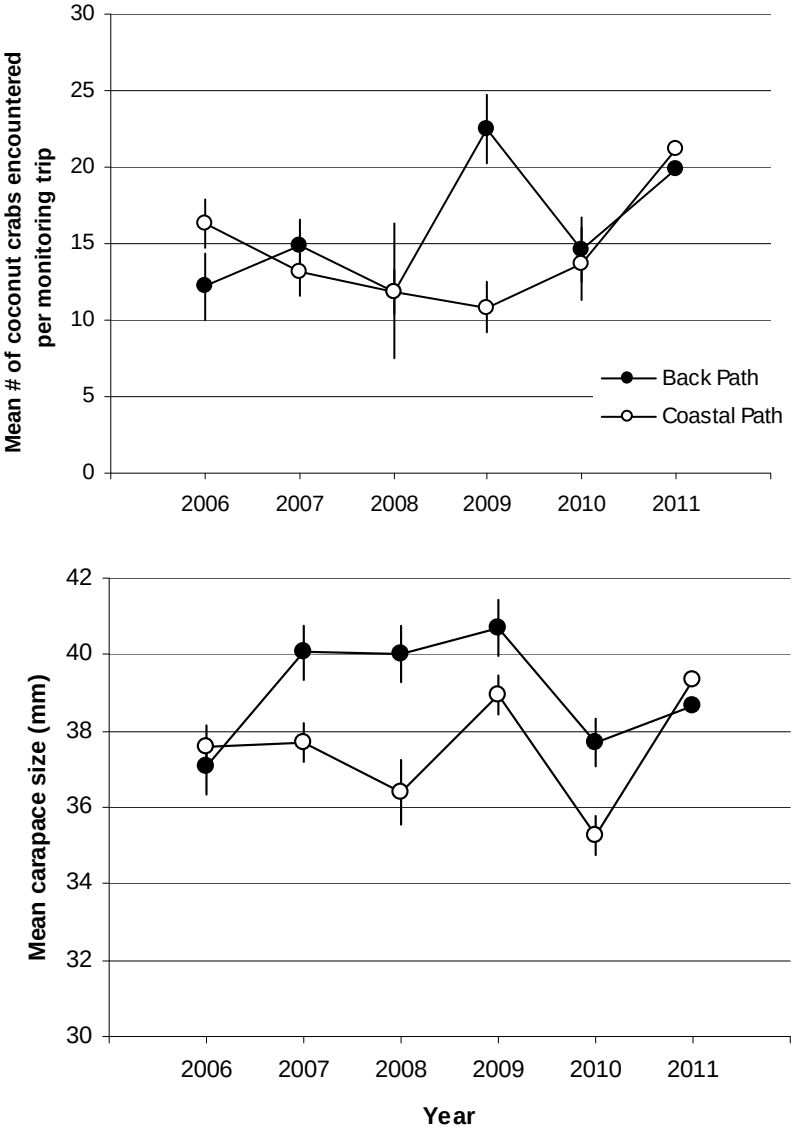


Figure 34. (a) Mean number of individuals encountered per monitoring trip and (b) mean carapace size of coconut crabs on Back Path and Coastal Path during each of the years 2006-2011.

4.3. Vegetation

4.3.1. Phenology transects

Phenology surveys are conducted twice a month, and each of the 33 species surveyed was represented by six individuals throughout. *Pandanus tectorius* and *Tournefortia argentea* are represented by three and five individuals respectively, as additional mature individuals of these species have not been found near the survey path. Throughout the year a few monitored plants died and another plant of the same species was assigned as a replacement. In January one *Clerodendrum glabrum var. minutiflorum* individual and one *Acalypha claoxyloides*, both in zone 2, did not start sprouting following the rains in December. They were dead and were therefore replaced. In November a *Trianolepsis africana subsp. Hildebrandtii* located in zone 1 died and was replaced by a new tree in the same zone in December.

In order to facilitate training of new staff and volunteers, there has been an ongoing effort to take photos of relevant parts of the monitored plant species, which can then be put into a handbook to help identify the relevant flowering and fruiting stages of all monitored species. A large number of photos have been collected and are stored on the Aldabra fileserver (under \Photos –

Research\Vegetation\phenology_photos). Catherina Onezia has been working on a catalogue with photos of the different fruiting and flowering parts.

A new database was designed for the phenology monitoring, which greatly facilitated the data preparation and analyses. Below, a number of variables (leaf buds, mature leafs, flower buds, full fresh flowers, developing fruits, mature fruits and fungus / insect damage) are plotted for a selection of plant species (Figures 34-36), showing different strategies of species occurring on Aldabra. In each panel the monthly rainfall measured at Picard Station is added to visualize phenological changes in reaction to rainfall / drought.

Most species on Aldabra totally defoliate during the dry (SE) season, which is easily visible in the scores monitored. Examples of such species are *Allophyllus aldabricus* and *Terminalia boivinii* (Figure 34).

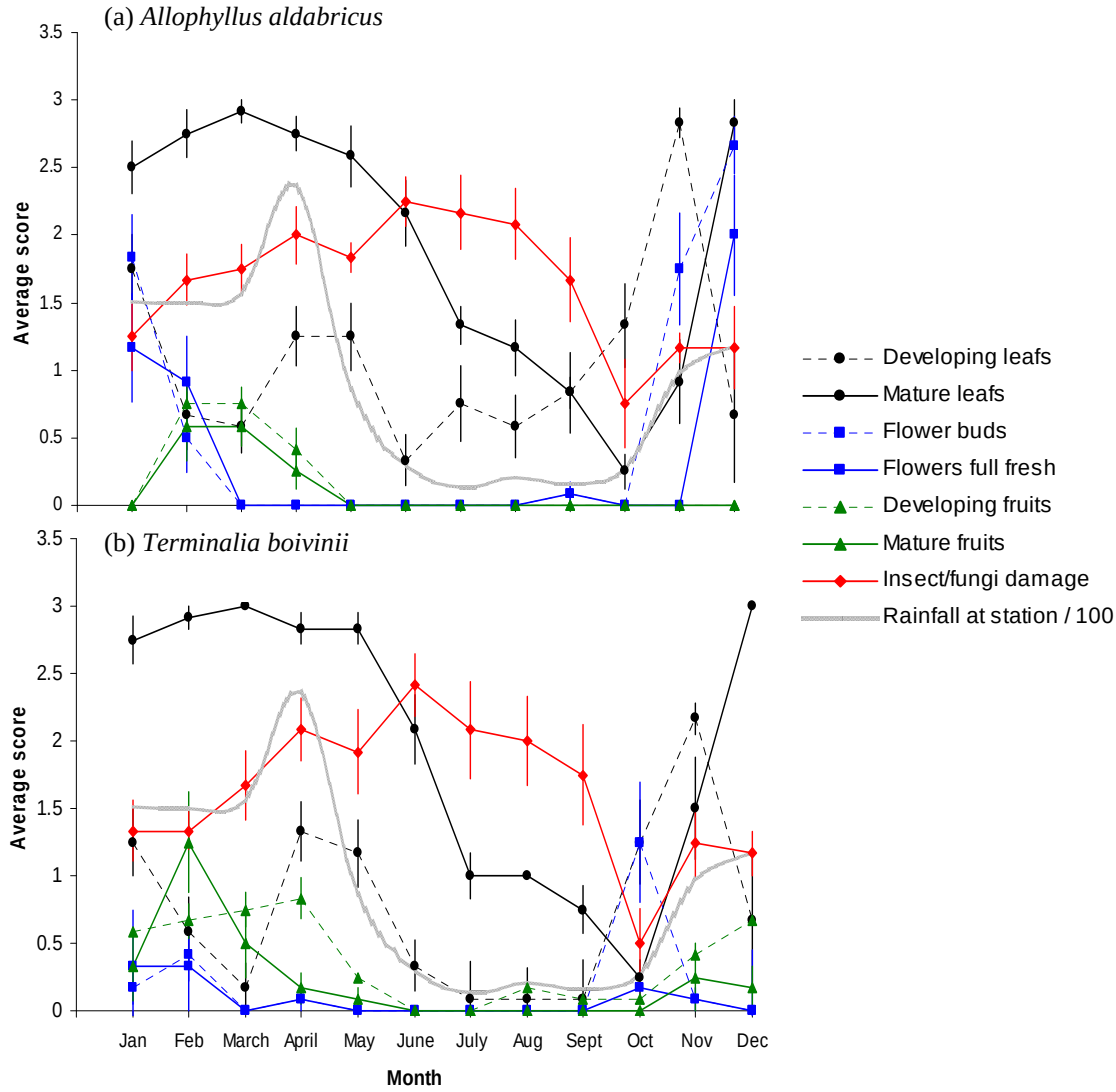


Figure 34. Average (± s.e.) phenology scores of selected variables (see legend) for two 'dry season-leafdroppers' (a) *Allophylus aldabricus* and (b) *Terminalia boivinii* in 2011, plotted with average monthly rainfall (divided by 100 to fit axis) measured at Picard Station (grey smoothed line).

Other species, such as *Pemphis acidula* and *Polysphaeria multiflora* only show a moderate defoliation (Figure 35). Most species carry flowers and fruits in the wet season (NW; first months of 2011), but reproductive activity stops in the dry season (see Figure 34, 35b). *Pemphis*, considered Aldabra's 'toughest' and most wide-spread plant, carries flowers year-round (Figure 35a).

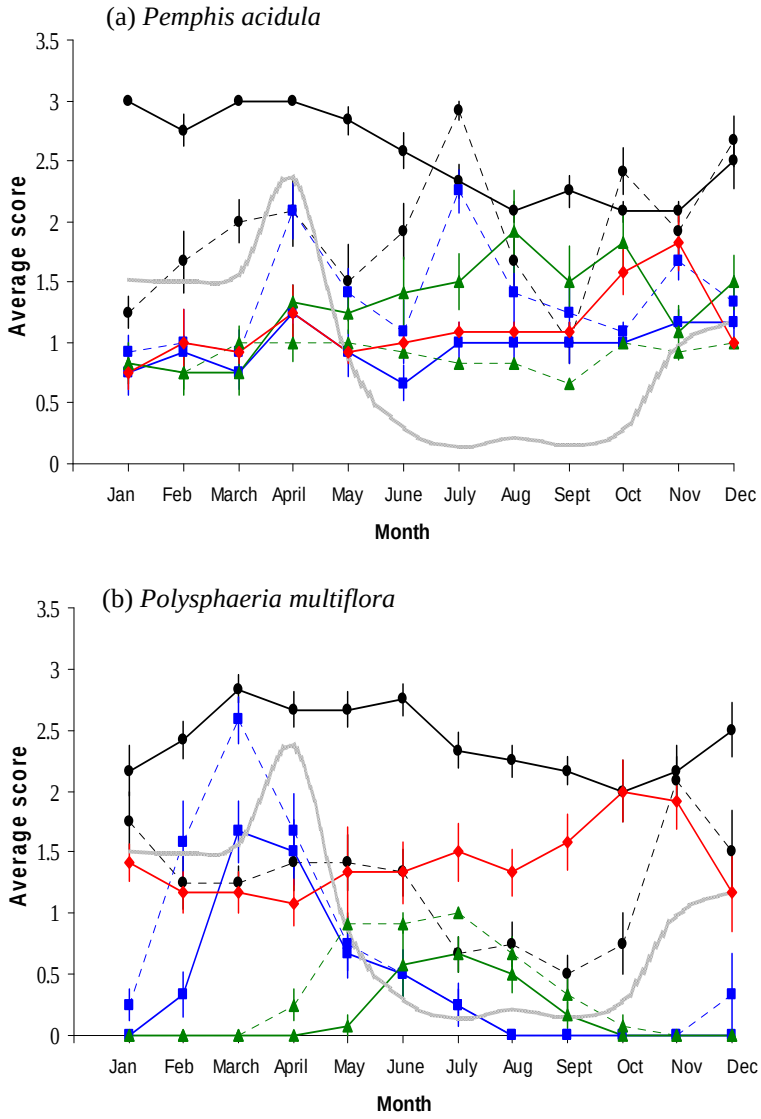


Figure 35. Average (± s.e.) phenology scores of selected variables for two semi- leafdropping species, (a) *Pemphis acidula* and (b) *Polysphaeria multiflora* in 2011, plotted with average monthly rainfall (divided by 100 to fit axis) measured at Picard Station (grey smoothed line).

There are also some species that show the total opposite pattern than the species discussed above. These species lose many of their leaves during the wet season and reproduce in the dry season. Examples of these species are *Capparis cartilaginea*, *Azima tetracantha*, and *Jasminium elegans* (Figure 36).

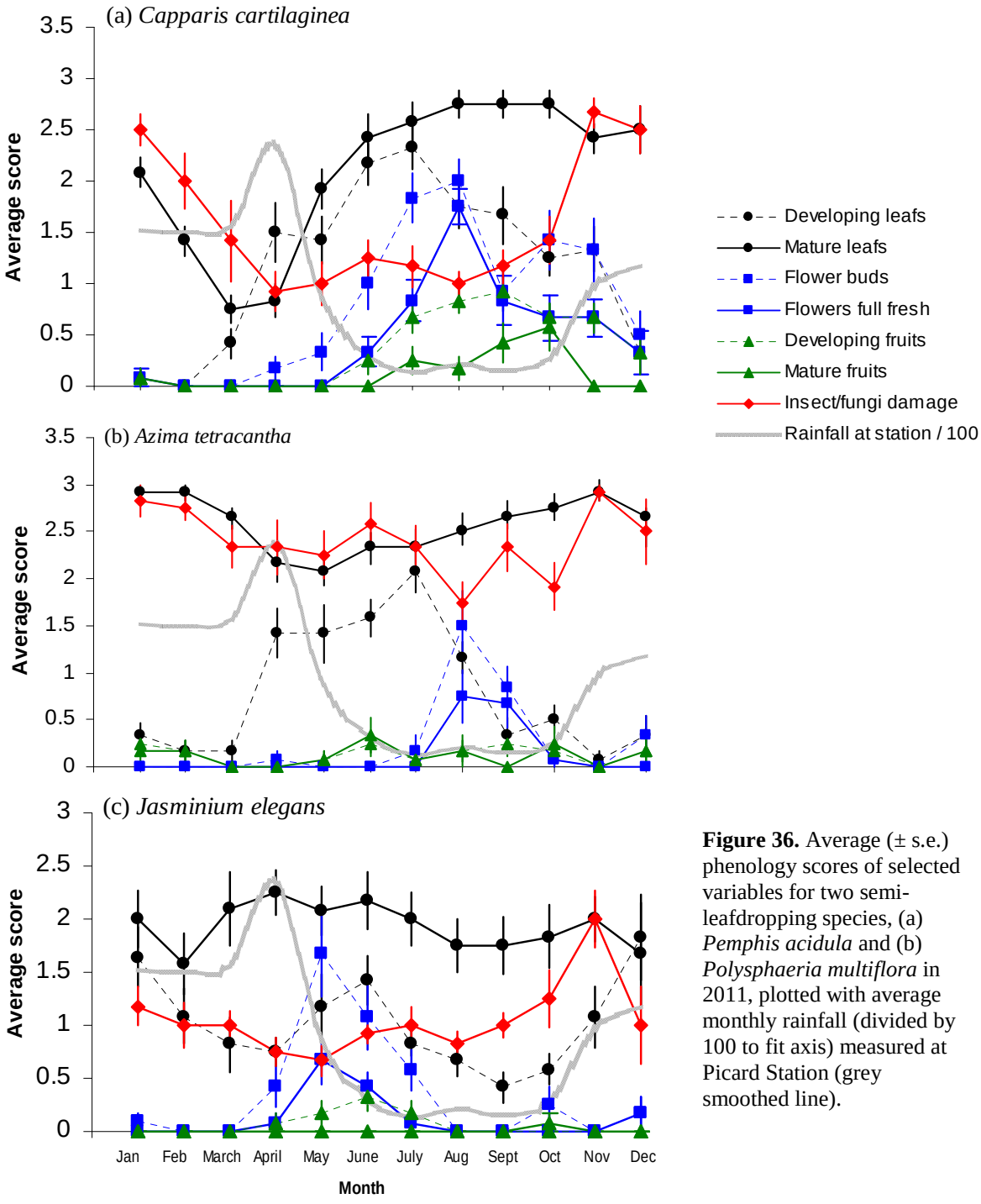


Figure 36. Average (± s.e.) phenology scores of selected variables for two semi-leafdropping species, (a) *Pemphis acidula* and (b) *Polysphaeria multiflora* in 2011, plotted with average monthly rainfall (divided by 100 to fit axis) measured at Picard Station (grey smoothed line).

Some species show a peak in flowering that is followed by a peak in fruiting (e.g., *Gagnebenia*, Figure 37a), whereas in others the flowering and fruiting peaks show an overlap (*Grewia*, Figure 37b and *Pemphis*, Figure 35a). Normally, a peak in flowering should be followed by a peak in fruiting. Such pattern is clearly visible only in *Gagnebenia* (Figure 37a). The lack in fruiting peak after the flowering in the other species may mean either that the circumstances were too poor for the plant to grow fruits, or more likely, that the fruits are eaten by animals (e.g., birds). Investigating this in further detail would be valuable, as it will give interesting information on which plant species are most preferred by animals. This once more shows that phenology monitoring is an extremely important part of the research program, as is can be included as a variable in analyses of all other monitoring programs in the context of plant-animal interactions.

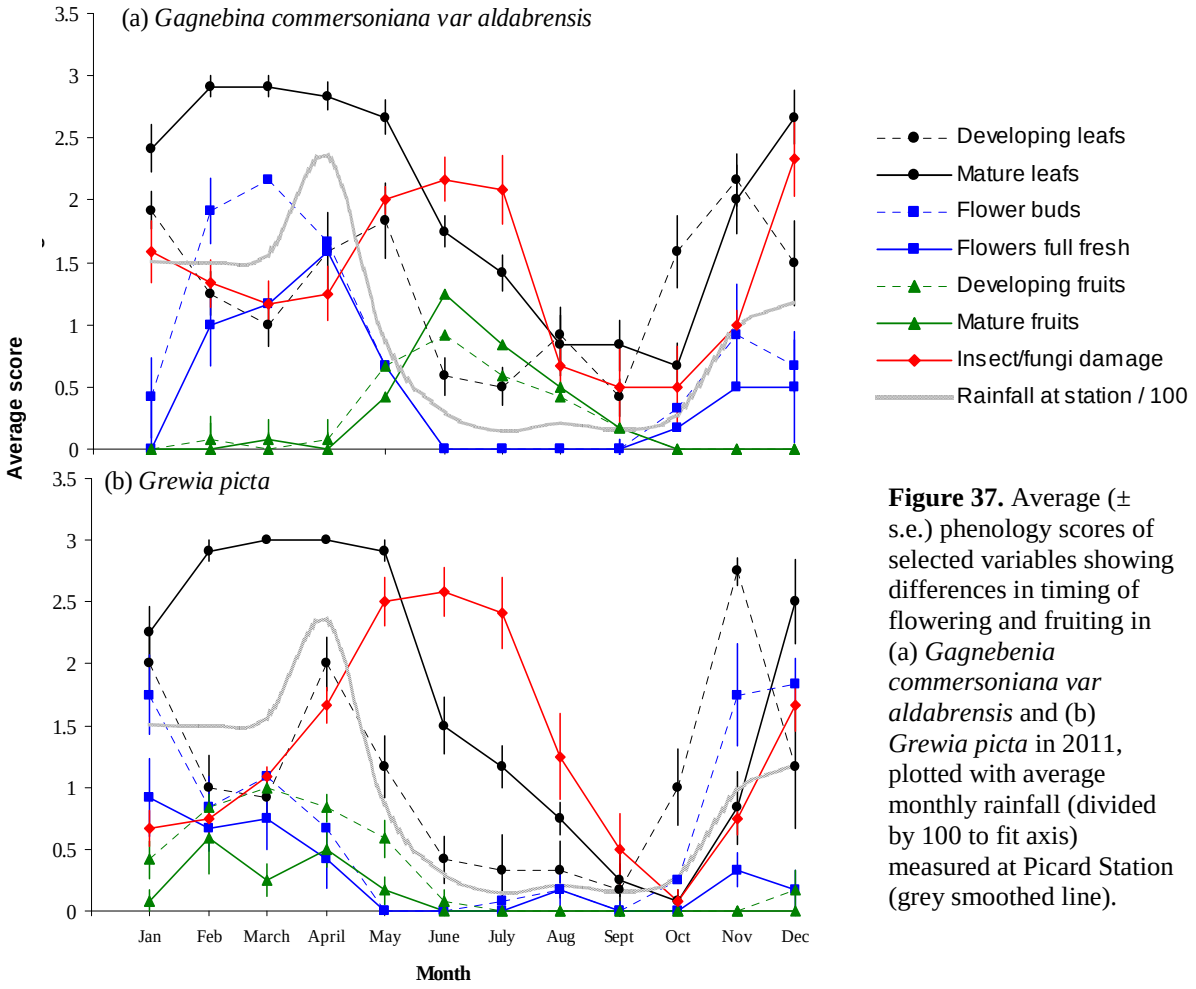


Figure 37. Average (± s.e.) phenology scores of selected variables showing differences in timing of flowering and fruiting in (a) *Gagnebenia commersoniana var aldabrensis* and (b) *Grewia picta* in 2011, plotted with average monthly rainfall (divided by 100 to fit axis) measured at Picard Station (grey smoothed line).

Patterns found in 2011 did not deviate from previous years' data and therefore 2011 was considered a normal, 'average' year.

4.3.2. Search for *Peponium sublittorale*

After communication with HO and the Plant Conservation Action group (Katy Beaver), a search for *Peponium sublittorale* specimens was conducted during the scheduled monthly monitoring visits to DJL and DDM. *Peponium* is a distinctive and easily recognizable plant that looks relatively similar to pumpkin (same family; Figure 38). At both sites, the first 50–150 m inland from the coastline on approximately 5km and 4 km stretches of coastal areas were surveyed (for specific information see the *Peponium* report on the fileserver: Monitoring\Vegetation\Peponium sublittorale project \Peponium search report April 2011). Neither team found any specimens, which may either imply that *Peponium* is not present in these areas or that it was not found because it has lost its leaves. However, no evidence for *Peponium* residuals (e.g., dried out stems) was found. Although the chances of finding any residual plant parts of *Peponium* decrease with the further continuation of the dry season, continued attempts will be made to look for *Peponium* on Grand Terre during 2012. Further attempts will be made during February–March 2012, when *Peponium* is known to have leaves and flowers / fruits again.

Figure 38. *Peponium sublittorale*

5. BIRDS

5.1. Land birds

5.1.1. Land bird point counts

Aldabra has, unlike almost all tropical islands of comparable size in the Indian Ocean, no introduced avifauna. All the land birds are considered endemic or native to Aldabra with one recognized as a full species (Aldabra drongo, *Dicrurus aldabranus*) and 10 sub-species. The land birds are present in all terrestrial habitats and most are widely dispersed around the atoll. Land bird data have been collected by means of roughly the same method since 1999, when Michael Betts established a simple point count method with some refinements made by Wanless in 2000. Dr Pierre Pistorius (ex-Aldabra Research Officer 2006-2008) standardised the point count methods. This year, an MS Access database was created by Philip Haupt to improve the way that data is entered and processed for this monitoring programme.

When analyzing the numbers of birds seen per count point, two issues should be considered:
- the total number of birds seen per transect should be divided for the number of counting points of that particular transect
- the occasions in which no birds of a particular species have been seen on a transect should be included in the calculation of monthly/yearly means. If this is not done, the outcome will be an overestimation as only the positive counts are included.
The latter issue has probably been overseen in earlier analyses, but is included in the current one.

Variance in observed birds between monitoring events is large, causing large standard errors when analyzing the data. Due to this large variance, long-term patterns found are non-significant (Figure 39). Densities are easier to interpret and were found to be largest in sunbirds (y-axis scaling up to six individuals seen per counting point), turtle doves, white-eyes, blue pigeons and bulbuls respectively.

Currently the protocol for the land bird point counts is being written up, and has resulted in some discussion issues that arose – also with respect to how to reduce the observation variance - and that need to be addressed:

- Estimation of 25m radius: Observers record the number of all land birds seen or heard within a **25 meter radius** of the count point **for 4 minutes.** The 25 m is estimated by eye, and is very subjective due to differences in perception between staff. Regular training should be done to help increasing accuracy.
- Avoiding of double counting: As more than one observer performs the counts (and number of observers is apparently not standardised), it is important to prevent double counting. Clear communication between the observers is thus crucial.
- Seasonal bias: The count includes both birds seen and birds heard. However, this might result in a seasonal bias, as it is likely that more birds are seen/heard (and thus counted) in the breeding season than in the dry season when they are less prominent and vocal.
- Missing of observations: Some species, such as nightjars, are not picked up with the current method. Rails and kestrels are also less likely to be picked up. Rails typically walk on the ground, and birds can only be spotted within some meters around the observer due to vegetation. Kestrels have very large territories, and the chance to pick them up during the transect is small. Also it is likely that always the same pair is picked up, thereby not representing the actual density.

The protocol is currently under consideration and this may result in alterations to the method.

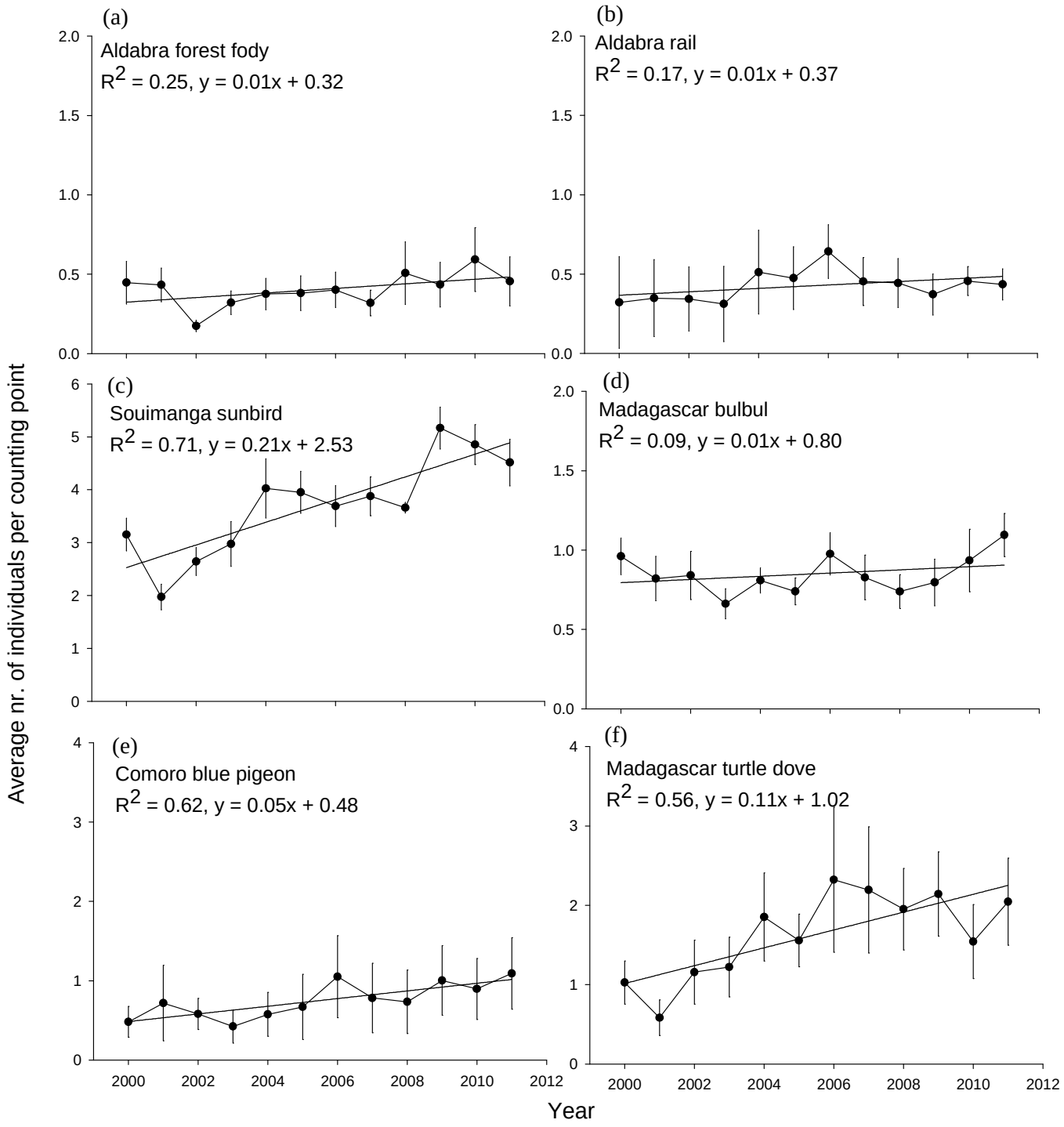


Figure 39 (I). Trends in land bird counts (average # of birds per transect point ± s.e.) over all transects in 2000-2011. Note that scales of y-axis vary between the panels. A plot for the Madagascar nightjar is omitted as these birds are very rarely detected in counts.

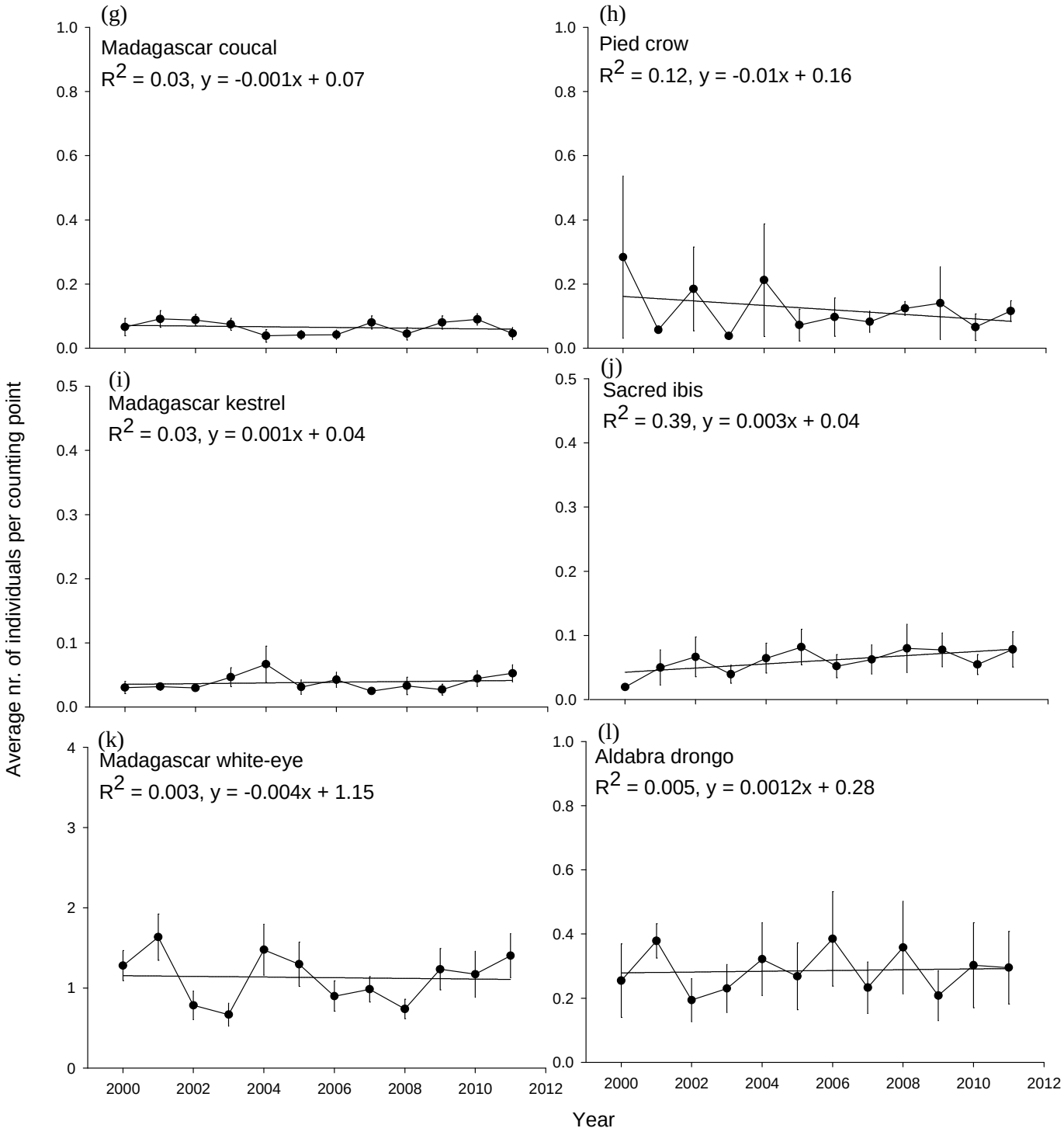


Figure 39 (II). Trends in land bird counts (average # of birds per transect point ± s.e.) over all transects in 2000-2011. Note that scales of y-axis vary between the panels. A plot for the Madagascar nightjar is omitted as these birds are very rarely detected in counts.

5.1.2. Land bird genetics

Currently only one of the land bird species living on Aldabra (Aldabra drongo) is recognized as endemic. All other species are considered sub-species under the Madagascar species; however, this taxonomic status requires further investigation. DNA extracted from blood samples can be used for genetic analyses and determination of species status. From July onwards, sampling of land birds has been started under supervision of the ASC. Most species were caught using mist-nets, whereas most rails were caught with a hand net. All birds were measured and sampled for DNA (from each bird two blood samples were taken; Table 11) and where possible birds received a unique combination of two plastic colour rings (one on each leg). Rails received one numbered metal ring (type 'Sn' from AC Hughes, 7.6mm diameter) and a plastic colour ring (size 6.5).

Table 11. List of land birds captured, sampled and ringed in 2011.

Species	Latin name	Number of individuals sampled in 2011	Location caught	Size ring
White-throated rail	*Dryolimnas cuvieri aldabranus*	18	Settlement, Back Path	'Sn' metal (7.6mm), plastic 6.5mm
Madagascar bulbul	*Hypsipetes madagascariensis rostratus*	10	Coastal, Back Path, Anse Mais	Plastic 3.1mm
Madagascar white-eye	*Zosterops maderaspatanus aldabrensis*	1	Back Path	Plastic 2.3mm
Aldabra drongo	*Dicrurus aldabranus*	2	Back Path	Plastic 4mm
Madagascar turtle-dove	*Streptopelia picturata coppingeri*	11	Settlement, Back Path, Anse Mais	Plastic 6.5mm
Red-headed forest fody (also called Aldabra fody)	*Foudia eminentissima aldabrana*	2	Settlement, Back Path	Plastic 3.1mm
Greenback heron	*Butorides striata*	1	Back Path	Plastic 6.5mm
Madagascar nightjar	*Caprimulgus madagascariensis aldabrensis*	1	Bassin Lebine trail	Not ringed

5.1.3. Rail census

The Aldabra rail (*Dryolimnas cuvieri aldabranus*) is an endemic flightless subspecies of the Madagascar white-throated rail (*Dryolimnas cuvieri cuvieri*) and the last surviving flightless bird in the Indian Ocean (Penny & Diamond 1971). At present it occurs on four islands of Aldabra Atoll – Picard, Polymnie, Malabar and Île aux Cèdres. A survey conducted by Huxley between 1973 and 1975 was the first detailed survey of the Aldabra rail, covering all three islands where they occurred (Polymnie, Malabar, Île aux Cèdres) at that time. In 1999, 18 birds from the Malabar population

were reintroduced to Picard (Wanless 2002). Apart from two proposed projects in 2004 and 2005 no survey of the Picard population has been done since the reintroduction in 1999.

In November 2011 a survey was performed by Michal Šúr (GEF Project Bird Survey Consultant) with the aim of studying the Aldabra rail population size on Picard. In 2002 the growth of the (in 1999 reintroduced) Picard population was modelled with the conclusion that Picard would reach its carrying capacity in about 10 years after the reintroduction holding approximately 1000 breeding pairs (Wanless 2002). Our current survey data could be used to examine whether the predicted saturation indeed occurred.

November was chosen as timing for the survey, because this is the period just before the breeding season starts. In this period, rail vocalisation is thought to be greatest and once the birds start to nest and feed their chicks the vocalizations are noticeably less frequent. Huxley's method was used to survey 4300m of existing paths and 4400m of newly cut transects (Figure 40). To cut the transects in a straight line compass and GPS were used. Playback points were marked with red tape and GPS coordinates of these points were taken. At each point type of habitat was recorded.

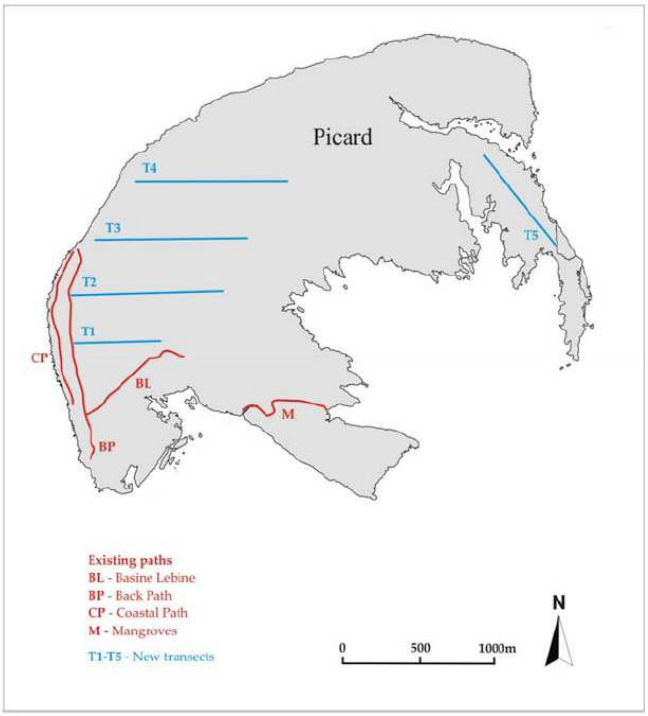


Figure 40. Transects on Picard surveyed for Aldabra rails in November 2011

Rails can be found in almost all habitats on Aldabra but they prefer dense mixed scrub with leaf litter where they find most of their food. As a large part of Picard is inaccessible due to dense vegetation, the population estimate is based on an extrapolation of the numbers of rails found on a few representative transects. It is important to correctly classify the vegetation along these transects to determine to what extent they represent the whole island of Picard.

During the current survey three habitat types were used to describe the vegetation along the transects in 2011 survey:
1) Open areas within the scrub (O) – Areas with exposed rock or soil and sparse vegetation that were at least 50m in diameter. Easy to walk through;
2) Dense mixed scrub (D) – Vegetation consisted of various bushes, pemphis is present up to 50%. Difficult to walk through but still possible to keep the transect in a relatively straight line;
3) Pemphis (P) – Vegetation consisted mainly of pemphis. Very difficult to walk through, not possible to go in a straight line. Some pockets of pemphis had to be walked around.

The time of the survey was 6–9am. A rail call (territorial call of a pair) was played at 50m intervals for a period of five minutes. Playback was played for five minutes nonstop but was paused if there was a rail call heard to record its direction and approximate distance. It was also interrupted when birds arrived and started calling. Playback continued for five minutes even if the territorial pair

arrived in a shorter time. A maximum of two extra people were taken to help with the survey. These were necessary for watching rails coming from different directions (some rails approached silently).

For the final calculation in of Picard population (Table 12) number of floaters (birds without mate or fixed territory) was included with approximately one floater per two territories (Wanless 2002).

Table 12. Calculated total numbers of rails on Picard in 2011.

Territory length	Territory area	Territories per ha	No. of territories on Picard (700ha)	No. of floaters (1 per 2 territories)	Total no. of rails on Picard
72m	0.63ha	1.58	1106	553	**2765**

The following conclusions were drawn:
- From the territory densities and amount of floaters it seems that the population on Picard has reached saturation with approximately 1100 breeding pairs and at least additional 500 floaters. In total there are approximately 3000 individual rails on Picard.
- Currently there is no surveying method available that would produce accurate population estimates of Aldabra Rail. This is due to a combination of several factors – extremely difficult and inaccessible terrain, complex behaviour of the species and lack of appropriate detailed vegetation classification for Aldabra.
- Several methods were used in the past for rail surveys each of them recommending different techniques and timing that were often contradictory to the previous recommendations. Raw data from Huxley's survey, that was considered the main study for Aldabra rail, has not been possible to track down and it is uncertain how some of the calculations were done. This study should therefore not be treated as the only baseline for any future rail censuses.
- There have been several attempts to monitor rail populations on regular basis. For various reasons these did not produce any meaningful data. It is not necessary to monitor the rail population as often as it was attempted in the past.
- Any future surveys should be conducted by using methodology and calculations described in this report which accounts for the previous constraints and all data and methods should be left on Aldabra. If detailed vegetation classification becomes available in the future it will be beneficial to incorporate this into the methodology.

The results and methods are further discussed in the survey report (Fileserver\Monitoring\Birds\Rails\2012 Rail census_Picard_Report_Final_030512). The report includes some other interesting findings:
- At the end of transect T1 a rail was seen with a metal ring on its right leg and a worn-out dark plastic ring on its left leg. The bird was on a territory with its mate. It was confirmed by Wanless that it was one of the reintroduced rails, ringed 10 years ago during the reintroduction. Unfortunately attempts to catch the bird failed.
- Rail presence was recorded on islands in the frigatebird colony at Camp Frigate - Malabar. This was observed during the frigatebird census in 2011 on one island and again in 2012 on four different islands (map to be found in the report). The size of the islands would in theory support at least one territorial pair. The islands consisted of submerged mangroves and dry land. Distance of the islands from the main land of Malabar was at least 30m.

5.1.4. Land bird nesting success survey

As a side project in the time available between other projects, Michal Šúr (GEF Project Bird Survey Consultant) also conducted a land bird nesting success survey.

On islands where introduced predators pose a threat to the native species, regular monitoring of nesting success of endemic birds can provide information on their recruitment trends and conservation status. The black rat (*Rattus rattus*) is the main introduced nest predator on Aldabra. Yet its impact on nesting success of endemic land birds on Aldabra has not been studied in detail. Breeding success of multiple land bird species was studied by Wanless (2000-2001), but the data from this study have never been processed and no conclusions could be drawn. The data collected this time is insufficient to draw any conclusions but it provides a basis for more detailed and intensive study in the near future.

Nest monitoring in the 2011/2012 season started in mid-November 2011 when the breeding commenced. The last remaining nests were checked in mid-March 2012. The peak in nest monitoring was in December with up to 40 nests being checked daily. The searches were conducted in the area between the Research Station and Old Cemetery and between the Coastal and Back Path in a strip approximately 2km long and up to 200m wide with total area of approximately 18ha. Approximately 60% of the monitored area can be described as dense mixed scrub, about 30% as Casuarina woodland and remnants of coconut plantation and remaining 10% as open areas around the Settlement and Research Station. A large number of nests (approximately 52%) was monitored in the vicinity of inhabited or uninhabited buildings. Markers on the Back Path and Coastal Path were used for reference to locate the nests. The nests were not marked by any temporary markers. The nest monitoring time was split into a time for locating new nests and time for checking the existing nests. Nest searches were conducted early in the morning starting with the first light (after 6am) and existing nests were checked on daily basis in the afternoons (usually after 3 p.m.). While morning searches were often done in a smaller area and were mainly focused on finding rail nests, afternoon checkups covered the whole area visiting all known nests. By splitting the nest monitoring in this manner and keeping to the same route every afternoon it was easier to make sure that no nests were accidentally omitted.

In total 140 nests were located and monitored between November 2011 and March 2012. The outcomes will be included in the 2012 Annual ASC report.

The landbird nest success report can be found at the fileserver:
Fileserver\Monitoring\Birds\Landbird nesting successReport_Landbird nest monitoring_ MSur_final_May12.

5.2. Waders and seabirds

5.2.1. Wader counts

Monitoring of waders is performed on a two-weekly basis on Settlement Beach. On the coastal stretches near Dune Jean-Louis and Dune d'Messe the monitoring is done on opportunistic basis. The counts are done during low tide when the reef is exposed and preferably in the early morning when temperatures on the reef are not too hot. The count also includes a few non-wader species, such as herons, egrets and terns.

A new MS Access wader database has been created this year by Philip Haupt. As stated in previous reports interpretation of the wader data is tricky as many factors can potentially influence the number of birds seen. Seasonal migration is obviously an important factor, but also local parameters such as weather conditions and tide play important roles. With regards to the latter, the water level has important implications for the amount of accessible wader habitat in the lagoon. For example, high spring tides in the lagoon can force most crab plovers and other waders out onto the outer beaches.

Figure 41 shows monthly averages for six of the most commonly sighted waders on Settlement Beach in 2011, revealing a seasonal pattern with a peak in occurrence in the wet season and a drop in the dry SE season when most of the birds migrate to the northern hemisphere / Arabian Sea area.

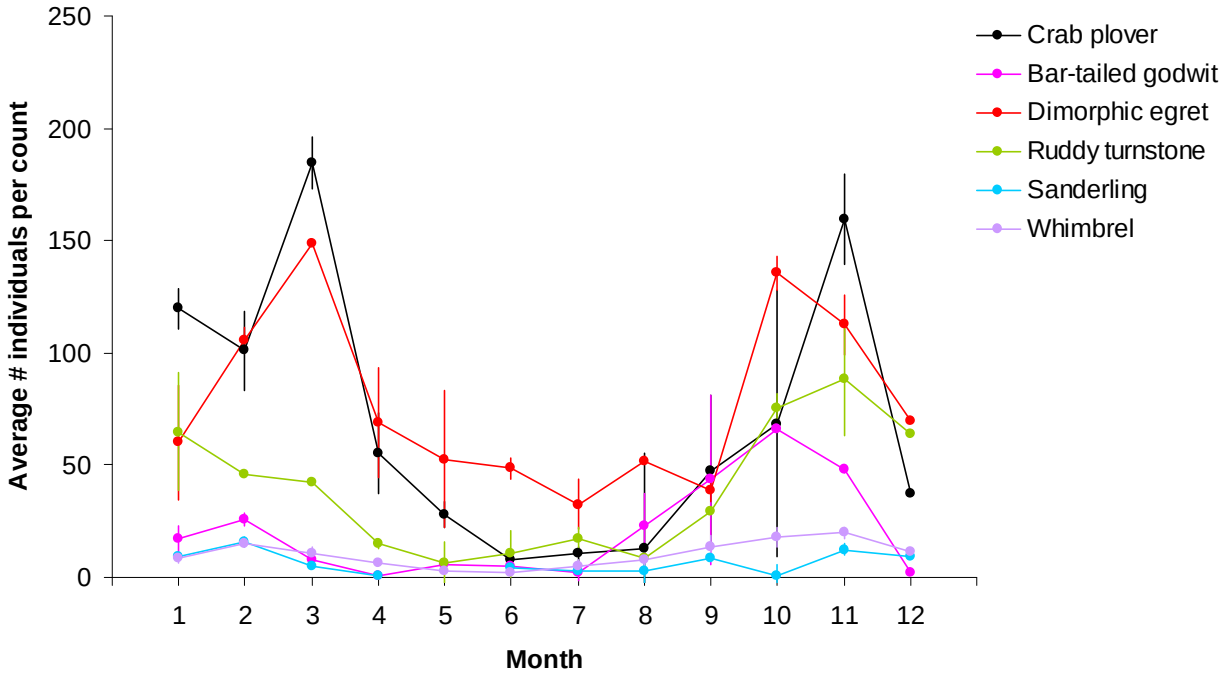


Figure 41. Average monthly counts of the six most common waders / shorebirds (crab plovers, bar-tailed godwits, dimorphic egrets, ruddy turnstones, sanderlings and whimbrels) in 2011 on Settlement Beach.

Comparison of wader counts in the four quarters of 2011 (Figure 42) shows that the dimorphic egrets, ruddy turnstones and crab plovers make up most (*ca*. 55-75%) of the total wader counts throughout the year.

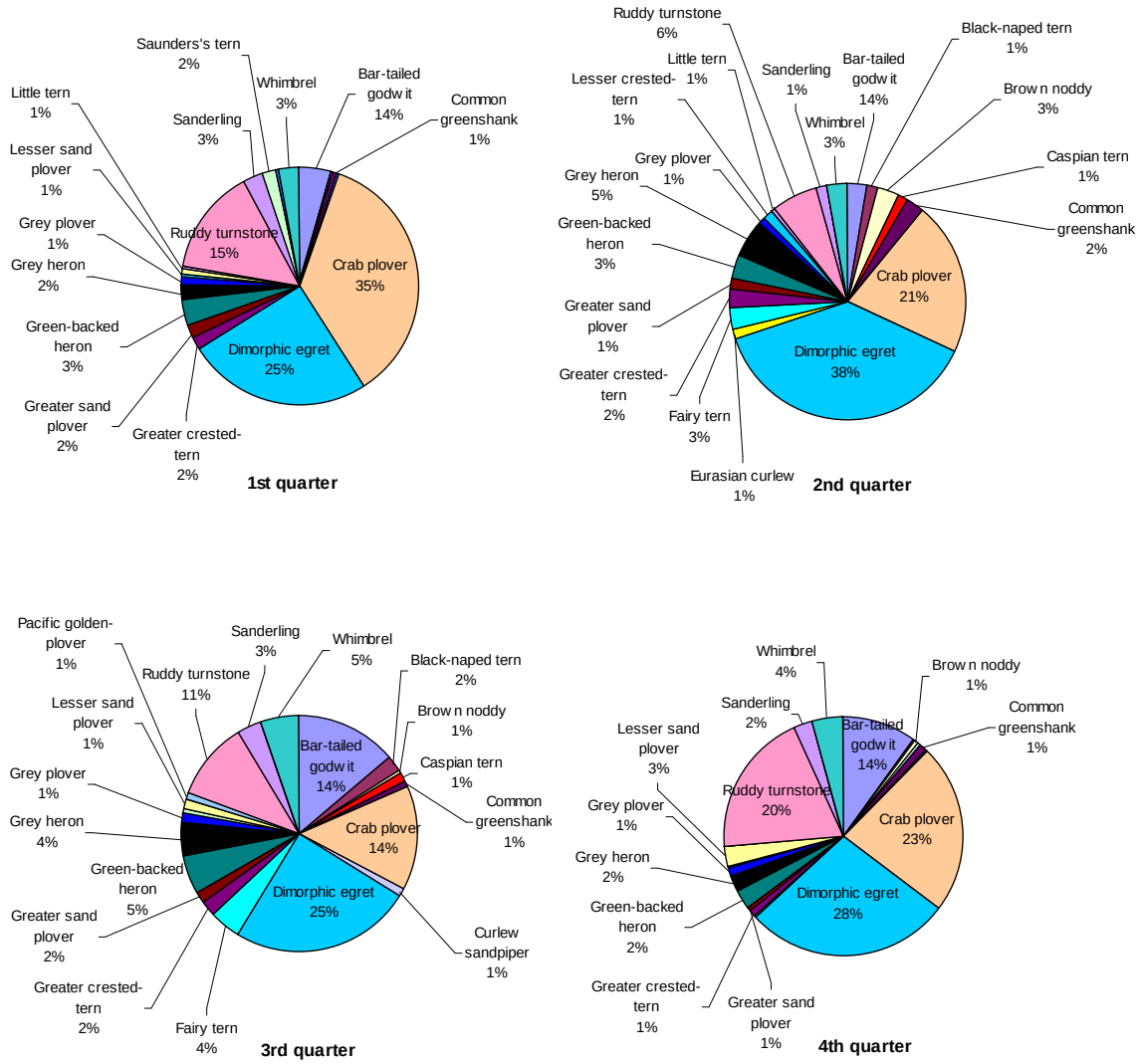


Figure 42. Pie-charts of wader proportions based on survey averages along Settlement Beach for all quarters of 2011.

Sighting rates over the last years differ per species (Figure 43): in 2011 an increase was seen in the number of bar-tailed godwits and whimbrels encountered, whereas fairly stable patterns were found in most other species.

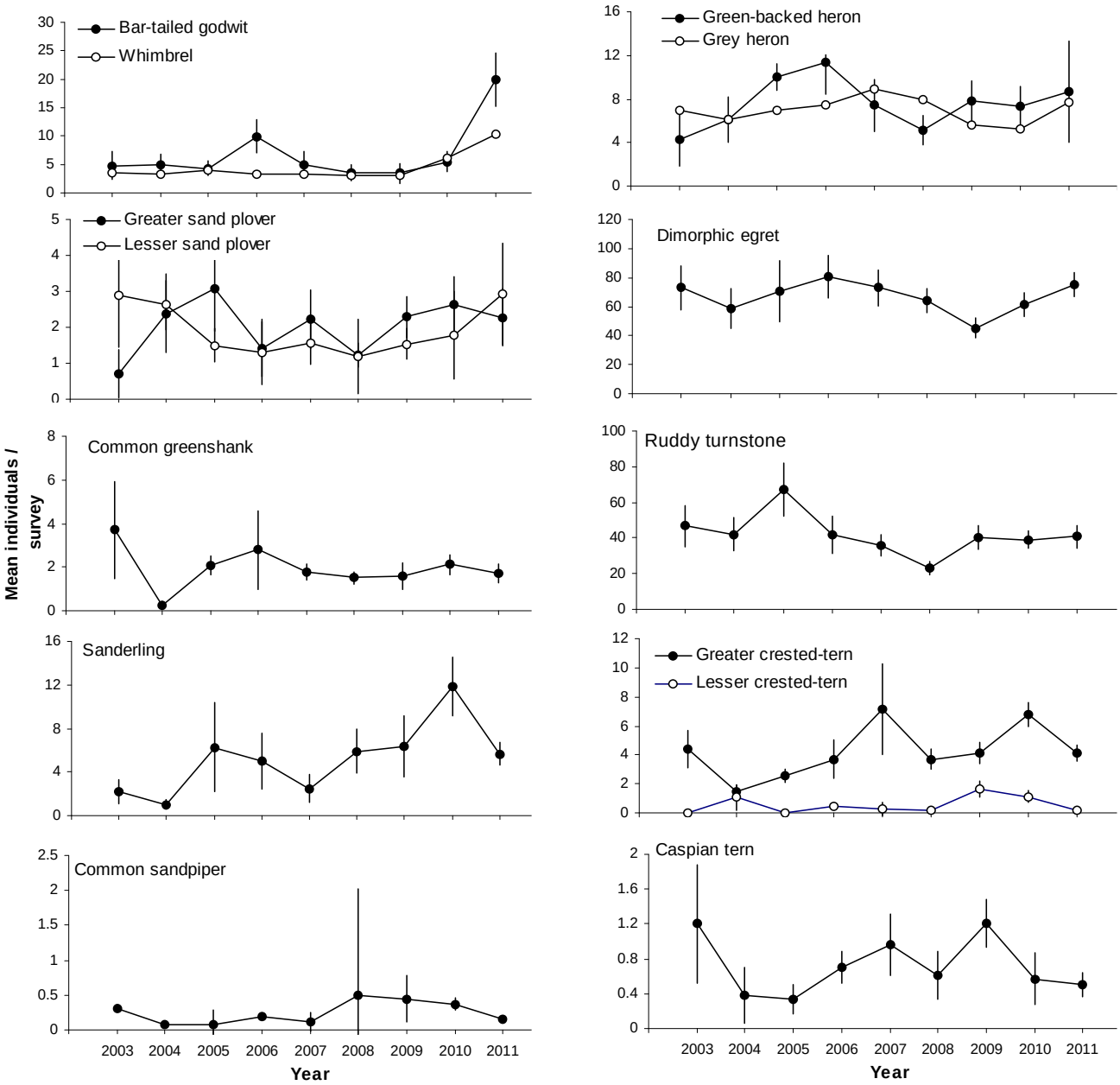


Figure 43. Mean number of individuals encountered during waders surveys for different species of waders / shore- and seabirds on Settlement Beach for the period 2003-2011.

5.2.2. Crab plover daily counts

Crab plover numbers were counted daily on Settlement Beach (during turtle track count). With March and April as only exception, crab plovers seen in 2011 were comparable to their 2007-2010 averages (Figure 44). After the drastic drop in June – July (as a result of the birds migrating to areas around the Arabian Sea), numbers of individuals sighted slightly increased again during August and September.

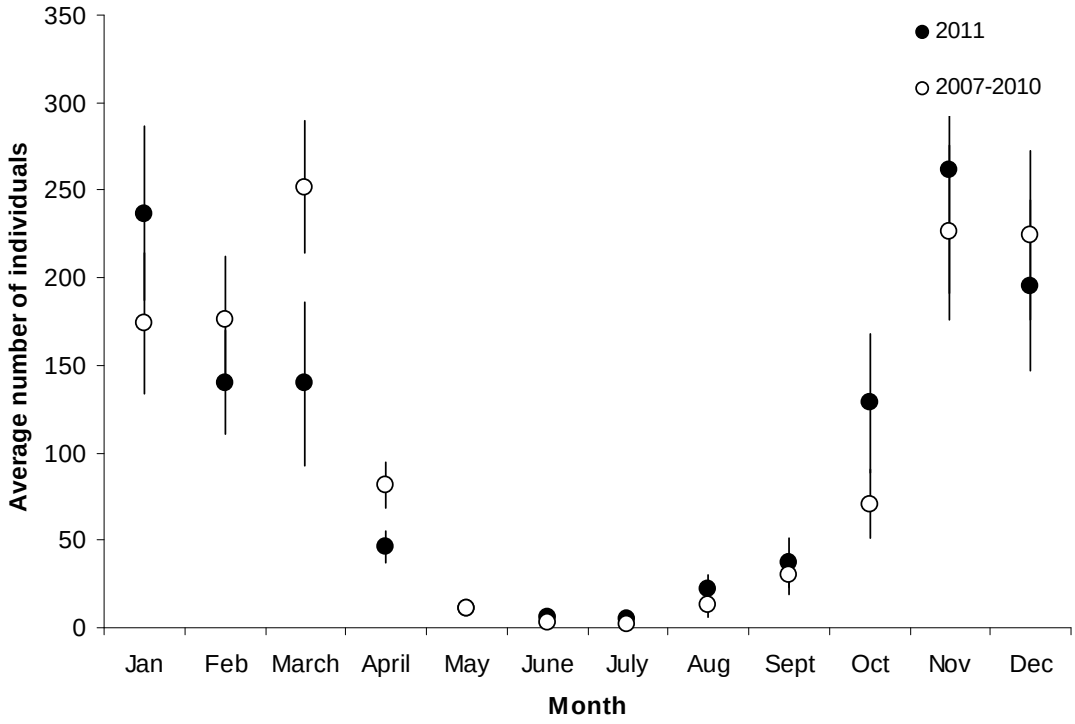


Figure 44. Average daily counts of crab plovers from Settlement Beach (± standard error) in 2011, compared to the average annual cycle from 2007-2010.

5.2.3. Caspian terns

Caspian terns (Figure 45) were sighted from the beginning of February until the beginning of October. At least a total of 10 assumed pairs were found (potentially) breeding on the sites summarized in Table 13.

Table 13. Sites with confirmed or supposed breeding of Caspian terns in 2011.

Location	Island	No. of breeding pairs	Successful?	Notes
La Gigi	Picard	1	Yes, see Fig. 43	
Anse Grand Poche	Picard	3	At least two fledglings	
Anse Polymnie	Polymnie	1	?	Not sure whether breeding
West Grand Terre beaches	Grand Terre	1	?	Seen in breeding plumage, not sure whether breeding (or this is La Gigi pair)
Dune d'Messe	Grand Terre	At least 1	?	Seen in breeding plumage, not sure whether breeding
Dune Jean-Louis	Grand Terre	At least 1	?	Seen in breeding plumage, not sure whether breeding
Ile Esprit	Lagoon island	At least 1	?	Seen in breeding plumage, not sure whether breeding
Ile Moustique	Lagoon island	At least 1	?	Seen in breeding plumage, not sure whether breeding

Figure 45. Successfully fledged Caspian tern juvenile at La Gigi (*Photographs by J. van de Crommenacker*)

5.2.4. Dimorphic egrets: black / white ratio

Dimorphic egrets are resident on Aldabra. They occur in two strikingly different colour phases: a white morph and a black morph. This dimorphism is not linked with gender, meaning that it is thus not the case that one sex is always white and the other is always black. The Skerrett 'Birds of Seychelles' book states that breeding pairs commonly include one white and one dark individual but this is yet to be proven. Not much is known about the distribution of the two morphs, but a publication by Benson & Penny (1971) states that there is a higher population of black morphs within the lagoon and channels compared to the coast. However, nowadays there are no clear signs of such pattern.

From July 2011 onwards, we started recording the number of white and black morph dimorphic egrets during the each wader count, resulting in the pattern shown in Figure 46. Black morph egrets are generally less frequently seen than white morph individuals, except in November when black morph birds are seen in greater numbers than the white ones. This may be related to their breeding behaviour, as the peak of egg-laying occurs in November. If this is the case, it could indicate that white birds are occupied with nest care to a higher extent than black birds. Yet, this does not explain the sudden increase in numbers of black morph birds during this November count (if the explanation above would be true, one would expect the numbers of white morph birds to drop and the number of black morph birds to stay the same. Now a movement of more black morph birds to the coast seems to occur instead). It would be interesting to perform daily counts during October, November and December to gather more data to study these patterns. Also it would be interesting to perform white / black morph counts in the lagoon and observe nests to indentify the morphs of the parents.

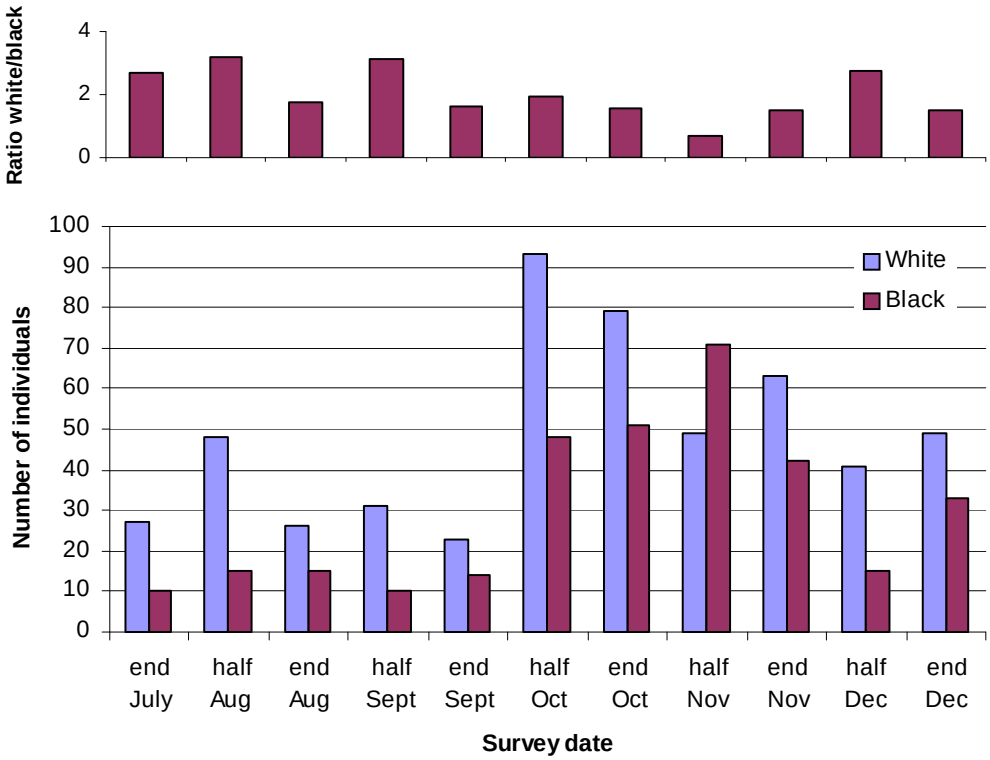


Figure 46. Numbers of white and black morph dimorphic egrets spotted on Settlement Beach during wader counts in 2011 and on top the ratios white/black morph.

5.2.5. Opportunistic wader / seabird sightings

Research staff have (re-)started recording the opportunistic seabird sightings in an Excel database (stored as Fileserver\Monitoring\Birds\Seabirds\Seabird activity). This yielded a number of interesting records. For example, black-naped terns were found breeding on the La Gigi champignon islets in May and July. Also, an Audubon's (now known as 'tropical') shearwater was found incubating an egg on islet 6 in the end of May (Figure 47). Then, in June and July, sooty terns were occasionally heard flying over. High numbers of brown noddies were found roosting at islands in Passe Du Bois, Passe Gionnet and Camp Frigate, but no breeding was recorded.

Figure 47. Audubon's / Tropical shearwater incubating an egg on LG6 (*photograph by J. van de Crommenacker*).

5.2.6. Crab plover ringing

Currently, very little is known about the migration of crab plovers to and from their breeding grounds, although it has been hypothesised that the East African population may come from the Red Sea, the Gulf of Aden or Somalia (Aspinall & Hockey 1997). Ringing of birds with internationally shared identification information will help in tracking the Aldabra crab plovers migratory routes. Metal numbered bird rings (7 mm diameter) have been ordered with SAFring and will be deployed on crab plovers caught on the beach at night time (it is fairly easy to catch them in the dark, 'blinding' them with a torch).

5.2.7. Tropicbirds

Red-tailed and white-tailed tropicbird nests are monitored every two weeks on a spring low tide at La Gigi, Picard. The birds are nesting on small 'champignon' islets in the lagoon (numbered LG01-LG18) and on a well-vegetated rocky headland on the southern tip of Picard.

A new database was created by Philip Haupt. Until recently, data analysis was tricky as nests were not receiving a unique nest ID. Labels with nest numbers were re-used which meant that a single nest number would re-occur several times in the database despite indicating different nesting attempts. When analysing the data it was extremely difficult to recognize the single nest attempts because of this double numbering. Also, labels were not taken away when a nest was finished, meaning that when a new bird started using the same nest spot, the same number was re-used and the attempt was not automatically recognized as new.

The reason for this previously adopted approach was related to the fact that tropicbirds frequent re-use the same nest sites. Previously these nest sites were numbered, and thereby the usage frequency of each nest site could be analyzed. However, this did not work for the nesting success rates, and because the latter is the main aim of this monitoring programme, the method was revised.
The system has now been changed (as of October 2011) as follows and modified in the monitoring protocol:
- A series of uniquely numbered disposable labels was made (using bright coloured paper, laminated labels).
- Each new nest is given a uniquely numbered label (only when finding an egg or chick, thus not when finding only an adult that could be resting).
- During each trip, last time's form is taken along to locate all the nests that were present during last trip
- When a nest is found empty, the label is removed (this means the egg/chick is predated, or the chick has fledged; either way the nesting event is finished. This conclusion can be drawn even without having last time's form).
- Important: All removed labels are thrown away so that no number occurs more than once
- When removing a label, a piece of bright orange plastic band is tied close to the nesting site to show for future searches that this is a potential nesting site.
The system has been introduced in October and is working well.

Staff expressed their concern that routine monitoring may be reducing tropicbird numbers on the islets. If this were true, a gradual decline would be expected in tropicbird numbers over time. Figure 48 shows the numbers of nests for each of the previous years, showing that numbers were highest in 2010 compared to the other two years. There is no evidence for a decline (more nests were found in 2011 than in 2009), therefore one cannot draw the conclusion that routine monitoring is reducing tropicbird numbers. Note there were 23 monitoring trips in 2009, 28 in 2010, and 24 in 2011.

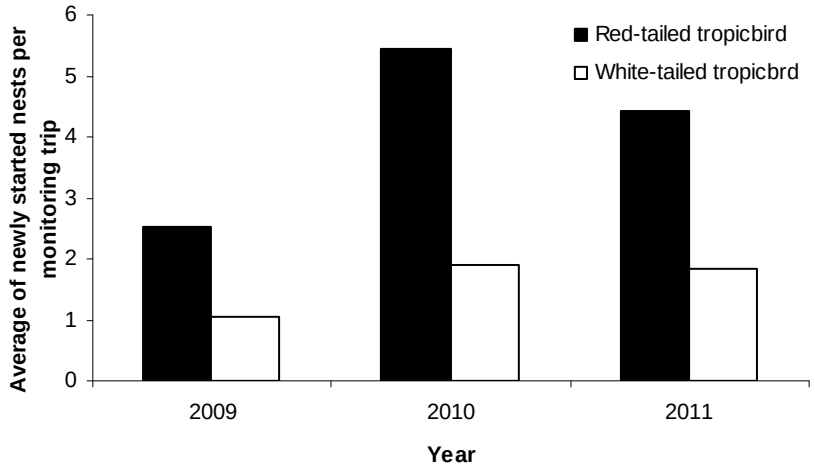


Figure 48. Average number of new red- and white-tailed tropicbird nests found per tropicbird monitoring trip in 2009, 2010 and 2011.

Nesting success rates of tropicbirds at La Gigi are generally low, and are thought to be influenced by predation by rats and herons. Overall success rates do not seem to differ between inner and outer islets (average inner: 9.8% and outer: 9.68%) despite the confirmed presence of rats on the inner islets. This result does not support the hypothesis that nests on inner islets are prone to rat predation to a greater extent than nests on the outer islands. The reasoning behind this is that rats can reach the inner islets more easily than the outer islets which are located further in the water away from the lagoon edge. Chew block trials in July showed that rats are present on inner islets, but absent on outer islets (see section 7.2.2. 'Chew block experiment on La Gigi Islets'). Possibly, predation by herons or other predators also plays a significant role. To help identify the cause of egg and chick failures, it is planned to install some trail cameras at nesting sites. Success rates are calculated by dividing the number of nests that reach a c3 chick stage by the total number of new nesting attempts. Success rates for each islet, both overall and for each species separately, are plotted in Figure 49.

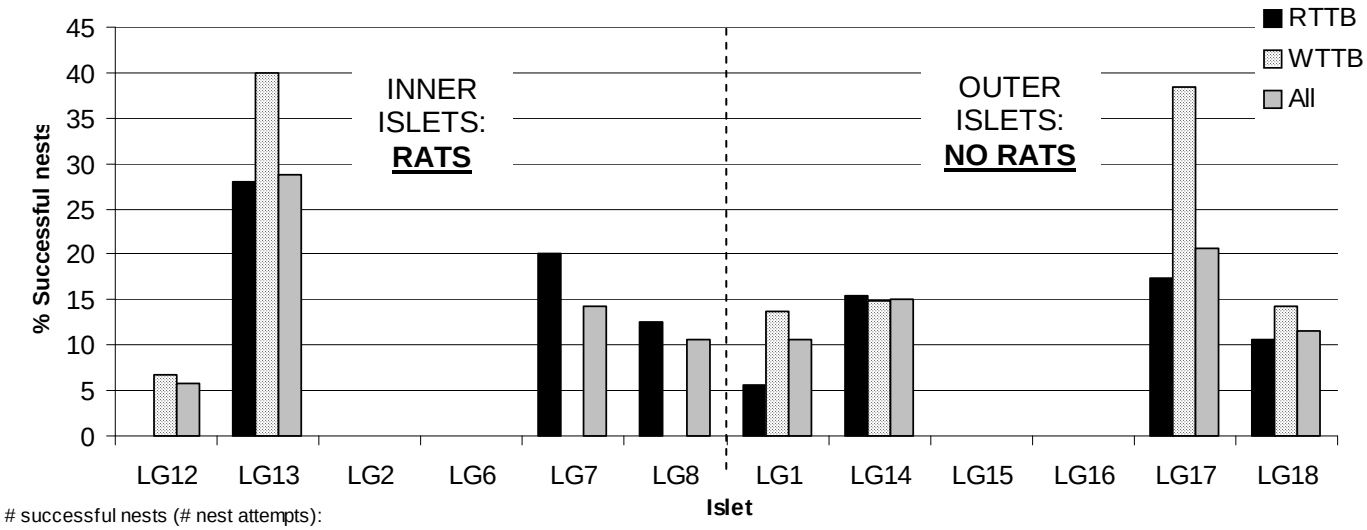


Figure 49. Percentages of successful tropicbird nests on inner and outer La Gigi Islets, based on all data of 2009 – 2011.

Figure 50 shows seasonality patterns of nesting for both species, by plotting the average number of active nests found each month (taking into account the number of monitoring sessions performed during that particular month). Red-tailed tropicbird nesting shows a peak in December until March, whereas the white-tailed tropicbirds show no obvious seasonality in their nesting numbers and remain low (relative to the RTTB) throughout the year.

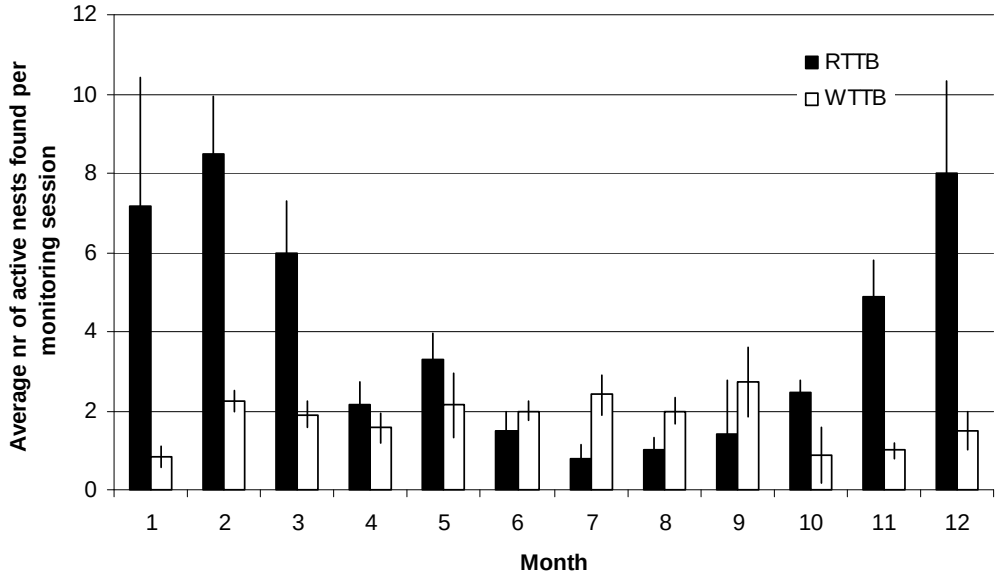


Figure 50. Monthly averages of active nests found for RTTB (red) and WTTB (grey), based on data of 2009-2011.

5.2.8. Madagascar Pond Heron

The Madagascar Pond Heron (MPH), *Ardeola idae,* is a seasonal migrant within Africa. The species is confined as resident to the Malagasy region, breeding almost entirely in Madagascar and on Europa Islands, Mayotte and Aldabra.

Unfortunately the species has been declining continuously for over the last 50 years in all known colonies except Aldabra, particularly on the high plateau of Madagascar. Continued habitat loss due to drainage and habitat conversion into rice fields are the main reasons for the decline, but hunting and egg collection have also been noted. In 2007 the MPH was listed as 'Endangered' on the IUCN Red List. At present the global population is estimated at 2000-6000 birds and declining. Recent, accurate population estimates are scarce or not available, due to the lack of survey information from most breeding areas. As a potentially important breeding area, it is therefore important to make an effort to monitor all sightings of Madagascar Pond Herons on Aldabra. The routine monitoring now occurring follows up the dedicated project on MPH in 2008/2009.

In total, 64 opportunistic sightings of Madagascar Pond Herons were recorded on Aldabra (all in the East Grande Terre region). Most, but not all records were recorded by a GPS coordinate, resulting in Figure 51 that shows 39 sighting locations. All birds were judged to be adults, and six of the 59 sightings were recorded as displaying breeding plumage.

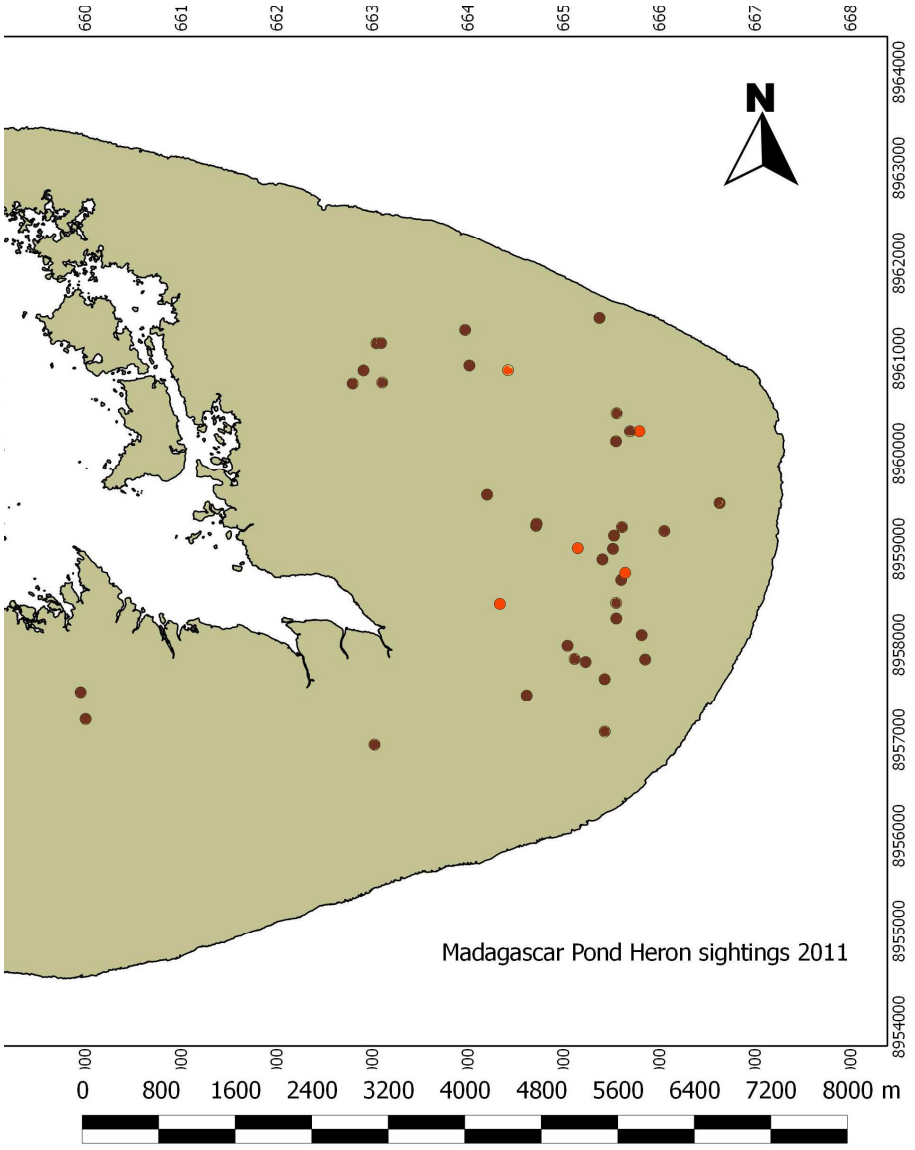


Figure 51. Madagascar Pond Heron sightings in 2011 (red = breeding plumage, black = non-breeding plumage).

Table 14 shows that MPHs in breeding plumage have been sighted in the last few years only in the period of November until March. Although evidence is scarce, it seems that Aldabra's MPHs do breed seasonally rather than year-round.

Table 14. Summary of Madagascar Pond Herons sighted in breeding and non-breeding plumage in the period 2009-2011. Months in which MPHs in breeding plumage were sighted are coloured in grey.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Breeding / non-breeding plumage												
2009						0/5	0/12	0/6	0/2	0/3	4/1	-
2010	1/1	-	1/4	0/5	0/11	0/15	0/9	0/2	0/2	0/5	-	4/2
2011	3/3	0/6	3/10	0/16	0/16	-	0/5	0/2	-	-	-	-

5.2.9. Flamingos

22 Sightings of flamingos were recorded for 2011, of which some were at the mudflats south of the CC landing stage, some at the CC Coco transect, and some at Bassin Flamant and Big Pool. The largest group seen at once comprised of 68 individuals (at the mudflats south of the CC landing stage). In this group one juvenile was spotted. Juveniles were sighted during six different occasions dated between January and April (Table 15). GPS coordinates were taken from most sightings.

Table 15. Selection of flamingo sightings during 2011 that included juveniles.

Date	Time	Location	Group composition	Activity
05/01/2011	08:15	South of the second CC landing stage	21 adults, 2 juvs	Feeding
06/01/2011	18:15	South of the second CC landing stage	67 adults, 1 juv	Feeding
13/04/2011	09:15	Big Pool	8 adults, 1 juv	Feeding
13/04/2011	10:30	Pool North of Bassin Flamant	2 adults, 1 juv	Walking, flying away
14/04/2011	08:00 - 09:00	Pool on Coco transect, point 25-26	7 adults, 1 juv	Flying
14/04/2011	08:00 - 09:00	Pool on Coco transect, point 28	4 adults, 1 juv	Flying

5.2.10. Frigate bird census

Aldabra holds the largest frigatebird colony in Indian Ocean with at least 4000 pairs of greater frigatebirds *Fregata minor* and 6000 pairs of lesser frigatebirds *F. ariel* breeding annually (Reville 1983). There have been several surveys of frigatebirds on Aldabra (Diamond 1967–68, Reville 1976–77, Burger & Betts 2000), but results are difficult to interpret and compare in terms of a general picture. In addition to the big gap in breeding population surveys, all of the previous studies applied different methodologies and were conducted at different times of year, making a direct comparison between their results problematic. It is therefore essential for the management of this important seabird population to establish a logistically feasible and repeatable survey method that can be used routinely in the future to monitor, examine and respond to long-term trends.

In this context, a frigatebird survey was started in January 2011, led by Michal Šúr (GEF Project Bird Survey Consultant). The survey was planned to cover two seasons at the same time of year, i.e., January 2011 and January 2012. Although the second part of the survey was carried out in 2012 it is included in the current Annual Report for sake of providing a complete overview of the results. The long survey period, covering two years, was chosen because of the long breeding cycle of the frigatebirds. Neither of the two species breeds in an annual cycle: it takes 12–19 months for a pair to fully raise one chick. To get a full picture of the current population size, distribution and development, the survey needed to cover at least one year.

The aims of the frigatebird survey were to:
(1) Summarize all previous frigatebird studies that have been done on Aldabra, and compare their methodologies and results;
(2) Develop a simple standardised census method that can be used on yearly basis and produce comparable results about the Aldabra frigatebird population and its trends; and
(3) Survey the Aldabra frigatebird populations of both species and compare the results with previous surveys.

The survey was done by a team of four people (three counters and one boatman) from a 16' fibreglass boat with a 25hp engine. The boat was driven slowly through the colony areas at high

tide, stopping when necessary. A distance of at least 15m was maintained from the nesting birds at all times to limit disturbance, and noise was kept to a minimum. A small part of one colony (Middle Camp) was surveyed on foot at spring low tide. See Figure 52 for the colonies surveyed. Information about timing of the surveys and other methodological considerations can be found in the census reports of 2011 and 2012.

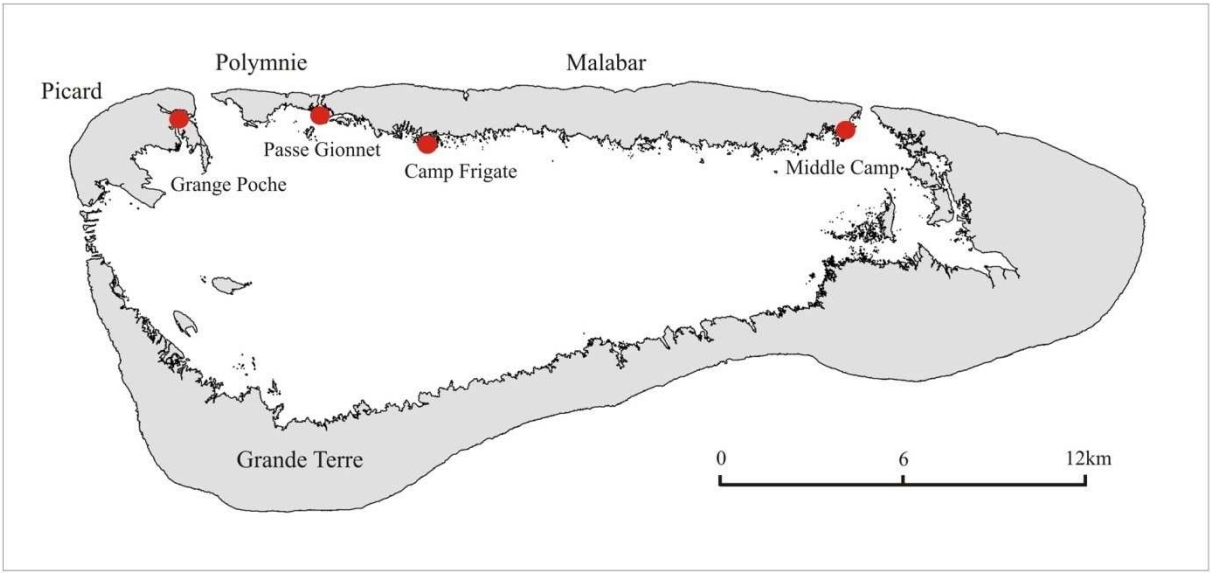


Figure 52. Frigatebird colonies surveyed in 2011 and 2012.

The total number of active nests was assessed, with each of the three counters focussing on one of the following three categories:
1) lesser frigatebird adult on nest (incubating/brooding small chick);
2) greater frigatebird adult on nest (incubating/brooding small chick); and
3) lone chick on nest (not distinguished by species).
Adults accompanying a chick were counted as 'adult on nest', and thus differentiated to species. Lone young birds on nests that had at least some downy feathers on the chest were counted as 'chick'. It was only possible to distinguish the species of young chicks when attended by their parents, which required longer observation than was feasible given the limited active survey time. Adult flying birds, roosting birds and independent juveniles were excluded from the census. The number of dependent fledged juveniles was calculated based on Reville's figures from 1977. All counters were trained and tested in species identification by the team leader (MS) and had practice sessions in a colony before the survey began.

We calculated a total breeding population of frigatebirds on Aldabra to be 9891 (4198 greater, 5693 lesser) pairs in 2011, and 5708 (2654 greater, 3054 lesser) pairs in 2012. Figures for both seasons, however, are conservative: birds hidden by vegetation may have been missed, and Reville's estimate of 10,000 pairs is based on counts during the breeding peak, whereas our surveys were at least three months later in the season. Therefore we estimate the breeding population size to have been at least 11,000 (4400 greater, 6600 lesser) pairs in 2011, and at least 6500 (3000 greater, 3500 lesser) pairs in 2012.

Detailed information and discussion of the results can be found in the following documents:
Frigatebird census report 2011: Fileserver\Monitoring\Birds\Seabirds\Frigatebirds\frigatebird census\Frigate_census_2011\ReportFrigatebird report 2011_final_220411
Frigatebird census report 2012: Fileserver\Monitoring\Birds\Seabirds\Frigatebirds\frigatebird census\Frigate_census_2012Frigatebird census on Aldabra in 2012

Manuscript: 'Census of greater and lesser frigatebirds (*Fregata minor* and *Fregata ariel*) on Aldabra Atoll, Seychelles' by Šúr, Bunbury & van de Crommenacker, to be submitted for publication in 2012.

5.3. Vagrant birds

For all vagrants that were reported in 2011 (Table 16), a Seychelles Bird Records Committee form was submitted to A. Skerrett with photos. Records were included in monthly SBRC reports.

Table 16. All vagrant birds reported to SBRC in 2011.

Species	Date	Reporter	Location
Allen's gallinule (*Porphyrio alleni*)	11/01/2011	Michal Šúr	Old Settlement, Picard
Pied wheatear (*Oenanthe pleschanka*)	17/02/2011	Michal Šúr	Settlement, Picard
Knob billed duck (*Sarkidiornis melanatos*)	16/03/2011	Philip Haupt	Cinq Cases, in pool near hut, East Grand Terre
Yellow wagtail (*Motacilla flava*)	06/04/2011	Philip Haupt	Settlement, Picard
Knob billed duck (*Sarkidiornis melanatos*)	13/04/2011	Philip Haupt	Cinq Cases Area, East Grand Terre
Great white egret (*Egretta alba*)	16/05/2011	Stan Denis	Cinq Cases Area, East Grand Terre
Tropical shearwater (*Puffinus bailloni*) (previously: Audubon' shearwater)	27/05/2011	Janske van de Crommenacker	La Gigi Islets
Little tern / Saunders tern (30-40 individuals)	01/09/2011	Catherina Onezia	Dune d'Messe, Grand Terre
Great White Egret (*Egretta alba*)	14/09/2011	Martijn van Dinther	Bra Takamaka, Grand Terre
Wattled Starling (*Creatophora cinerea*)	05/10/2011	Catherina Onezia	Back Path, Picard
Common swift (*Apus apus*, race pekinensis)	06/10/2011	Catherina Onezia	Old Settlement, Picard
Eurasian golden oriole (*Oriolus oriolus*)	18/10/2011	Catherina Onezia	Old Settlement, Picard
Ortolan bunting (*Emberiza hortulana*)	26/10/2011	Catherina Onezia	Old Settlement, Picard
Tree pipit (*Anthus trivialis*)	29/10/2011	Catherina Onezia	Old Settlement, Picard
Barn swallow (*Hirundo rustica*)	30/10/2011	Michal Šúr	Between Settlem. Beach and Anse Var, Picard
Spotted flycatcher (*Muscicapa striata* race *neumanni*)	05/11/2011	Catherina Onezia	Settlement Beach, Picard
Spotted flycatcher (*Muscicapa striata* race *neumanni*)	10/11/2011	Catherina Onezia	Anse Mais Beach, West Grande Terre
Great white egret (*Egretta alba*)	14/11/2011	Catherina Onezia	Passe Hoareau
White wagtail (*Motacilla alba*)	16/11/2011	Catherina Onezia	Settlement, Picard
Broad-billed roller (*Eurystomus glaucurus*)	17/11/2011	Catherina Onezia	Settlement, Picard
Eleonora's falcon (*Falco eleonorae*)	23/11/2011	Catherina Onezia	Between old and new settlement, Picard

Spotted flycatcher (*Muscicapa striata)* (race neumanni)	24 & 26/11/2011	Catherina Onezia	Old Settlement, Picard
Broad-billed roller (*Eurystomus glaucurus*)	29/11/2011	Jakawan Hoareau	Dune d'Messe, Grand Terre
Eurasian hobby (*Falco subbuteo*)	11/12/2011	Michal Šúr	Settlement, Picard
Namaqua dove (*Oena capensis*)	11/12/2011	Michal Šúr	Back Path, Picard
Blue-cheeked bee-eater (*Merops persicus*)	15/12/2011	Michal Šúr	Settlement Beach, Picard
Northern wheatear (*Oenanthe oenanthe*)	21/12/2011	Michal Šúr	Back Path, Picard
Asian lesser cuckoo (*Cuculus poliocephalus*)	24/12/2011	Michal Šúr	Coastal Path, Picard
Lesser Crested Tern (*Thalasseus bengalensis* race Torresii)	26/12/2011	Catherina Onezia	Settlement Beach, Picard
Greater spotted cuckoo (*Clamator glandarius*)	30/12/2011	Michal Šúr	Old Settlement, Picard

6. OTHER RESEARCH ACTIVITIES

6.1. Tidal gauge *(Contributed by Christina Quanz)*

A Valeport Tidemaster tidal gauge was installed at Passe du Bois (Figure 53) in March 2011 by Seychelles National Meteorological Services (SNMS) technician Jean-Paul Dodin. The overall objective is to collect sufficient data to generate our own tidal charts, rather than relying on the tide chart from Mayotte. Since the set-up of the device, tidal data have been recorded every 15 minutes. However, without obvious reason data collection was interrupted between May 24th and July 6th 2011. Despite the device providing sufficient room to store data up to one year, it is advisable to monitor the data recordings on a monthly basis so that data loss is avoided.

Figure 53. Tidal gauge at Passe du Bois

After the installation, SIF was advised by the SNMS technician that a site calibration of the gauge is required and site leveling work needs to be performed. He already referenced the gauge sensor since this was essential to support leveling the gauge to a known datum level. Two points on the gauge structure were noted for future consideration in the events of a leveling exercise, which is a necessity (for details see Tidal gauge installation report: ALDABRASERVER\Monitoring\Tidal\Tidal gauge\ReportsAldabra_Tidalgauge_Installation _Report _ Apr11_final.pdf).
The results from a leveling exercise will allow corrections to be applied to the data logger and hence reduce the logged sea level data to a known datum level e.g. ACD (Admiralty Chart datum) and MSL (Mean Sea Level). There is a benchmark already established at Passe du Bois, next to the installed data logger on the champignon. The benchmark was placed by Vidal (4-8 September 1967) and ACD was defined as 3.536 below this level. Also see Appendix 2 for more information.

In November and December 2011 we received support from the Indian Navy survey vessel INS Sarvekshak to carry out the necessary leveling exercise. The Navy team has been manually monitoring the sea level at Passe du Bois for at least 24 hrs and data were matched with the vessel's tidal gauge data. However results from this leveling exercise are still to be applied to our tidal data and a report of the duties is still to be submitted.

6.2. Collection of *Cratopus* samples

SIF received a request from PhD student James Kitson (University of East Anglia, UK, supervised by Dr. Brent Emerson and Dr. David Richardson) to collect beetles from the *Cratopus* genus on Aldabra. The beetles are collected as part of a larger ongoing study to understand the role of the Seychelles and Aldabra Islands for the evolution of *Cratopus* weevils across the Indian Ocean. The aim of the project is to 1) assess the genetic diversity within Seychellois and Aldabran *Cratopus* weevils, 2) examine how the Mascarene species studied are related to species in the same groups across the Indian Ocean as a whole and 3) Quantify the patterns of colonisation that have lead to *Cratopus* being so wide spread across the Indian Ocean.

The study required a small number of samples (1-5 beetles) of each species from as many localities as feasible. Samples (i.e., whole individuals stored in 96% ethanol) were collected by hand or by beating or sweeping vegetation.

From the samples, DNA is extracted and amplified in the lab back in the UK and the data is added into the overall dataset to produce phylogenetic trees for the entire genus.

There are three *Cratopus* species listed from Aldabra (Cratopus *griseovestitus*, *Cratopus adspersus and Cratopus viridiparsus*), and one other that might be there (*Cratopus murinus*). All the species are brown or grey (possibly a bit green in *C. viridiparsus*) and about 7-15mm long (Figure 54). They can be found feeding on the leaves of woody shrubs and trees or in the new leaf whorls at the tips of *Scaevola taccada* stalks.

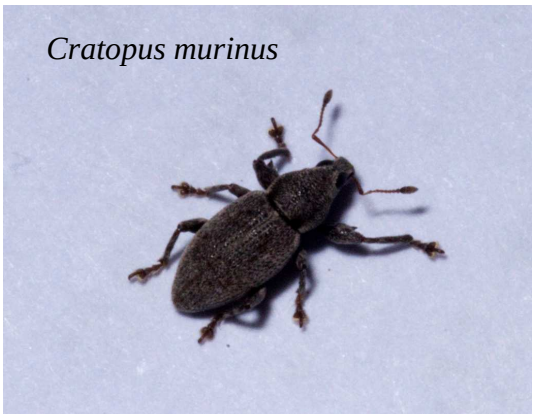


Figure 54. Cratopus species to be found on Aldabra.

In total, 60 samples were collected on different locations (Picard, DDM, DJL, Cinq Cases) in the period of June – September 2011. Of these *Cratopus* beetles 35% were found in *Tournefortia argentea* bushes, 30% in *Scaevola taccada*, 20% in *Maytenus senegalensis*, and very few others in *Colubrina asiatica*, *Clerodendrum glabrum*, *Sideroxylon inerme cryptophlebium* and *Pemphis* (yellow variant). The samples were sent off to the UK in the end of December.

7. INVASIVE SPECIES

7.1. Goat Eradication Program (GEP)

During 2011, no NJGs (non-Judas goats) were sighted. The last sighting of NJGs was reported in March 2010, when the Aldabra team managed shoot two NJGs. In January 2011 four of the six JGs had working (new) collars. Monthly GEP trips were performed throughout 2011, with the following notable events:

- In February J10 (female) was misidentified as J9 and unnecessarily darted due to missing numbers on the collar and the shot that had to be taken in a rush. The opportunity was taken to insert a Compudose-100 implant, which acts to increase oestrus for several months and effectively makes her far more attractive to any male goats.
- In May again the wrong JG was darted. This time it was J1 because it walked across while shooting the dart. This was the first darting action since the departure of Jock Currie, and staff successfully managed to administer the Yohimbine drug and wake up J1.
- Simultaneously to the Cinq Case GEP trip a Takamaka exploration trip was organized in August to check for signs of NJGs. No signs of goats (droppings, tracks or sounds) were found.
- As the JGs seemed to have settled down as a little herd (they have been together since April 2010) and were not actively looking for others anymore, it was advised in August by Rainer von Brandis to eliminate the two females J10 (re-collared) and J9 (not yet re-collared). That would leave four males (three with new collars and one with old) and potentially make the JGs more effective as JGs as their drive for females should get them searching again.
- Following the advice and decision above, the team successfully managed to kill J9 in September. In the same month another exploration of the Takamaka area was done but no signs of goat droppings, tracks or sounds were found.
- At the beginning of December the Indian navy survey ship INS Sarvekshak visited Aldabra. The navy offered Aldabra staff to help with the GEP as they have a helicopter on board with which Grand Terre could be scanned from the sky. The main objective was to scan the Takamaka / CC / Anse Cedres area and to assess whether there are more than the five collared goats present.

The helicopter team provided photos of goats that they had spotted (see the December 2011 GEP report). These were identified as J8, J2, a collared goat without number, and a potentially uncollared goat. The latter sighting of a supposed uncollared goat sparked a discussion about the concern over the last NJGs which were seen in March 2010 but never since:

(A) 1 adult male - black - got away when the two juveniles were shot in March 2010

(B) 1 adult female - black - got away when the two juveniles were shot in March 2010

(C) 1 kid (now adult) - white-brown - got away when female was shot in July 2009, but was thought to have been hit as the team saw some blood on the animal (but did not know where on the body it was hit).

The possibility of these goats being still alive urges the need for an extensive search covering Grand Terre to confirm the absence of NJGs. However, with no NJGs encountered throughout the whole year, the GEP is showing promising signs of approaching a successful end.

7.2. Rats

7.2.1. Rat DNA study

In September 2010 a small project was initiated to complement parts of the EC Invasive species project by collecting rat tail samples to later have the potential to assess the origin, population structures and connectivity among the rat populations on Aldabra (which are present on all major islands). Samples are opportunistically collected when staff are at camp and rats are trapped. The following samples were collected (Table 17) and are stored at HO.

Table 17. Rat DNA samples collected on field camps.

Location	Number of samples collected in 2011	Total number of samples
Picard	0	32
Middle Camp	11	21
Malabar	2	3
Cinq Cases	2	2
Dune Jean-Louis	1	1
Dune d'Messe	1	3
Anse Mais	1	2
Total	**18**	**64**

7.2.2. Rat chew block experiment on La Gigi Islets (*Contributed by Martijn van Dinther*)

Since the start of the tropicbird islets monitoring program there have been several occasions where tropicbird eggs were suspected or proven to be predated. As initial stage of a future impact study of rats on the breeding success of these birds, it was first needed to confirm the presence or absence of rats on the different islets. To prove rat activity on the tropic bird islets we used chew blocks made out of candle wax and peanut butter. Rats will be attracted to these blocks, and because the blocks are semi-hard, teeth marks can be seen on the blocks showing proof of rat presence on the islets.

Figure 55. Chew block with rat bite marks on LG 8.

On 28th July, a single chew block was placed on each of the islets LG17, 14, 13, 12, 8, 7 and 6. The chew blocks were nailed on a branch of available bushes between 0.6 – 1.6 meters above the ground. Islets LG18, 15, 2 and 1 left out of the investigation, mainly because there were no prior suspicions of rat activity on these islets.

The next morning, all the islets with chew blocks were revisited. Clear evidence of chew marks were found on islets LG8 and LG7 (Figure 55). Both of these blocks were removed from the islets and kept as evidence. On 31st July, we revisited LG17, 14, 13, 12 and 6. Again LG17, 14 and 13 did not have chew marks on the blocks. On LG12 there was little left of the chew block but there was clear evidence of chew marks. The chew block on LG6 also had chew marks and was removed.

]

Using the method of chew blocks rat activity has now been proven on LG13, 12, 8, 7 and 6 (all are inner islets in the tropicbird monitoring program), whereas no chew marks were found on LG17 and 14. On 12th August, approximately two weeks after placing of the chew, still no chew marks were found on the blocks of LG17 or 14, suggesting that no rats are present on these islets. More information can be found in the July 2011 ASC report.

7.3. Control of invasive vegetation

7.3.1. Sisal (*Agave Sisalana*)

(Contributed partially by Bevil Narty and Philip Haupt)

Removal of invasive alien species (IAS) is one of the primary requirements for island restoration, and aligns with requirements set by the IUCN for management of nature reserves and UNESCO World Heritage sites of which Aldabra is one. Sisal (*Agave sisalana*) is a known IAS that occurs on Aldabra Atoll.

Figure 56. Patch of introduced Sisal at Anse Polymnie (Stoddard 1971).

Sisal is a perennial succulent plant with very large (150×15 cm) leaves that are arranged in a dense roseate around the stem. The leaves are linear-lanceolate, shallowly channelled on top, and slightly convex below. The leaves are smooth, and margins may be armed with prickles, while the apex is a hard brown spine as long as 2.5 cm. The inflorescence bears a dense cluster of erect yellow flowers on horizontal branches near the apex of the large (< 7 m) stem (pole). The flowers are 4.5 – 5.5 cm in length from the base of ovary. The perianth segments are cream, 3.5 – 4 cm long, and the lower third is fused. Anthers are linear, 2.5 cm long, and protruding at maturity. Capsules are rarely produced on Aldabra, and reproduction is chiefly by bulbils which develop after flowering in the axils of bracts (Fosberg & Renvoize 1983).

History

Sisal was noted by Beamish (1957) as being present at least on Picard island, but extensive surveys were lacking. In papers published by the Royal Society, sisal was mentioned as one of the important cultivated species on Aldabra and neighbouring islands (Renvoize 1971). It was reported to grow on Picard and Anse Polymnie (Figure 56, derived from Stoddard 1971).

Event cards in the Aldabra library provide an insight in the efforts made during the subsequent years to remove Sisal in different areas (Table 18). From these reportings it appears that Sisal occurred not only on Picard and Polymnie, but also on Malabar and Ile Michel.

Table 18. Reports (event cards) of efforts made to remove Sisal in different areas in the 1970-80s and 2000s.

Date	Location	notes
27/5/1973	Anse Malabar	Noted large stand of sisal in area, 9 days work to clear
5/7/1973	Ile Michel	Removed half of stand and piled on the ground
1/8/1973	Anse Polymnie area	Pulled out plants and packed them against cliff on sand
May-Oct 1974	Picard Settlement	Cleared major patches around Settlement and burned them for period of 6 months. 4 hours per day 5 days a week with about 8 people.
8/8/1974	Ile Michel	Did some clearing and burning, not complete removal
9/5/1975	Anse Polymnie area	Checked previously cleared area. Found that some adults had re-rooted and that many seedlings (several hundreds had re-grown).
5/9/1975	Beach north of Settlement	Burning of dried sisal
5/11/1976	Ile Michel	All sisal pulled out and burned over period of 5 days, no need to return for long time
16/9/1986	Anse Badamier (assumed to be beach 41, A. Badamier Malabar)	Sisal cleared over course of few days
1995	Anse Badamier	Five adults eradicated
1995	Back Path Picard	210 Adults and 40 bulbils eradicated
14/6/2005	Anse Badamier Malabar	5 adults killed (Olivier Maurel, Uzice Samedi)
04/7/2005	Back Path 100m east of pigsty (point 31 of transect)	200 adults 400+ bulbils killed (Olivier Maurel, Uzice Samedi, Devis Monthy, Keddy Isnard, Rainer von Brandis)
20/7/2005	Back Path 100m east of pigsty (point 31 of transect)	10 adults + 30 bulbils killed (Olivier Maurel, Uzice Samedi, Devis Monthy, Keddy Isnard)

Then, in 1995, five adult plants were reported and eradicated from Anse Badamier (Malabar). Also, in the same year, 210 adult and 40 bulbils at point 31 along the back path transect on Picard. Digital data sheets provide information about more recent Sisal eradication attempts (Table 18).

In the May 2005 RO report it was communicated that a significant stand of sisal was located just inland of the Back Path on Picard (GPS coordinates 0632407 8961442 (UTM)), covering an area of approximately 1km² and including hundreds of individual plants. Staff made efforts cutting down all the flowering stems in the area (see Table 18) and the RO (Rainer von Brandis) started a discussion about the most suitable eradication method. Upon this discussion, different experts were contacted and it was questioned which species of sisal occurs on Aldabra. A summarized report from the RO in May 2005 (File location: \\ALDABRASERVER\fileserver\Monitoring\ Vegetation\Control of invasives\Agave sisalana\Sisal Control summary.doc), pinpoints the question which of the two conspecific species, i.e., sisal (*Agave sisalana*) and Mauritius-hemp (*Furcraea foetida*), is present on Aldabra. According to Katy Beaver it is most probably *Agave sisalana*, based on references from Fosberg and Renvoize (1983) and Robertson (1989).

Sisal still occurs on Back path Picard, Ile Michel and Anse Polymnie (Table 19, Figure 57). No signs of Sisal were found on Anse Badamier Malabar.

Picard Back Path: After the serious efforts made in 2005 to eradicate the sisal (Table 18), only two or three big plants remain (mostly to check their phenological patterns). Monthly visits to this patch are conducted during phenology monitoring to ensure that new plants are removed and the few remaining adult plants are not given a chance to produce new flowering stems. Over the last few years no flowering stems have been reported and not since the start of dedicated monitoring in 2010.
Ile Michel: Ile Michel is currently being visited as often as possible when staff are camping at Middle Camp or during transports to Cinq Cases. On these visits, photos of the site are reported in the RO monthly reports. Figure 58 shows the most recent photo taken of the Ile Michel patch, along with the GPS track surrounding its area (March 2012). During all recent visits no plants were showing sign of flowering.
Anse Polymnie: The Polymnie patch now consists of a few adult plants that are not flowering.

Table 19. Current sisal patches on Aldabra with their characteristics and their locations.

Location	Number of adult plants	Surface area	GPS	Point on map	Monitoring done
Back Path Picard	2-3	ca. 20x20m	0632407E 8961442N	A	Checked each month for flowering, new plants removed
Anse Polymnie	4	ca. 5x5m	0637263E 8963684N	B	Checked each month for flowering, new plants removed
Ile Michel (Figure 53)	100-150	ca. 70x30m	0659065E 8960245N	C	Checked regularly for flowering

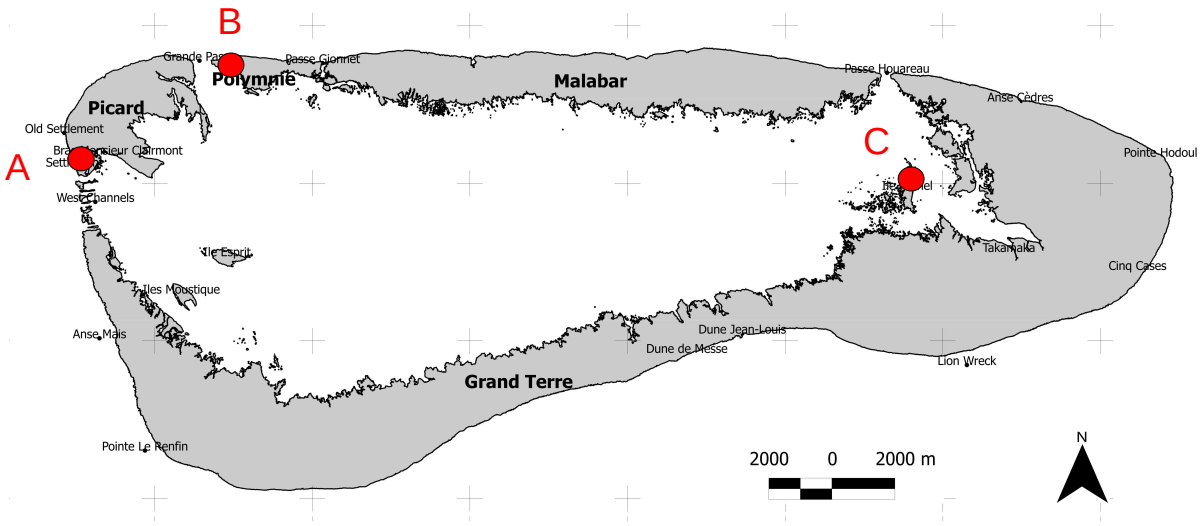


Figure 57. Current distribution of Sisal patches on Aldabra.

Figure 58. (a) Sisal patch at Ile Michel (March 2012) and (b) its GPS track.

Management options

In Kruger National Park (South Africa), Foxcroft *et al.* (2008) attempted to remove sisal, and they found herbicidal foliate treatment to be the most successful. On the Back Path patch there are still some root remains alive on places where sisal plants have been previously removed. The problem is that the roots are able to grow through holes in champignon and are impossible to dig out. Indeed, probably the only way to get rid of these living root remains is to treat them very locally with some herbicide on the root tip. The best timing for this would be towards the end of the dry season when circumstances are already harsh for the roots to survive in.

Dr. John Mauremootoo, Senior Scientist Invasive Species at CAB International made the following recommendations to the RO in 2005, based on successful removal of *Furcraea foetida* (Mauritius-hemp, superficially similar to *A. sisalana*), on Ile aux Aigrettes, Mauritius, in the early 1990s by manual clearance: cutting the floral spike at the base of *F. foetida* while the plant is in flower results in its death. He also recommended continuous surveillance such that floral stalks are cut during flowering, and stressed that the plant should not be left until the formation of seed. It was recommended that SIF contact the Global Invasive Species Programme (GISP) in South Africa, where the plant is a declared invader, for further advice on eradication.

8. MISCELLANEOUS

8.1. Assistance with EC Bird Eradication Project on Assumption

Some of the Aldabra research staff (Catherina Onezia in December and Martijn van Dinther in November) visited Assumption Island to assist with the EC eradication project of introduced bird species. Assumption Island used to host similar land bird species to Aldabra. All but one of these species have been wiped out in the last century through exploitation of the island, habitat destruction and the introduction of cats and rats. Of Assumption's original breeding land birds (including rails, sunbirds, coucals, turtle-doves, fodies, bulbuls), only the sunbird remains. Mauritian staff working on the guano mining activities on Assumption introduced several bird species from Mauritius to the island in the mid-1970s. Of these, the red-whiskered bulbul and Madagascar fody, have established populations and exploded in numbers since then. Current population estimates for red-whiskered bulbuls and Madagascar fodies on Assumption are 3000–

6000 and 1200–2200 birds, respectively and both populations appear to still be growing (Bunbury 2012).
Assumption is only 27 km from Aldabra at its closest point and scientists and conservation practitioners have warned for over 30 years (Benson & Penny 1971; Prŷs-Jones *et al*. 1981; Roberts 1988) that the introduced bird species would reach Aldabra and threaten its birds if no action is taken. Eradication was therefore long recommended but in practice difficult and expensive to implement. To protect Aldabra, the Seychelles Islands Foundation launched a programme in October 2011 to research and eradicate the introduced birds from Assumption under a broader EU-funded project focusing on invasive alien species. The activity began with censuses of all land birds on Assumption, alongside plant surveys, trials and ecological research (Bunbury 2012). Aldabra staff assisted the Assumption team during the next phase, which consisted of capturing of the birds mainly by mist nets, culling and physiological examination (dissection).

8.2. Staff training

Throughout the year, various training s and course were given to (and in some cases provided by) Aldabra staff (Table 20).

Table 20. Training given to (and provided by) Aldabra staff.

Date	Training	Participants	Given by	Notes
February-March 2011	PADI Dive Course: Open Water	Andy Gouffé, Marc Jean-Baptiste, Christina Quanz Michal Šúr	Tessa Hempson (volunteer, dive instructor)	
February-March 2011	PADI Dive Course: Advanced Open Water	Andy Gouffé, Marc Jean-Baptiste, Christina Quanz Michal Šúr, Stan Denis	Tessa Hempson (volunteer, dive instructor)	

Date	Training	Participants	Given by	Notes
July 2011	GIS course	Andy Gouffé, Stan Denis, Joel Souyave, Catherina Onezia, Martijn van Dinther, Janske van de Crommenacker	Philip Haupt (GEF Project Officer)	2-days course of the programme QGIS: e.g., how to plot GPS on a map, background information on GIS
August 2011	GEP tracking training	Catherina Onezia, Joel Souyave, Janske van de Crommenacker, Martijn van Dinther, Philip Haupt	Stan Denis (Ranger)	Training in how to find a collar by using the telemetry gear, handling the dart gun and shooting on target
September 2011	Boat training	Catherina Onezia, Joel Souyave, Janske van de Crommenacker, Martijn van Dinther, Philip Haupt, Christina Quanz	Jude Brice (Skipper)	Training in how to handle a small boat, demonstration of the engine and how to make knots
December 2011	Training of Vaisala Automatic Weather Station	Martijn van Dinther	Seychelles METEO & Vaisala consultant	Training in troubleshooting of AWS

9. CONCLUDING REMARKS

2011 has been a productive year in which efforts have been made to improve and strengthen regular long-term monitoring programmes (e.g., introduction of MS Access databases, writing up of protocols, alterations in tropicbird monitoring) that will be continued in the coming year. Also many new long- and shorter term projects were initiated (e.g., ZARP tortoise collaboration, turtle satellite tagging project, *Cratopus* sample collection). The efforts of all team members within research, and the continuous support of the skipper and logistics department made it possible to make these developments happen, and hopefully this positive vibe will be continued in the near future. Another incredibly important development is the installation of a solar energy system and the nearby switch from fuel-driven generators to solar energy. This will be an epic milestone in the history of Aldabra Atoll in the venture for a greener future by reducing CO_2 emissions. The impressive dedication of EMS Project Officer Christina Quanz played a huge role in this major achievement.

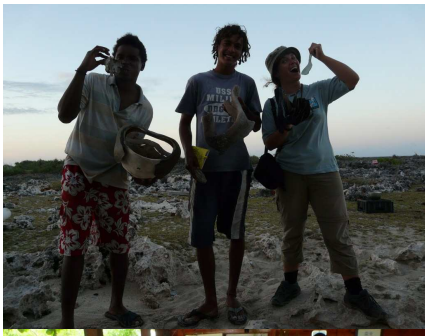
2012 will be another year with many expected developments: we may reach the end of the Goat Eradication Programme, which will be another landmark in the conservation history of Aldabra after more than a century of goat presence on the atoll. On Assumption, efforts will hopefully result in a significant decline and eventually total elimination of the red-whiskered bulbul and Madagascar fody populations, thereby safe-guarding from further spread towards Aldabra. Another focus will be the re-initiation of a marine monitoring programme on Aldabra led by GEF Project Officer Philip Haupt, with as main goals to expand Aldabra's Marine Protected Area, to map Aldabra's reefs and to develop a marine bio-indicator programme. In addition, the satellite tagged turtles will hopefully provide valuable data on their migration routes.

All these projects and developments make life on Aldabra go by fast, full of missions and challenges which we as a team try to make a success. On my behalf, as ASC, I am very happy and extremely proud to be part of it, and hopefully will be for a long period of time.

10. ACKNOWLEDGEMENTS

The results shown in this report could not have been accomplished without the teamwork of several people at different locations and several levels. First I would like to express my thanks to all of those I have worked with on Aldabra: Curtis Baker, Alain Banane, Richard Baxter, Philip Benoit, Jude Brice, Stan Denis, Martijn van Dinther, Gonzague Domingue-Armade, Roland Duval, Murvin Green, Andy Gouffé, Philip Haupt, Tessa Hempson, Jakawan Hoareau, Marc Jean-Baptiste, Johnny Joubert, Roy Laurette, Barney Marengo, Mike Marianne, Ian Mellie, Bevil Narty, Catherina Onezia, Marcus Pierre, Christina Quanz, Hendrik Quatre, Joël Souyave, Michal Šúr, Louis Telemaque and Nella Victor. Everyone has contributed in one way or another to conduct the research activities or ensure smooth running of the Station; and not to forget the fun we had and the sharing of the Aldabra experience together! I would like to thank the members of the Research Team for their efforts and interest in implementing Aldabra's monitoring programme. The Aldabra logistics team has been invaluable in supporting the Research Team in several ways.

Equally important has been the support from SIF Headquarters, in particular from SIF Executive Officer Dr. Frauke Fleischer-Dogley, Dr. Nancy Bunbury (Projects Programme Coordinator) and Ms. Wilna Accouche (Science Programmes Officer), and all other office staff. Next to your ongoing support, encouragements and understanding I would like to thank you for giving me the opportunity of working and spending the current and next year on this amazing atoll. I would like to thank the members of the SIF Board for their guidance. Soldiers of SPDF did not only protect us from piracy, but also helped us greatly with the monitoring and Station activities. Furthermore I am grateful to several people for their input and support: my predecessor, ex-RO Jock Currie for training and continued communication, members of the ZARP platform at Zurich University (Dr. Dennis Hansen, Dr. Erik Postma, Dr. Gabriela Schaepman-Strub and Dr. Lindsay Turnbull), Philip Haupt for ongoing help with the databases, Dr. Jeanne Mortimer for her advice in turtle monitoring questions, Dr. David Rowat and Dr. Michel Vély for support with regards to marine mammal monitoring, ex-RO Dr. Rainer von Brandis for advice on GEP and ex-RO's Dr. Naomi Doak and Dr. Pierre Pistorius for advice on other monitoring progammes, Katy Beaver for plant advice, Adrian Skerrett for communications about birds, Dr. Brendan Godley for advice about turtle satellite tagging. Financial support has been gratefully received from several funders: GEF (Global Environment Fund; for several projects including the improvement of monitoring, databases), European Union (for invasive species project), International Seafood Sustainability Foundation (ISSF; for turtle satellite tagging project) and the University of Zurich (tortoise work). It's been a pleasure to have worked with you all and I hope these enjoyable cooperations will continued in the future.



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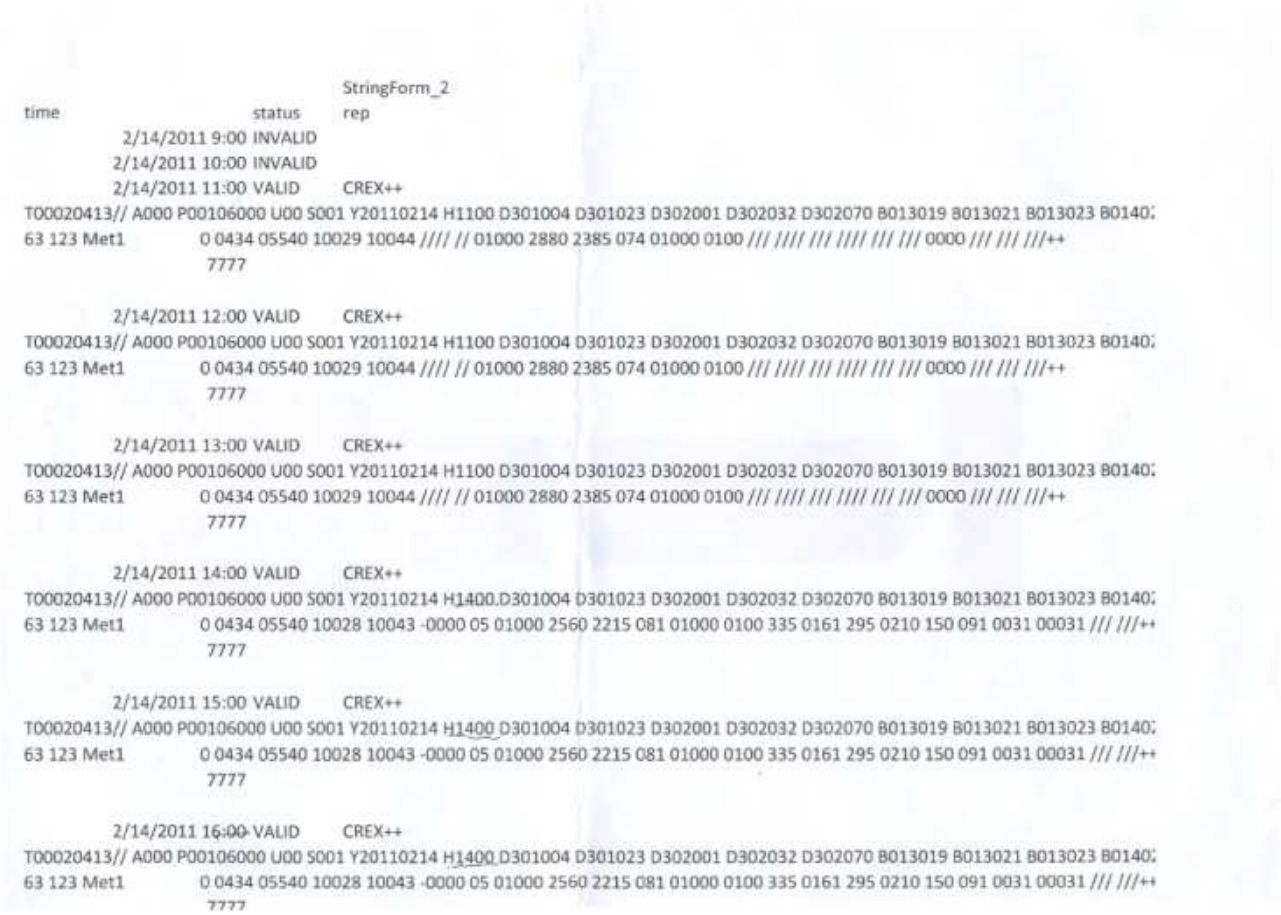
12. APPENDICES

Appendix 1. Decoding of CREX-format data

A CREX is a built-up of a number of codes; it contains general info (e.g., date and time), then a number of descriptors, and then the real data.



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2/14/2011 10:00	INVALID	
2/14/2011 11:00	VALID	CREX++

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63 123 Met1 0 0434 05540 10029 10044 //// // 01000 2880 2385 074 01000 0100 /// //// /// //// /// /// 0000 /// /// ///++
7777

2/14/2011 12:00 VALID CREX++

T00020413// A000 P00106000 U00 S001 Y20110214 H1100 D301004 D301023 D302001 D302032 D302070 B013019 B013021 B013023 B0140
63 123 Met1 0 0434 05540 10029 10044 //// // 01000 2880 2385 074 01000 0100 /// //// /// //// /// /// 0000 /// /// ///++
7777

2/14/2011 13:00 VALID CREX++

T00020413// A000 P00106000 U00 S001 Y20110214 H1100 D301004 D301023 D302001 D302032 D302070 B013019 B013021 B013023 B0140
63 123 Met1 0 0434 05540 10029 10044 //// // 01000 2880 2385 074 01000 0100 /// //// /// //// /// /// 0000 /// /// ///++
7777

2/14/2011 14:00 VALID CREX++

T00020413// A000 P00106000 U00 S001 Y20110214 H1400 D301004 D301023 D302001 D302032 D302070 B013019 B013021 B013023 B0140
63 123 Met1 0 0434 05540 10028 10043 -0000 05 01000 2560 2215 081 01000 0100 335 0161 295 0210 150 091 0031 00031 /// ///++
7777

2/14/2011 15:00 VALID CREX++

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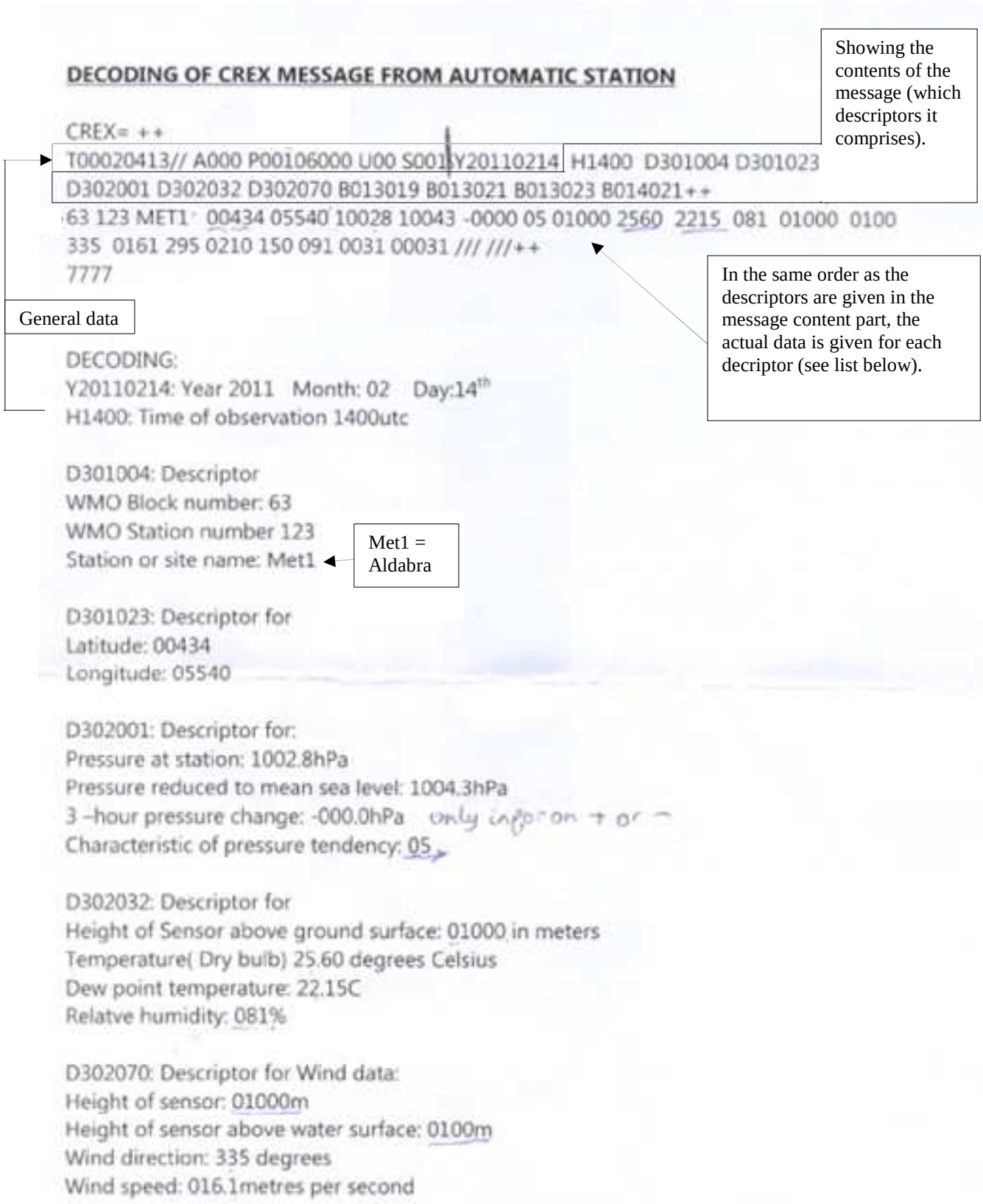
63 123 Met1 0 0434 05540 10028 10043 -0000 05 01000 2560 2215 081 01000 0100 335 0161 295 0210 150 091 0031 00031 /// ///++
7777

2/14/2011 16:00 VALID CREX++

T00020413// A000 P00106000 U00 S001 Y20110214 H1400 D301004 D301023 D302001 D302032 D302070 B013019 B013021 B013023 B0140
63 123 Met1 0 0434 05540 10028 10043 -0000 05 01000 2560 2215 081 01000 0100 335 0161 295 0210 150 091 0031 00031 /// ///++
7777



DECODING OF CREX MESSAGE FROM AUTOMATIC STATION

CREX= ++
T00020413// A000 P00106000 U00 S001 Y20110214 H1400 D301004 D301023
D302001 D302032 D302070 B013019 B013021 B013023 B014021++
63 123 MET1 00434 05540 10028 10043 -0000 05 01000 2560 2215 081 01000 0100
335 0161 295 0210 150 091 0031 00031 /// ///++
7777

Showing the contents of the message (which descriptors it comprises).

In the same order as the descriptors are given in the message content part, the actual data is given for each decriptor (see list below).

General data

DECODING:
Y20110214: Year 2011 Month: 02 Day:14th
H1400: Time of observation 1400utc

D301004: Descriptor
WMO Block number: 63
WMO Station number 123
Station or site name: Met1

Met1 = Aldabra

D301023: Descriptor for
Latitude: 00434
Longitude: 05540

D302001: Descriptor for:
Pressure at station: 1002.8hPa
Pressure reduced to mean sea level: 1004.3hPa
3 –hour pressure change: -000.0hPa only infor on + or –
Characteristic of pressure tendency: 05

D302032: Descriptor for
Height of Sensor above ground surface: 01000 in meters
Temperature(Dry bulb) 25.60 degrees Celsius
Dew point temperature: 22.15C
Relatve humidity: 081%

D302070: Descriptor for Wind data:
Height of sensor: 01000m
Height of sensor above water surface: 0100m
Wind direction: 335 degrees
Wind speed: 016.1metres per second

Max wind gust direction: 295 degrees
Max wind gust speed: 021.0 metres per second
Extreme counter clockwise wind direction of Variable wind: 150 degrees
Extreme clockwise wind direction of variable wind: 091 degrees.

B013019: Element descriptor
Total precipitation for past one hour: 003.1kg per metre square (or mm)

B013021: Element descriptor for
Total precipitations past 6 hours: 0003.1kg per metre square (mm)

B013023: Element descriptor for:
Total precipitation for past 24hours: //// (Data not available)

B014021: Descriptor for
Global solar radiation, integrated over period specified: //// (Data not available)

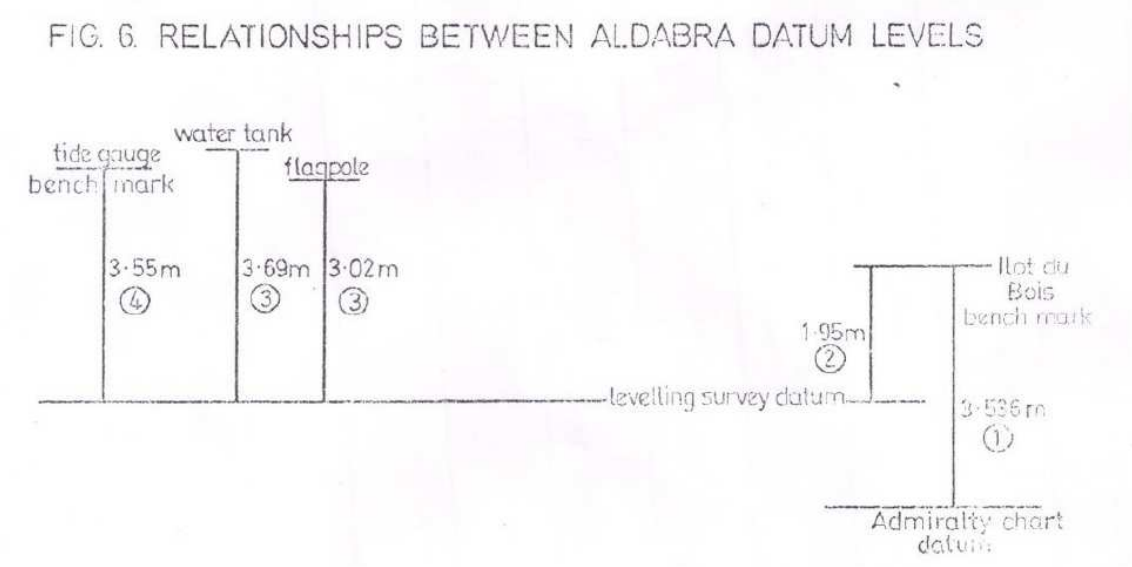
7777 end of message

Appendix 2. Tidal gauge: data correction to ADC

Copy of report located on ALDABRASERVER:\Monitoring\Tidal\Tidal gauge \ Aldabra Tide Gauge Data Correction to ACD.pdf

Aldabra Tide Gauge - Data correction to (Admiralty Chart Datum).

Thursday, August 11, 2011



Referring to the figure above illustrating the relationships between Aldabra datum levels; the "HMS VIDAL 1967 TRIANGULATION STATION" on Ilot du Bois is located 3.536 m above Admiralty Chart Datum (ACD).

The tide gauge sensor point of reference is 4.026 m below the aluminium HEX bolt upon which is pre-inscribed (NBN-A4-80) situated on the top edge of the horizontal aluminium supporting pole, at the point where it interacts at right angle, the vertical pole upon which the gauge sensor is installed.

In the absence of a leveling exercise to determine the exact height of the aluminium HEX bolt in reference to the "HMS VIDAL 1967 TRIANGULATION STATION" and other known datum points; I have estimated the HEX bolt to be approximately 1 meter above the "HMS VIDAL 1967 TRIANGULATION STATION" sited on Ilot du Bois.

Hence the HEX Bolt (NBN-A4-80) is sited 4.536 m above ACD.

The gauge sensor was measured to be 402.6 cm (4.026 m) below the HEX Bolt, hence the gauge sensor is;

(4.536-4.026) m = 0.51 m (above ACD)

Note that the only parameter estimated at this point is the height of the HEX Bolt above the "HMS VIDAL 1967 TRIANGULATION STATION".

Application of corrections.

The gauge sensor is said to be 0.51m above the Admiralty chart datum.

As stated in the manual; the relationship between pressure and depth in shallow water is a straight line function.

*Height above Datum = (GAIN *Pressure) + Offset*

where,

offset is the transducers position in respect to a known Datum.
Offset = 0.51m above ACD

Height above Datum = corrected tidal height in reference to ACD.

Pressure= the actual value being recorded by the gauge logger in "dBar".

"GAIN"

The relationship between depth and pressure for shallow water can also be expressed as:

$$\textit{Depth (m)} = \frac{\textit{Pressure}}{\textit{Density * Acceleration due to Gravity}} + \textit{Offset}$$

Where:
Pressure is measured in Pascals (1Bar = 10^5 Pascal, therefore 1 dBar = 10^4 Pascal)
And, (Density * Acceleration due to Gravity)$^{-1}$ is the Gain Factor

Sea Water: Using a standard density of 1025.97 kg/m^3 [standard seawater at 15°C] and a gravity figure of 9.81m/s^2,

$$\textit{Depth (m)} = \frac{10^4}{1025.97 * 9.81}$$

then 1 decibar = 0.993 metres water depth

Therefore Gain Factor = 0.993

If the user therefore knows the density of the water (by using a hydrometer) and the local gravity value, the Gain Factor can be calculated.

Since the local density of sea water at Aldabra is not known to me, I have stick to the standard density value for the calculations.

Hence ,

Height above datum (m) = (GAIN*Pressure) + Offset
= (0.993*Pressure) + 0.51

Note that the pressure being recorded by the tide gauge logger is being labeled as "Depth" in the downloaded log file just after the Timestamp.

I the Microsoft Excel worksheet named "*Aldabra Tide Data.xls*" I have applied the calculations to the recorded "Depth" value for the entire data set to obtain the corresponding "**Tide Height (m)** ".

If the local density of sea water at Aldabra is known, you can substitute it for the standard value used so as to make the gain factor more precise.