

**Proceedings of the  
Aldabra Science and Conservation Workshop  
Held on Aldabra  
8 – 18<sup>th</sup> December 2000**

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## 1. WORKSHOP OBJECTIVES

The Science and Conservation Workshop was held on Aldabra from 8-18 December 2000 to mark 21 years of the Seychelles Islands Foundation. Its overall objectives were:

- To appraise and report upon the current state of the marine and terrestrial environment of Aldabra, including the status of endemic and introduced species,
- To develop proposals for future scientific and conservation projects and plans for their funding,
- To review progress under the Management Plan for Aldabra, and
- To promote and publicise the important work of the SIF in protecting and researching Aldabra.

From these four objectives a number of specific objectives were developed prior to departure to Aldabra. Most, but not all, of these were addressed during the Workshop. These were:

### 1. **To appraise and report upon the current state of the marine and terrestrial environment of Aldabra, including the status of endemic and introduced species.**

- Rapid assessments of the status of endemic species of plants and animals, particularly emphasising Red Data book species.
- Assessment of the status of introduced mammals. Concern focused particularly on goats which were the target of an extensive eradication campaign funded by the Global Environment Facility. Feral cats and rats also pose significant threats, especially to ground nesting birds.
- The status of the invasive mealy bug (*Icerya seychellarum*) which was considered a serious threat to the native flora when it was first detected. The effectiveness and status of the more recently introduced coccinellid biological control agent should be assessed as well as the overall impact of the mealy bug since its arrival on Aldabra in the 1970's.
- To assess changes in the vegetation reflecting factors such as the recently documented decline in numbers of giant tortoises and the goat eradication programme.
- Assessments of changes in substrate characteristics, coral recruitment and regeneration, and associated impacts on coral fish and other marine organisms following recent coral bleaching events.
- A rapid assessment of introduced bird and mammal species on Assumption. Rabbits and several exotic bird species became naturalised on Assumption during the years of active guano extraction. The birds, in particular, pose a threat to neighbouring Aldabra.

### 2. **To develop proposals for future scientific and conservation projects and plans for their funding.**

- This was a topic for continuous discussion throughout the workshop, with a review session at the end of the meeting, to list possible proposals and agree the actions needed to follow them up.

### **3. To review progress under the Management Plan for Aldabra.**

- The Workshop participants were well placed to evaluate the implementation of the Management Plan and to consider what further actions, if any, might be needed to ensure that it is carried out most effectively.
- The prospects for making the operation of the Research Station more environmentally friendly, in terms of energy and sewerage systems, were also considered.
- The potential for establishing a comprehensive Aldabra Information System using geographical information systems (GIS) and internet-accessible databases was discussed. Event record cards dating back to the 1970's were originally computerised but no longer exist in electronic form. The original resources are now scattered, but most, if not all, of them are still present on Aldabra.

### **4. To promote and publicise the important work of the SIF in protecting and researching Aldabra.**

- The Workshop itself and the report coming out of it should be newsworthy in themselves and should be used to raise awareness of the success of SIF in continuing to protect and study Aldabra. Sending the report to funding agencies should also contribute to keeping the importance of Aldabra in the minds of staff within such agencies.

The format of the workshop was a field-based interdisciplinary visit, bringing specialists from a variety of scientific disciplines together on Aldabra so that ideas for research and conservation projects could be developed in the field. The expectation was that these would subsequently lead to proposals to funding agencies for implementation. The workshop involved a mixture of discussion sessions at the Research Station and site visits (with overnight stays) to different parts of the atoll. These site visits were a particularly important aspect of the workshop because they contributed to a rapid appraisal of the current state of the environment on Aldabra. The workshop was held immediately after the 21st Annual General Meeting of the Board of SIF, which also took place on Aldabra.

## **2. WORKING GROUPS AND PROGRAMME**

Participants divided into several working groups according to their expertise, mobility and interests. The Report is arranged according to the same Groups. Membership was as follows:

#### **Group A. Grande Terre**

Brian Betsy (Ranger)  
Stephen Blackmore  
Roger Bour  
David Bourn

Lindsay Chong-Seng  
Bernard Legae (Fieldworker/guide)  
Maurice Loustau-Lalanne  
Selby Remy

### **Group B. Marine environment and Islets**

Katy Beaver

Justin Gerlach

Anna Liljevik (Research Officer)

Jeanne Mortimer

Kristian Teleki

### **Group C. Mainly birds**

Steven Boniface (Boatman/Ranger)

Joseph Francois

Claude Pavard

Robert Prys-Jones

Ross Wanless

Richard White

### **Group D. Geography**

David Stoddart

### **Group E. Research Station Staff**

Franky Aglae (Mechanic)

Francis Alcindor (Fieldworker)

Philip Baccus (Head Boatman)

Jourdan Barra (Cook/Fieldworker)

Allen Cedras (Logistics Manager)

Jeanders Ernesta (Cook)

Guy Esparon (Warden)

Maureena Hollanda (Cleaner)

Yvon Juliette

Tony Jupiter (Former Senior Ranger)

Jacques Laval (Mechanic)

## **3. OBSERVATIONS**

The observations reported were written up by members of each of the Working Groups and have been edited together to form this report. The format used varies according to the preference of the Working Group and the nature of the information recorded.

### **GROUP A.**

Group A undertook to walk around Grande Terre from Passe Houreau to Anse Anglais with overnight camps at Cinq Cases, Takamaka, Dune Jean Louis and Dune Blanc. Several members of the group had completed the route previously. The general objectives of the walk included assessing the status of feral goats and cats, observations on giant tortoises and seeing the infrastructure available at the main fixed camps.

Specific reports:

- Stephen Blackmore – General observations
- Roger Bour – Morphometric Studies on the Aldabran Giant Tortoise
- David Bourn – Status Of Aldabra's Giant Tortoise Populations

### **General Observations - Stephen Blackmore**

10 December. Group A departed at 5:00am on board L'Amitie to Middle Camp at Passe Houreau. The hut at Middle Camp is the largest accommodation away from Ile Picard with beds for six people and a fixed antenna for radio communication to the Research Station. Most of the group walked to Anse Malabar where the hut was in good condition with plenty of drinking water and a small amount of supplies. No fresh turtle

tracks on beach. Log books to record visits are not placed in any of the huts, as they were formerly, and could usefully be re-instated to provide a record of work needing to be done at huts, the quantities of supplies and as record of visitors. A few coccids were seen on *Avicennia* near the camp.

11 December. Crossed over Passe Houreau at 7:00am. The concrete marker dating from the 1966 airport survey is by the beach. Walk to Anse Cedre took almost three hours, even though the path had been partially cleared by Bernard Legae and Francis Alcindor on an earlier visit. The hut/shelter at Anse Cedre is in a poor state of repair and there was no fresh water. Roger Bour felt ill and remained at Anse Cedre to be collected by L'Amitie (after radio contact by Maurice Lalanne). Departed for Bassin Fregate at 11:30 and at the start of the plain saw two goats (and adult and a kid). Major landmarks and way points are still easily located, including the "Grove" studied by Charlie Gibson in the 1970's. Reached Cinq Cases at 5:30. The hut was in good condition but with very little fresh water. Fresh water was collected from the well, which is tidal but in which a lens of fresh water floats on the denser salt water. The location of the well was not well known to all and needs to be clearly marked for future visits. No coccids were seen.

12 December. Walked along the coast to Takamaka Grove and the Takamaka hut. Numerous sets of cat prints seen along the raised beach. A few shrubs (especially of *Ochna ciliata*) in the Takamaka Grove were heavily infested with coccids. Collected dried leaf material of Takamaka (*Calophyllum inophyllum*) in silica gel. These could be used for future DNA comparisons with samples of Takamaka from other places and may help indicate the origin of the trees on Aldabra. The hut near the lagoon is in poor condition, only the shell is standing, with a partial roof and two bunk beds. Tortoises had broken through the barrier. No fresh water had collected at the hut, but supplies had been dropped at the lagoon. Coccids not seen anywhere else.

13 December. Walked to Dune Jean Louis. Cat foot prints again common on the raised beach. Several goats heard calling near to Takamaka Grove but not seen. Cinq Cases hut is in good condition having been built with Aluminium sheeting recycled from the Royal Society Research Station buildings. A considerable improvement on the thatched hut that was here in the 1970's. Water butts at the hut contained salty water. Fresh water dropped off at the beach by Tyomityo after Maurice Lalanne called the Station by radio (with good reception from the top of the Dune). At night a few turtle hatchlings came into the hut – disoriented by the light. No coccids seen.

14 December. Walked to Dune de Messe, encountering cat prints on almost every patch of sand. No goats heard. Hut at Dune de Messe is in excellent condition with ample supply of fresh water in tanks. Pair of kestrels seen in shrubs near the hut. Dead carapace of a large tortoise, number 01490, recovered by David Bourn. Continued on towards Dune Blanc and camped there overnight. *Salicornia* founded growing on raised beaches. No coccids seen.

15 December. Started walking at 6:00, first hour along coastal turf very easy going but then rough champignon with path through dense *Pemphis* hard to follow. Several *Salvadorea* trees seen at Anse Tambalico. No goats heard or coccids seen. Arrived at Anse Mais at 11:00 am. Hut in excellent condition with good supply of

drinking water. Walked on to Anse Anglais in the afternoon, no coccids seen.

Conclusions: Infrastructure of huts is good, although huts at Takamaka and Anse Cedres need re-building if they are needed for camping. Water supply at Anse Cedres, Dune Jean Louis and Takamaka is unreliable in the dry season. Very little evidence of goats encountered during the walk – small groups present near Anse Cedres and Takamaka. Few sightings of coccids (presumably scarcer because this is the dry season) except at Takamaka Grove and Middle Camp.

## **Morphometric Studies on the Aldabran Giant Tortoise - Roger Bour**

### **1 Additional Information to be Collected on Regular Tortoise Transects**

In addition to information already collected on tortoise transects, the presence or absence of a cervical (“nuchal”) scute should also be recorded. This is the smallest scute on the front border of the shell, just above the head. Another column labelled “nuchal” should be added in the field data-recording sheet. The following information should be recorded:

- 1) Scute present: P ( the great majority of the observations).
- 2) Scute absent or apparently (in dorsal view) absent: the ventral (inner) surface of the carapace border should also be carefully checked.
  - 2a) Scute totally absent: A.
  - 2b) A small scute is present, this should be recorded: V.

These findings will be compared with observations of old museum and captive specimens.

This information should be collected until at least 100 animals have been recorded on each transect, with a total of a least 1000 tortoises for the whole atoll. It is anticipated that this is likely to be achieved within a period of about six months.

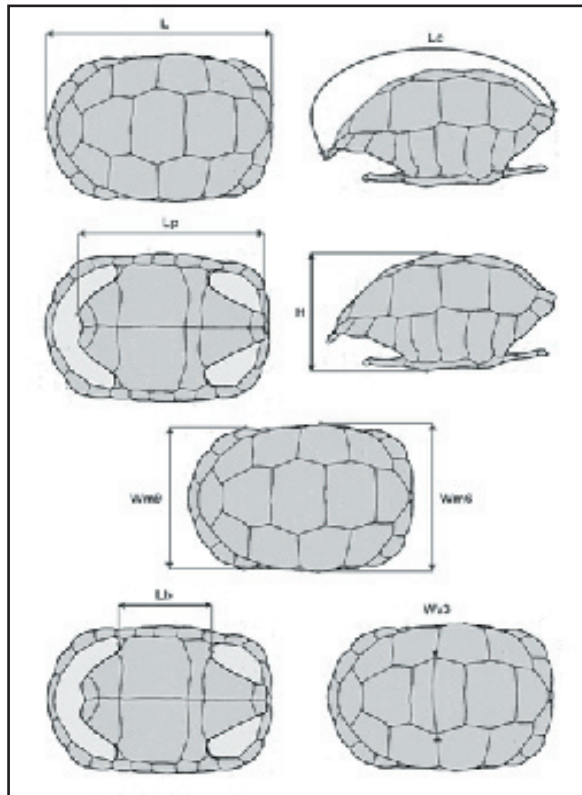
### **2 Further Morphometric Studies**

The purpose of this study is to assess the variation in size and shape between sub-populations of giant tortoise on Aldabra and for comparison with old museum specimens, some of which presumably originated from granitic islands.

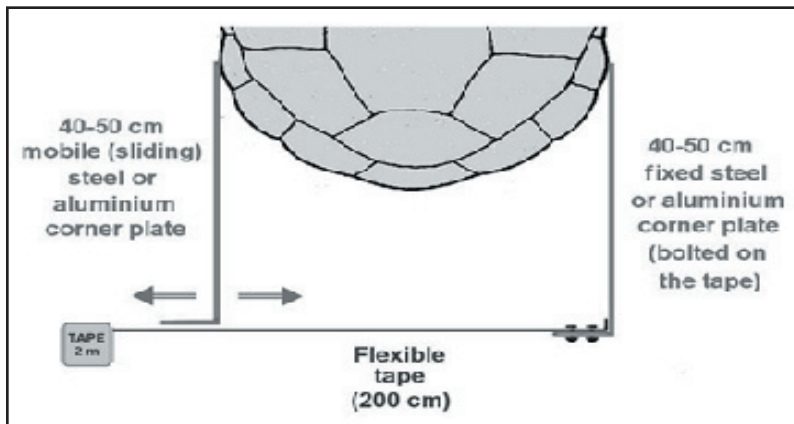
In order to establish a ‘model’ for comparison, the following measurements should be made using a large callipers:

- L: maximal straight length of the dorsal shell;
- Lc: curved length, from cervical to supracaudal scutes outer borders;
- Lp: maximal plastron length (including anal points if any);
- Lb: minimal bridge length, from axillary to inguinal notch;
- Wm6: straight width at level of 6th marginal (i.e. middle of the carapace);
- Wm9: straight width at level of 9th marginal (i.e. rear of the carapace, where the border is more or less flared). (NB. Wm9 may be higher or lower than Wm6).
- H: straight height, from plastron on the ground to the top of the 3rd vertebral;
- Wv3: curved width of 3rd vertebral scute, the usual measurement taken.

Other measurements need a large calliper and the collaboration of two workers, with materials depicted below. Measurements should be made on males and females separately, 20-25 individuals of each sex, over 40 cm; the individuals must be selected ‘randomly’, i.e. the 2<sup>nd</sup>, 5<sup>th</sup>, 8<sup>th</sup> etc. individuals encountered on a transect or during a walk.



**Fig. 1.** Sketch showing the way to take the measurements. Lc and Wv3 taken with tape.



**Fig. 2.** Method for taking measurements with a large calliper.

The study would include sub-populations on Picard (1), Malabar (1-2 sites) and Grande Terre (5-6 sites, e.g. Anse Cèdres; Cinq Cases; Takamaka Grove; Dune Jean-Louis; Dune d'Messe and Anse Mais).

## **Status Of Aldabra's Giant Tortoise Populations - David Bourn**

### **Summary**

Far fewer giant tortoises survive on Aldabra in year 2000 than the 100,000 censused in 1997. Monthly tortoise transect counts indicate that there has been a further significant reduction in numbers on Grande Terre (the largest of three sub-populations on Aldabra). As before, the decline has been most marked in the highest density, south-eastern region of Grande Terre, but is also evident in areas of intermediate density in the vicinity of Dune Jean-Louis on the south coast. Lower density populations on Malabar and Picard appear to have been more or less stable. The population crash on Grande Terre was anticipated and is attributed to an excessive build up in numbers and "over-shoot" during the latter part of the twentieth century, followed by repeated years of below average rainfall during the 1990s, the driest decade on record.

### **Taxonomy**

The taxonomic status of the Aldabran giant tortoise, formerly known as *Geochelone gigantea*, is disputed. Four alternatives are currently being considered: *Aldabrachelys dussumieri*; *A. elephantina*; *Dipsochelys dussumieri* and *D. elephantina*.

### **Population Trends**

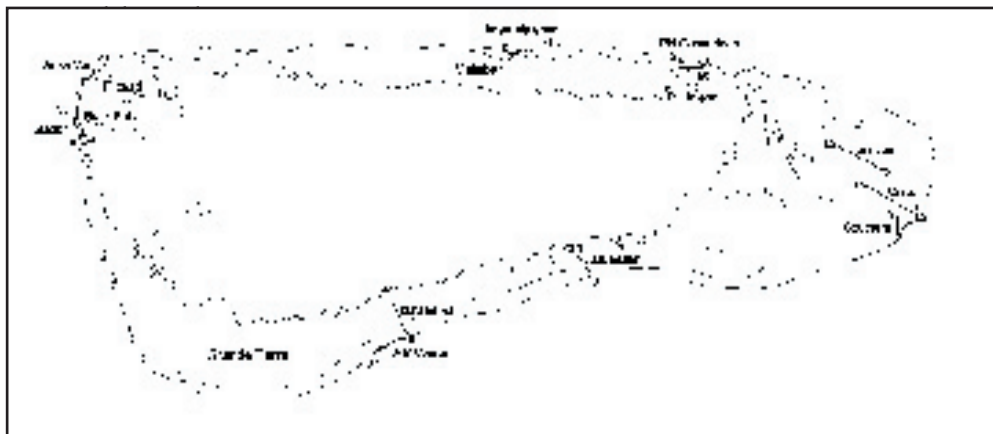
Tortoise ecology and population dynamics have been subject to an extended series of studies on Aldabra dating back more than thirty years: Gaymer (1968, 1973); Grubb (1971); Merton *et al.*, 1976; Hnatiuk *et al.* (1976); Bourn (1977); Bourn & Coe (1978, 1979); Swingland & Coe (1978, 1979); Coe *et al.* (1979); Hamilton & Coe (1982); Gibson & Hamilton (1983, 1984); ERGO (1997) and Bourn *et al.* (1999). These studies included a population census, based on a 5% stratified random sample of 292 hectares, carried out over an 18-month period from April 1973 to September 1974, the findings of which are presented in Bourn and Coe (1978). 24 years later, the Seychelles Islands Foundation commissioned a follow-up study to conduct a second census of Aldabra's giant tortoise population in 1997, using the same methods as employed in the seventies. 160 of the original 292 sample hectares were revisited and searched thoroughly for live animals and tortoise remains. Results obtained are described in ERGO (1997) and Bourn *et al.* (1999).

### **From 1973/4 to 1997**

Key findings of the second census of Aldabra's tortoise population were:

The total number of giant tortoises on Aldabra had declined by 20-25% to 100,000 over the 24 year period from 1973/74 to 1997, with 94,000 on Grande Terre, 4,000 on Ile Malabar and 2,000 on Ile Picard. Reductions were greatest where density had been highest in south-eastern Grande Terre, with numbers declining by 30-40% at Cinq Cases and Takamaka, reflecting a major population crash in that region. Areas of intermediate tortoise density along Grande Terre's south coast had declined by 8%, but this was not statistically significant. In marked contrast, low-density populations





**Figure 1:** Location of Tortoise Monitoring Transects

Picard had increased substantially over the same period, with a doubling in the number of tortoises on Malabar. The population crash on Grande Terre was corroborated by two independent observations: a significant increase in tortoise mortality, as reflected by an increase in the density of tortoise remains; and a decline in tortoise counts on long-term, population monitoring transects. Grande Terre tortoises were significantly smaller than they had been, indicating that larger animals were dying off and that smaller individuals had a better chance of survival.

#### From 1997 to 2000

The Aldabra tortoise population monitoring programme was reviewed and redefined by ERGO (1997). Findings presented in this section are based on a preliminary analysis of tortoise transect data collected by Aldabra Research Station field staff and made available with the kind permission of the Seychelles Islands Foundation. The names and locations of 12 tortoise population monitoring transects on Aldabra's three main tortoise-inhabited islands are shown in Fig. 1. Each transect is divided into 50m sectors and all tortoise within a fixed distance of the centre line are measured and recorded on a monthly basis. Tortoise transect counts converted into standard density values for Ile Malabar, Ile Picard, Grande Terre (South Coast) and Grand Terre (South East) are shown in Figs. 2-5.

**Ile Malabar** - No statistically significant population trends, up or down, are evident on either of the two transects at Passe Houareau, or on the Anse Malabar coastal/inland transect, although, discounting one exceptionally high value in October 1997, there is an indication of a gradual increase in density on the latter. Some complementarity between the two Passe Houareau transects is evident, with high values on one being associated with low values on the other, indicative of a movement back and forth between the coast and inland ridge. The mean density of tortoises on the Passe Houareau inland transect (25/ha) is slightly higher than on the Anse Malabar coastal/inland transect (20/ha).

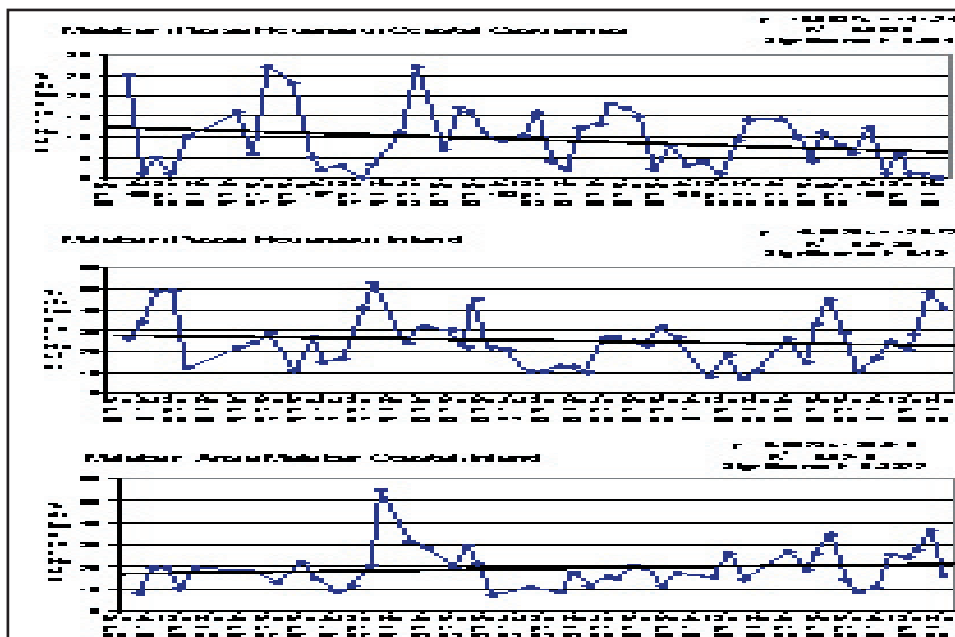


Figure 2: Malabar Tortoise Transect Counts: April 1996 to November 2000

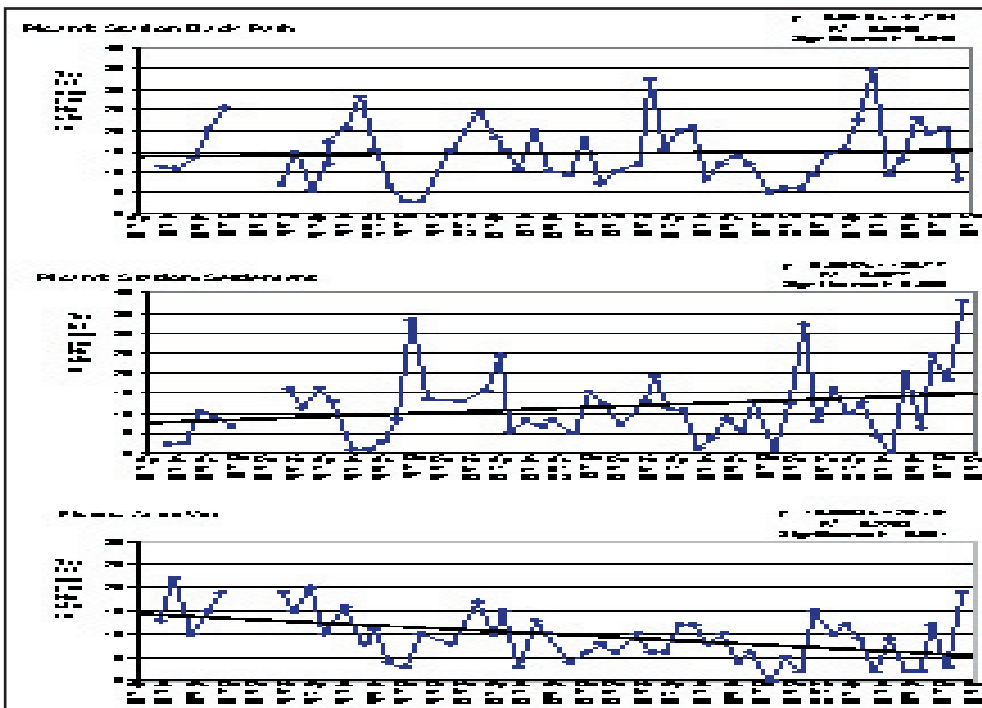


Figure 3: Picard Tortoise Transect Counts: april 1996 to November 2000

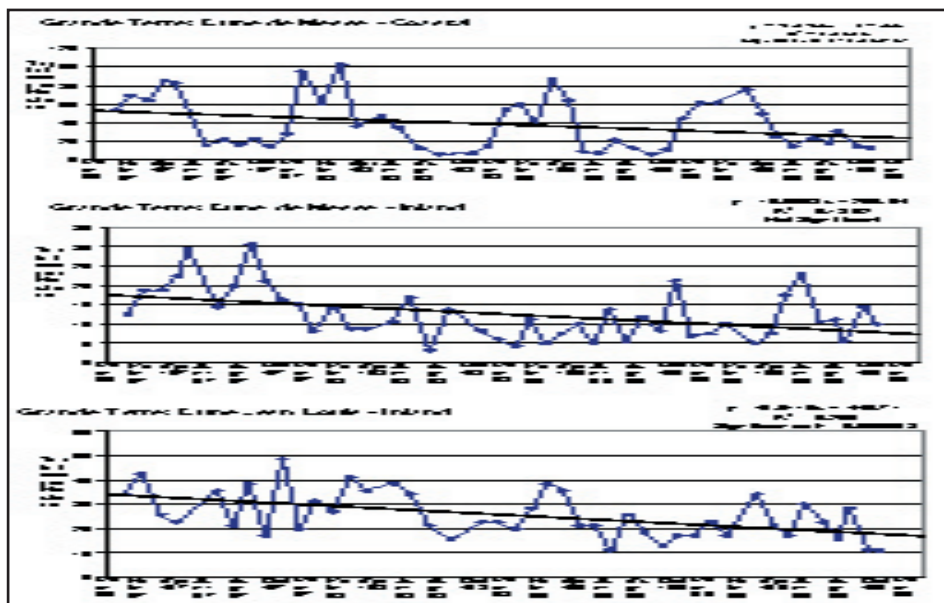


Figure 4: Grande Terre (South Coast) Transect Counts: Jan 1997 to November 2000

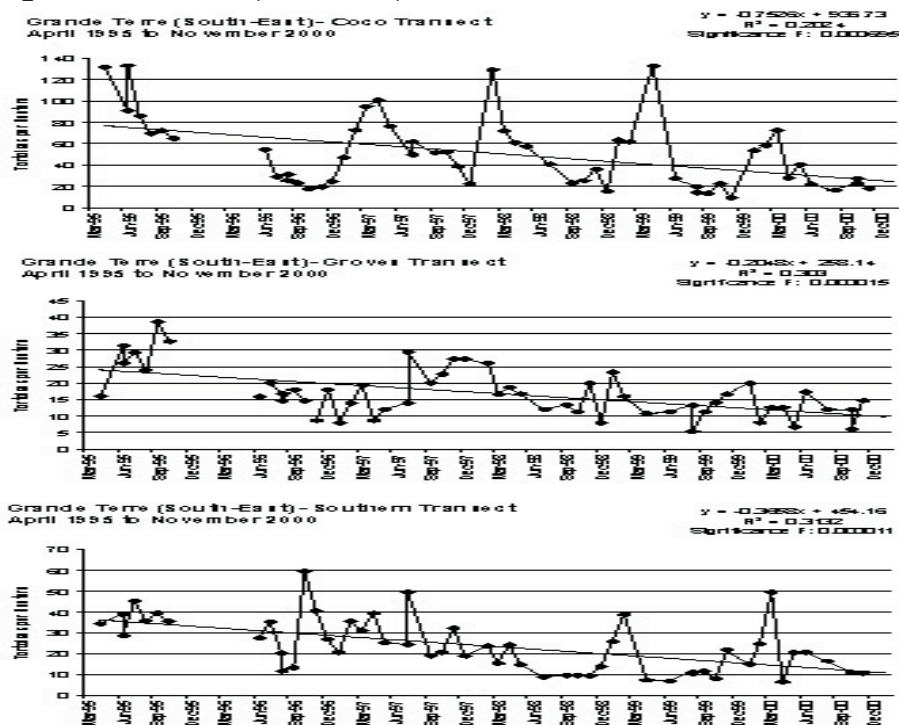


Figure 5: Grande Terre (South-East) Transect Counts: April 1995 to November 2000  
Picard - There has been a statistically significant decline in tortoise density on the Anse

Var transect from around 15/ha to 5/ha, with a less than one in a thousand probability of chance occurrence. In contrast, tortoise numbers on back path and station/settlement transects appear to have increased slightly over time, although, because of marked variation in monthly counts, these are not statistically significant. One plausible explanation for the decline at Anse Var is that tortoises have moved from there into the settlement/station area. Back path and station/settlement transects show marked month-to-month density variations, with no clear seasonal patterns and little complementarity. It would be interesting to compare these findings with station meteorological records - especially rainfall immediately preceding transect counts - to see if climatic conditions provide some explanation for observed variation in tortoise numbers.

**Grand Terre (South Coast)** - All transect counts on the south coast of Grande Terre show a progressive decline in numbers since 1997, but only at Dune Jean-Louis is this decline statistically significant, with a probability of less than one in a thousand of chance occurrence. The coastal transect at Dune de Messe exhibits a marked seasonal pattern of tortoise abundance on coastal grasslands, with peaks during the wet season from December/January to April/May. Conversely, the Dune de Messe and Dune Jean-Louis inland transects, which run through mixed scrub and Pemphis from their respective huts to lagoon landing points, show little or no seasonal variation.

**Grand Terre (South-East)** - The inland coco transect shows a marked seasonal variation in numbers, similar to that observed on coastal grasslands at Dune de Messe, peaking in March and April towards the end of the wet season. Most importantly, however, all three transects in south-eastern Grande Terre, show highly significant declines in tortoise density, with probabilities of far less than one in a thousand of chance occurrence. The only plausible explanation for these findings is that the previously reported tortoise population crash in south-eastern Grande Terre (ERGO 1997; Bourn *et al.* 1999) has continued through further years of below average rainfall in the late 1990s, which was the driest decade on record (Stoddart pers. comm.). The magnitude of this most recent decline since 1997, which might well exceed 50% cannot be verified, however, until further much more detailed tortoise transect data analysis and population modelling has been carried out.

## **Recommendations**

### Automated Analysis and Reporting of Tortoise Population Monitoring Data

The Seychelles Islands Foundation and in particular its field staff on Aldabra are to be commended for a marked improvement in tortoise population monitoring since the mid nineties, as reflected in the frequency and coverage of twelve sample transects around the atoll and the maintenance of up-to-date digital data files. However, a major shortcoming, remains in that no mechanism is currently in place for the regular analysis, interpretation and reporting of the tortoise monitoring information. Despite previous reports of a major decline in tortoise population levels on Grande Terre prior to 1997 (ERGO 1997; Bourn *et al.* 1999), SIF were unaware at the December 2000 Workshop

that their staff had obtained strong evidence of a further significant decline since 1997. A fully-automated, user-friendly data entry and database management system, with standard analysis and reporting procedures, is required to assist field staff and inform management on the status of Aldabra's tortoise populations. The system should be menu-driven and based on a standard software package, such as Microsoft Access. Outputs should include a series of tables and figures summarising monthly transect statistics and comparing these with previous records. Trend lines should be shown and their statistical significance determined. A method of estimating population totals from transects counts and vegetation types should be developed and tested for Picard, Malabar, Grande Terre and the whole of Aldabra, and included as one of the menu-driven options.

#### Maintenance of Rainfall Monitoring

Rainfall is a key determinant of terrestrial primary production and is of critical importance to the survival of plants and animals on Aldabra. It is imperative that rainfall records be maintained, both from the meteorological station on Picard and rainfall gauges at campsites around the atoll, as part of routine monitoring operations. Serious consideration should be given to the installation of mini automatic stations for recording rainfall and temperature in south east Grand Terre, along the south coast and on Ile Malabar. Rainfall figures should be reported regularly and major deviations from long-term mean values should be highlighted. Below average rainfall may have adverse effects on the survival and reproductive performance of many species. Protracted periods of below average rainfall will have cumulative and potentially catastrophic impacts on even the most enduring of terrestrial populations, as exemplified by the population crash on Grande Terre during the nineties.

#### Vigilance in Monitoring Recovery of Goat Population on Grande Terre

During the course of the five-day workshop hike around Grande Terre, goats were seen on two occasions; a male and a female close to the path between Anse Cedre and Crois Blanc in south-eastern Grande Terre; and another group of at least three individuals close to the path between Takamaka Grove and Anse Takamaka. Feral goats remain a threat to the integrity of the terrestrial ecosystem of Aldabra and, ideally, should be eradicated, but this is easier said than done and previous attempts have failed. Continued vigilance is required to monitor the situation and record the location of all sightings and the number of individuals seen. Special measures, including the use of military helicopters and sharpshooters, should be considered to eliminate the problem once and for all, provided this service can be obtained at minimum cost as some form of carefully controlled military exercise.

#### Development of an Aldabra Geographical Information System

Computer based Geographical Information Systems (GIS) are increasingly widely used as analytical and decision support tools for planning, resource management and environmental monitoring. The Seychelles Government is in the process of developing a national GIS that is ultimately to include Aldabra and new aerial photographic coverage of the atoll has been obtained recently with this objective in mind. Much of the information collected on Aldabra over the past 40 years has already been geo-referenced and resides on data record cards in the Research Station Library. Information of immediate interest for incorporation within an Aldabra GIS includes: species

distributions; vegetation cover; geomorphology; benchmarks; tortoise sample sites; tortoise mark and recapture records; turtle nesting beaches; tortoise, rail and vegetation monitoring transects; goat sightings; management zonation; field activities; boat visits; tourism pressure; and satellite imagery. This unique resource is inaccessible and is highly vulnerable to fire and storm damage. An early start needs to be made to establish a user-friendly GIS for Aldabra, to include records of previous work and past events, and provide a standard framework and guidelines for the monitoring of future activities and events.

#### Assessment of Changes in Vegetation Cover since 1960

The acquisition of new aerial photographic coverage of Aldabra provides an excellent opportunity for assessing long-term changes in vegetation patterns over the whole atoll by comparison with coverage obtained 40 years earlier in 1960, which were the foundation of the most detailed vegetation map of Aldabra (Gibson & Phillipson 1983). Such a study would also be able to provide an objective assessment of various other dynamic environmental processes, including: dune formation, beach erosion/accretion and mangrove expansion/contraction.

#### Improved Radio Communications around Aldabra

The five-day marathon hike around Grande Terre would not have been completed without access to enhanced radio communications enabled by the presence of the m.v. L'Amitié. Serious consideration should be given to the installation of a solar-powered, radio repeater-station on Dune Jean Louis to ensure reliable communications with the research station on Picard from all round the atoll for safety and peace of mind of staff and visitors.

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## GROUP B

### Marine Members Summary Report - Kristian A. Teleki, Jeanne A. Mortimer, Anna Liljevik

We know far less about the marine ecosystems of Aldabra than we do about those on land. The 1998 Indian Ocean warming event and its associated coral bleaching and subsequent mortality, however, drew attention to both the importance and the vulnerability of habitats in the lagoon and on the submarine slopes along the perimeter of the atoll.

In 1998, a Cambridge Research Unit (CCRU) based expedition was conducted to survey the fishes and corals of the outer islands of Seychelles. The timing of this expedition was serendipitous as it coincided with the height of the warming event in April. The CCRU team had originally intended to conduct a one-off survey. But, realising the significance of the warming event, they decided instead to establish a permanent monitoring programme that would enable documentation of the long term processes of damage to and recovery of the reefs. They employed video transect survey techniques that would produce a detailed record of physical and biological features for later analysis. The team subsequently returned to Aldabra for three weeks in November 1999, and again for three weeks in February 2001 (at the time of this writing).

The results of the Aldabra reef surveys have revealed that coral death was particularly high in the branching corals (*Acropora* spp., *Pocillopora* spp.), fire coral (*Millepora* spp.) and blue coral (*Heliopora* spp.) species. Death in the massive or boulder corals (e.g. *Porites* spp., *Pavona* spp.) was in most cases partial and very variable throughout the reef. It appears that there has been some recovery in these larger, hardier massive species. The bleaching was generally worse in shallower waters (10m or less) than amongst those corals found in deeper waters (>20m). The areas least impacted were those influenced by currents, for example, those coral colonies which are found within lagoonal channels where water fluxes are high. Furthermore, coral normally subjected to frequent high temperatures, such as in the lagoon, fared well; thus many of the corals survived in the Aldabra Lagoon suggesting an adaptation of corals there to periodic inundation by high sea temperatures.

Three marine biologists attended the recent Aldabra Scientific Workshop - Anna Liljevik (Scientific Officer for Aldabra), Dr. Jeanne Mortimer, and Kristian Teleki (CCRU). During the Workshop they visited marine ecosystems typical of the lagoon, the passes, the outer reef slopes, and the inland bassins. On behalf of CCRU, Kristian submitted documents entitled "Aldabra Marine Programme" (Teleki *et al.* 1999) and "Aldabra: Marine Monitoring into the 21<sup>st</sup> Century" (Teleki 2000) that summarised the findings of CCRU to date and recommended elements for a long-term marine monitoring programme at Aldabra respectively. Based on the content of the CCRU documents and their own field observations made during the workshop, the three scientists recommended that the following provide the basic elements of a marine monitoring programme for Aldabra:

1. Gather and assess data describing physical parameters associated with or believed to stimulate coral bleaching, including:



- water temperature and incidental UV radiation. These need to be measured on site especially as both variables are known to play important roles in the coral bleaching process. In February 2001 an array of temperature loggers are to be deployed that can be left *in situ* and which will be set to automatically take water temperature measurements at 30 minute intervals. Ten loggers are going to be set out at a range of locations throughout the atoll and will include the channel (Pass Dubois and Grande Passe), lagoon (near Ile Esprit and site to be determined in the eastern end of the lagoon) and outer reef slope environments (near the settlement and Malabar camp). The two outer reef slope environments will have loggers at 3, 10 and 20m depths to record any depth dependent temperature stratification. All loggers can be left out for a maximum of a year and a half before being retrieved for downloading. But ideally, those at the more accessible sites will be downloaded regularly and data analysed with accompanying software by Aldabra SIF staff.
  - current speeds and direction, sea surface temperatures, and sea levels in the region. These are available on the internet and need to be monitored and evaluated.
2. Produce a GIS map of Aldabra that defines the marine ecosystems and habitat types. Digitised colour and infrared aerial imagery acquired in 1998 is now available and is currently in the process of being geo-referenced by the GIS lab in the Ministry of Land Use and Habitat. These images will provide a quantitative estimate of marine and adjacent habitats, as well as bathymetric information. However, these images require ground-truthing so that the spectral signatures in the imagery can be correlated with habitat types. This is an activity the SIF Rangers can do during the course of their regular monitoring activities — with the aid of a hand held sonar depth recorder and a GPS device.
  3. Compare the new GIS map with aerial maps produced in the 1960s to detect any changes in the shallow marine habitats (i.e. reefs, mangroves, seagrasses) which may have occurred in the intervening years.
    - Continue and enhance the long term monitoring and marine species inventory of corals and fishes, through:
    - Annual videography of the permanent transects to record long term change;
    - Production of fish lists by knowledgeable SIF staff, and visiting scientists and divers;
    - Comparison of recent species inventories with the results of older studies to provide a historical perspective.
  4. Modify the “Diver Record Sheet (DRS)” currently on file at Aldabra to enable visiting divers to make significant contributions to the long-term data base. The “DRS”s currently on file are too complicated and subjective to produce reliable data, and should be modified to enable recording of the following key information relevant to each dive: where (name of dive site & GPS position, if available); when



(date & time); conditions (visibility, etc.); depth (average & maximum); temperature (recorded at surface and deepest point of the dive, as well as any unique temperature occurrences such as thermoclines, etc.); large fauna observed (sharks, large groupers, turtles, rays, etc.); and whatever anecdotal information the divers find to be of interest. Information would then be entered into a computer database by SIF Aldabra staff. Ideally, the SIF Scientific Officer for Aldabra would brief the passengers aboard each visiting dive boat about how to use the forms.

5. Establish and conduct long term monitoring of the lagoon and passes. The resilience of coral patches within the lagoon to the stress of the 1998 warming event indicates that these coral communities may provide important sources of coral larvae for reef communities throughout the atoll.
6. Conduct coral recruitment studies, within the lagoon and also on the outer reef slopes, using ceramic settlement plates oriented at various angles. The density of juvenile corals and recording the growth rates through measurements and underwater photography will also provide an indication of coral recovery and success.
7. Initiate studies of mangrove ecosystem dynamics and linkages between mangroves, lagoon and outer reef system productivity.
8. Continue the sea turtle monitoring programme as described in the handbook “Marine Turtle Monitoring at Aldabra — 1997 version” (Mortimer 1998).

A key element critical to success will be the training of Aldabra rangers to maintain and develop the programme long into the future.

## **Islets and Terrestrial Observations - Justin Gerlach**

### **1. Notable observations and activities**

Tortoise blood samples: Collection of tortoise blood samples and smears for DNA and parasitology comparison with captive and granitic island tortoises. Samples were collected from Picard and from Anse Mais, these will be added to samples from Malabar and eastern Grande Terre collected in 1990.

Pacific house gecko: Capture of Pacific house gecko (*Gehyra mutilata*) during unloading of supplies, searches of buildings indicate that this species has not established itself on Aldabra despite records from 1976 and 1988.

*Phelsuma*/tortoise association: Quantification of *Phelsuma*-tortoise association; *Phelsuma* resident in *Pandanus aldabrensis* feed on flies (horseflies) on tortoises in dense shelter. Tortoises sheltering under other plant species are not visited by *Phelsuma* due to the scarcity of insect prey and more open vegetation structure.

Snails: New locality records for land snails, possibly introduced species restricted to Picard. Evidence of historical change in snail populations (local extinctions, particularly

on Picard), main endemic snail population now appear to be restricted to Esprit and Grande Terre. Identification of new snail taxa on Ile Esprit (*Gulella gwendolinae* ssp.) and on Assumption (*Quickia* cf. *aldabrensis*)

Mealy bugs: Scarcity of *Icerya seychellarum*, observed only on *Avicennia marina* at La Gigi, sooty mould extensively grazed by *Littorina scabra*. No associated ants observed.

Specimen collection: The existing collection of specimens is in very poor condition. It is not clear whether the deterioration is historical or is continuing. Maintenance of the collection is included in the Management Plan but should be more integrated into the Research Officer's work. Particular attention should be placed on maintaining the preservatives in wet preserved specimens. Although many specimens have deteriorated badly they should not be discarded as they could be of some scientific value even if not as reference specimens.

Equipment & chemicals: The research station maintains an odd assortment of equipment. Items used regularly (such as for turtle monitoring) are well maintained, other items appear to have gone missing or are not maintained. This is most significant for the two microscopes, both of which seem to be in good condition but should be kept in an air-conditioned room to slow the growth of fungus. The chemical store contains a wide range of chemicals. Preservatives such as ethanol and formalin are not functional, possibly due to deterioration of mislabelling. Most of these supplies are some 30 years old and many are probably hazardous. The existing chemical store should be removed from the island and disposed of safely on Mahe. Aldabra should maintain a supply of appropriate chemicals, principally preservatives (ethanol and paraformaldehyde).

Rat impacts: *Pandanus aldabrensis* heads fallen at Gionnet due to stems being chewed, probably by rats. Some plants with up to 30% of heads felled, others not affected. Rat gnawed branches and snail shells were observed on the highest part of Esprit island and very locally on the back path on Picard. Bark and stem gnawing is probably related to the extreme dry conditions.

Ants: Common ants appear to comprise only native species (*Plagiolepis madecassa*, *Camponotus grandidieri*, *C. hova mixtellus*, *Tetramorium quadrispinosum*).

Millipedes: Millipedes are restricted to 3 species: the common striped millipede, *Dactylobolus bivirgatus* and the 'tufted millipede' *Lophoturus madacassus* and the spiny millipede *Orthomorpha coarctata*. The latter was only found on the back path of Picard and is an introduced species. The other two are locally abundant native species also found on Assumption and Madagascar.

Spiders: The spider fauna contains significantly more species than have been recorded, the giant palm spider is presently recorded as *Nephila inaurata* but does not resemble the supposedly conspecific form in the granitic islands. The Aldabran spiders may be *N. madagascariensis*, a comparison of recent and historical material would be desirable.

Butterflies: Butterflies observed on Aldabra: *Belenois aldabrensis*, *Colotis evanthides*, *Phalanta phalanta aethiopica*; Assumption: *B. aldabrensis*, *P. phalanta aethiopica*, *C. evanthides*, *Danaus chrysippus*. Abundance was much higher on Assumption

Invertebrate abundance and diversity: Invertebrates were extremely scarce in the dry conditions. The only site with significant diversity was mixed scrub leaf litter on Esprit island. Here beetles, a centipede species (?*Nesogeophilus* sp.) and spiders were

abundant.

Tortoises: Evidence of tortoises observed on Esprit and Gionnet. Esprit appears to have been colonised by small numbers of individuals in the past, although no population has established to date (station records include a card describing 2 carapaces found on Esprit by S. Hnatiuk in 1973).

Assumption: General observations were made, with specific searches for land snails and repeats of photographs taken in 1967. The high dune communities retain the plant species recorded in 1967 but comparison of photographs suggest that *Scaevola sericea* has replaced *Suriana maritima* as the dominant shrub on the lower seaward slopes. The west coast sand beach community remains exactly as observed in 1967, interestingly this area was damper than the rest of the island and Aldabra, *Cordia subcordata* was in flower and invertebrate life was comparatively abundant. The mixed scrub community is notable for the great abundance of bushy *Ficus lutea* trees. The dominance of *Gossypium hirsutum* does not appear to be as extensive as recorded in 1967, *G. hirsutum* was observed but did not appear to be dominant. *Lomatophyllum aldabrense* was locally abundant in the south of the island. In 1967 it was noted that the vegetation was patchy, this is not as apparent with extensive low scrub cover over most of the island. The Pave community is also covered by more shrubby vegetation, species composition was not noted. The extensive open aspect photographed in 1967 was not apparent; open rock areas do occur but are enclosed by 1-2m high shrubs. *Lomatophyllum aldabrense* was observed in this habitat. Settlement vegetation does appear to have changed significantly although *Casuarina equisetifolia* are more widely planted on the west coast, *Cocos nucifera* have been planted along the coastal road but were mostly dead. *Terminalia catappa* have been planted along the concrete road on the north-west coast, these are some 4m high and look vigorous. *Catharanthus rosea* has spread out of settlement areas and was seen on the pave. *Ipomoea pes-caprae* was seen along the edges of the runway. *Agave sisilana* is highly abundant and widespread throughout the centre of the island. This is the most significant invader on the island, although *Stachytarpheta jamaicensis* and *C. rosea* are widespread.

Of land vertebrates only *Cryptoblepharus boutonii* and birds (pied crow, Souimanga sunbird, red-whiskered bulbul, Madagascar fody, cattle egret, dimorphic egret, grey heron, green-backed heron, turnstones and Eleonora's falcon) were observed. Of the birds 3 nests of pied crow were seen and a group of 30 cattle egrets were all in full breeding plumage. Eggs of *Hemidactylus mercatorius* were found, as were footprints of giant tortoises, cats and possibly rabbits. Footprints of the latter two species were found in sand on the west coast road only. Green turtle nests were abundant on both east and west coasts.

Invertebrates observed include the hunting wasp *Eumenes maxillosa*, the ant *Plagiolepis madecassa*, the butterflies *Belenois aldabrensis*, *Phalanta phalanta aethiopica*, *Colotis evanthides* and *Danaus chrysippus*, the grasshoppers *Catantops insulans* and *Pternoscirtus aldabrae*, a tenebrionid beetle (?*Uloma* sp.), 2 weevils, the cockroach *Pycnoscelus indicus*, the millipedes *Dactylobolus bivirgatus* and *Lophoturus madacassus*, several spider species (including a highly abundant Scytodidae sp.) and the snails *Assiminea parvula*, *Truncatella guerini*, *Quickia* cf. *aldabrana*, *Gastrocopta*

*tripunctata* and *Allopeas pumilum*.

Although Assumption is not appealing at first inspection, comparison with historical records suggests that the vegetation is recovering and that there are at least local pockets of habitat that support a more diverse fauna than most of Aldabra. The island clearly has great potential for restoration, or, more significantly, the monitoring of natural regeneration. Assumption is of great importance for the running of Aldabra and the abandoned hotel development is probably the best base for any eco-tourism associated with Aldabra. Efforts to integrate Assumption into conservation management, particularly in regard to eco-tourism, should be encouraged. Such efforts should also try to include other islands of the Aldabra group, particularly Cosmoledo.

## **2. Possible Future Research projects**

Biodiversity surveys Collections of Aldabran terrestrial invertebrates were made in 1894, 1908 and during the Royal Society expeditions. In addition collections of Lepidoptera were made in 1959 and in the 1960s. The early collections were fully identified but those of the Royal Society were only partly worked up and published. Brief surveys of the invertebrate fauna that could be located in the very dry conditions during the workshop indicate that there have been significant changes in the snail fauna over the last 100 years and spiders include several undescribed taxa. These are two of the most easily located and identified groups, other invertebrates probably show similar patterns of change and under-recording. Aldabran terrestrial biodiversity is relatively well known with the exception of invertebrates; there is a need to complete the identification of existing collections and to survey the current terrestrial invertebrate fauna of the atoll. The Indian Ocean Biodiversity Assessment 2000-2005 aims to survey historical and existing biodiversity of all Seychelles islands, surveying the Aldabra group of atolls as part of this assessment is planned for 2004 but could be carried out earlier if required. The paucity of invertebrate life at the end of the dry season suggests that the assessment should be carried out in March/April when invertebrates are likely to be more abundant and conditions favourable.

The biodiversity assessment will concentrate on the under-recorded groups, using recent species lists for vertebrates and angiosperm plants. Sampling methods previously tested on other islands will be used to provide rapid and largely complete collections. Tests of this methodology demonstrate that these methods are able to collect at least 80% of species within a few days. In addition it is planned that a Malaise trap be placed on Picard during the assessment and maintained for 1 year. This will require the replacement of the collecting bottle at 2 week intervals and can be carried out by station staff with little difficulty or expenditure of time. This would provide a valuable evaluation of changes in flying insect abundance/diversity throughout the year and a comparison with collections made in 1974/5. Funding for the project is currently being sought.

Assumption, Astove & Cosmoledo Biodiversity surveys of the other parts of the Aldabra group are highly desirable. These surveys are planned in the Indian Ocean Biodiversity Assessment 2000-2005. Research on Assumption should try to establish some system of long-term habitat monitoring. The photographs taken in 1967 and repeated in 2000

should be repeated in the future and added to with quantified habitat monitoring. Developing comparative research across these islands should be encouraged.

Invertebrate identification I am able to provide identification of all Seychelles invertebrates; if identification is required as part of any research project or casually, preserved specimens should be sent to J. Gerlach, PO Box 207, Mahe. Identification will be provided, preliminary identification can usually be provided within weeks of receipt of a specimen, definitive species identification may take longer depending on the taxon.

Cryptogamic plants Mosses, ferns, algae, lichens and fungi have been collected on Aldabra in the past but the collections are small and probably very incomplete. The Indian Ocean Biodiversity Assessment will include these groups.

Ilot biodiversity The biodiversity of the ilots has not been studied systematically. Birds, reptiles, plants, Lepidoptera and Orthoptera were recorded on the ilots in the 1970s. These provide an insight into colonisation and extinction processes but the data are all limited to highly mobile taxa. More informative would be data on the distribution of less mobile invertebrates. Some data on snails were collected during the workshop which provide limited evidence of extinction patterns in the fragmented islands. More data could be provided from more diverse wingless invertebrates such as woodlice. Searches of islets for such taxa should record island size, altitude, vegetation, distance from other islands and distance to the nearest large island. This could be carried out as a small research project in conjunction with existing sea-bird monitoring.

Bassins The fauna (and algae) of some bassins appears to be of interest due to special ecological factors such as isolation, water temperatures and levels of salinity. These vary from highly isolated, such as Bassin Lubine, with a very restricted fauna to the more diverse coastal bassins. Research into their fauna would provide interesting comparisons. The presence of these ecosystems within the terrestrial environment may be of significance to the general ecological processes of the atolls, most obviously by influencing the distribution of fish/crustacean eating birds and littoral grazers and detritivores.

Rat diet Rats are trapped around the station and records are kept of measurements and reproductive states. Removal and preservation of the stomach for subsequent dietary analysis could be carried out without difficulty and would provide valuable data on rat diet. Rats around the station may not provide representative evidence of their impact on Aldabra, data from more isolated parts of the atoll would be of great interest. Such a study of rat diet should cover both wet and dry seasons. Similar research has been carried out on mice on Aride and black rats on Silhouette but nowhere else in Seychelles.

Bats There are 5 species of bat recorded in the Amirantes and Aldabra group. Of these the Aldabran fruit bat (*Pteropus seychellensis aldabrensis*) appears to be secure although there is a need to assess its population size. There have also been some

suggestions that this is a distinct species and not just a subspecies, this may also be worth further investigation. More importantly, the microchiropteran urgently need investigation. There have been several records of small bats on Aldabra but these have only been opportunistic and rarely fully identified. It would be relatively easy to determine which species are resident on Aldabra by use of a bat detector during visits to field camps as all 4 species recorded on the coral islands can be distinguished on a bat detector by their characteristic frequencies. Such surveys for bat presence should be repeated as widely as possible and in all seasons to determine which species are permanent residents, which are migrants and which are only vagrants. Resident or migrant species could then be targeted for more detailed population studies. Attention should also be paid to the nearby islands where bats have been recorded (Assumption and Cosmoledo) and where bats have not been recorded but are possible (Astove).

Pollinators Research into pollinators of selected plants would be of great interest, particularly in conjunction with invertebrate studies. Such research should include ecologically significant plants, those of conservation interest and obvious, easily studied species. At least some of these could be carried out as volunteer projects.

Pave/glacis The ecology of the communities on the pave would be of interest in comparison with the topographically similar glacis habitat of the granitic islands. These have reduced but specialised faunas (such as endemic moths associated with cyanobacteria on the rocks) and the comparison of granitic and coralline systems would provide an interesting regional contrast. Such a study is planned for Silhouette island and a comparison with Aldabra could be informative.

Tortoises The tortoises have been studied more than any other species on Aldabra and most of the important parts of their ecology have been researched. There is no urgent need to continue research on Aldabran tortoises beyond population monitoring. Two components of their behaviour and ecology remain to be studied fully; social behaviour and diet. There are some data on basic social interactions but the full details and consequences of social structuring within herds has not been investigated. Unpublished studies of captive groups show that social structure has important implications for reproduction and dominance hierarchies but the wild situation is not known. It would be of interest to investigate the extent to which social structuring is maintained in the wild and whether this has a major impact on reproductive dominance. In this context current research into giant tortoise molecular phylogeny may allow genetic tests of paternity in future.

Data on diet do exist in the form of seasonal species lists but no investigation has been carried out into the chemical composition of the diet. Research is being carried out into the diet of Seychelles giant tortoises as part of the Seychelles Giant Tortoise Conservation Project (NPTS) and Aldabran food plants could be incorporated into this. This would require the collection of air dried samples (approximately 200g) of the main dietary species. Samples should be collected in both wet and dry seasons.

Flora Rare plants: Several plant species have not been recorded for several years,



searches of their recorded localities and similar habitat should be considered a high priority of conservation related research.

**Vegetation monitoring:** The vegetation transects should be incorporated into monitoring schemes.

**Parasitology** Parasitology has been a neglected area of research for many years. Research into the parasites of terrestrial reptiles, amphibians and birds has been initiated by the Nature Protection Trust of Seychelles in the granitic islands. This will be expanded as part of the Indian Ocean Biodiversity Assessment to obtain preliminary data on the general distribution of parasites. These preliminary data will indicate the distribution of parasites in relation to their hosts, providing further evidence of speciation patterns. More extensive collections should be made to investigate the prevalence of parasites, particularly of introduced species. Future research by the NPTS in the granitic islands will focus in particular in the transmission of alien parasites from the introduced Pacific house gecko (*Gehyra mutilata*) to endemic geckos and their possible role in exclusion of the bronze geckos (*Ailuronyx* spp.) from *Gehyra* occupied areas. This may have particular relevance to Aldabra where *Gehyra* has so far failed to establish itself. Avian parasites are also of interest, the presence of Madagascar fodies and associated parasites on Assumption is notable in this context. Blood smears were collected from giant tortoises during the workshop. Captive tortoises in the granitic islands are free from blood parasites, and negative results are expected from the wild collected smears.

Research into parasitology need not be complicated or time consuming. Anyone collecting blood samples of any species should take a few seconds to smear a drop of blood onto a microscope slide, this should be air dried and stored in a dry, insect proof environment. Intestinal parasites can be studied by collecting a small faecal sample and storing it in 4% potassium dichromate. A collecting protocol and supply of potassium dichromate and parasite identification can be provided by NPTS.

**Data handling** The existing monitoring programmes are of the greatest importance and would be enhanced by improved data handling on Aldabra. A system that automates reporting and graphical representation would provide a direct demonstration of the value of continued monitoring. A dedicated system would be most desirable but a basic linkage of data input and graphical representation could easily be compiled at relatively low cost. This could easily be applied to all monitoring programmes.

**Population modelling** It would be desirable to integrate single species research projects with the development of predictive population models. Such a model has been developed for tortoises and it is hoped that one will be developed for rails in the near future. The developing rail models could easily be expanded to other species. Such models would be of great value in interpreting population fluctuations identified by monitoring programmes. The decline of *Icerya seychellarum* is a case in point; in the absence of predictive modelling it is impossible to determine whether or not the decline is due to the control programme or simply a consequence of population dynamics. A model of molluscan biological control (Gerlach 2001) indicates that the control programme actually results in maintenance of the target population, a similar situation may exist

with *Icerya*. A large part of a population model for this species could be developed from existing data and incorporated into the monitoring programme.

## References

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## GROUP C.

### Land Birds - Ross M. Wanless

My focus was on land birds, with particular attention given to rails. A 2-night trip (10-11 Dec.) to Passe Houareau afforded the chance to compare the current Rail-monitoring method with that used to estimate the population in the 1970's. The latter method yielded almost double the former, prompting a decision to perform a number of paired samples to determine the degree of underestimation of the current method. (see below)

A 2-night trip (12-13 Dec.) to Cinq Cases was planned, but water shortage at the hut prompted us to abandon the camp on the morning of the 13<sup>th</sup>. I was able to check the status of Ibises that usually breed around Bassin Flammant. There were no active nests, possibly as a result of the extremely dry conditions. Late in December 1999, after showers ended what had been similarly dry conditions, more than 50 nests were counted. A landbird census was conducted as part of the regular monitoring programme.

Rails A reintroduction to Picard took place in November 1999. During the workshop, several pairs of Rails were "retrapped" (jargon for positively identified) on Picard, suggesting that the success evident earlier this year, with numerous chicks fledged, looks set to be repeated this breeding season.

Currently, Rails are being monitored on a regular basis. The method employed is quite different from that used in the past, and I am engaged in a comparison of the two techniques. I have a concern that the current system is not standardised – whistling imitations are not the same as playing back taped recordings of rails, which can be standardised. I ensured when I left in April this year that there were 2 cassette playback machines and recordings, but these are not being used. A second concern is that monitoring birds once a month might cause the animals around the transects to become habituated to the calls, and this would have an unquantifiable, negative effect on the census. Suggestion: quarterly censuses using tape playback of the same call each time, at same volume.

Land birds There is (as of my visit to Aldabra commencing August '99) a census method to monitor the passerine land birds. The method is relatively simple, and Aldabran birds present no ID problems, so there should be no hassle with its continued use. The technique is inappropriate for the non-passerines, but there does not seem to be an alternative (Rails exclusive). Further, there do not appear to be any population



issues for most of the birds. The exceptions are listed below.

I am instituting a nest record card scheme. The purpose of this is to ensure that the data collected by Joe Francois and myself remain on Aldabra in a useful format. Also, add-hoc discoveries of nests can be recorded in a sensible and useful manner, and we can begin to build a picture of the breeding biology of the birds here.

Ibises Ibises nest, semi-regularly, in the wet season, at several localities. An annual count of nests at one of the more regular colonies (Bassin Flammant) was undertaken in the past 2 seasons. This should be continued in the December, January and February trips to Cinc Cases. I will be banding juveniles this season (assuming they breed successfully there); future monitoring should check for ringed birds breeding (noting numbers).

Kestrel The population does not appear to be healthy. This is probably the result of problems associated with small population sizes (e.g. inbreeding depression). I am trying to secure funding for a research effort directed at the Kestrels. Their breeding success, while difficult, should be monitored wherever possible. They represent the most threatened bird species on Aldabra.

Pied Crows Further to the suggestions of the Chairman of the Board, Pied Crows are in need of research. They are natural colonists of the atoll. Their numbers have been stable, and very low, over the last 30 years, and probably longer. Before any intervention directed at them is made, we should understand their role in Aldabra's ecology, and the impact they have on its ecosystems – especially the breeding success of land birds and turtles.

### **General Observations - Joseph Francois**

There are magnificent breeding tropical seabird colonies, pristine mangrove forests, brilliantly coloured giant clams, countless tortoises, an abundance of sea turtles, and a lagoon with its range of colours, from aquamarine shallows to royal blue depths, unpolluted and crystal clear that has to be seen to be believed. There is no doubt that I am speaking of Aldabra, and its ecological wealth that most other oceanic islands have lost. 'Paradise found' were the two words that came to my lips when I first set foot on the special reserve on December 7th 2000. I would like to congratulate SIF for inviting me to the workshop and for having been able to protect and manage what many people have described as "the last bit of Paradise left on Earth".

However, putting aside accomplishments, the dilemma facing Aldabra and SIF presently is one associated to conservation. Although only humans are capable of appreciating the beauty of Aldabra, it is also humans, if they come in any numbers and without respect, that could ruin it. For the small developing island states (e.g. Seychelles), the pressure to exploit such an asset is enormous and so are the risks of destroying it. Also, more threats come from the rise in sea level since the atoll could disappear in the next century unless we manage to halt global warming. Therefore, it is indisputable that SIF and the government of Seychelles face an enormous challenge in this new millennium to conserve the beauty of this pristine paradise which represents

the world's hopes for a better Earth.

To me, the importance of such an unpopulated place in an overpopulated world, shows how a small developing country can set an example to rich, large ones by representing hope for the future. We are also conserving a symbol for mankind to look back over the past century and consider how we have spoiled things. Aldabra represents the picture of how the world used to be without human interference.

Below is my contribution to SIF based on observations made both during the Scientific Workshop on Aldabra and in my job as a research officer in Ministry of Environment. The views expressed below are aimed exclusively at improving SIF as the organisation managing Aldabra, and Aldabra itself as a World Heritage Site.

## **Recommendations**

### 1. Involvement and promotion of Seychellois scientists

1.1 In the past in many occasions foreign scientists or experts doing research on Aldabra have found themselves in need of an assistant(s). In the majority of these instances those scientists or experts have advertised for their 'helper(s)' abroad via the Internet or directly to foreign tertiary institutions. In very few cases have advertisements been made locally to relevant institutions such as the Ministry of Environment, or the Seychelles Polytechnic to attract our local students or scientists who are interested in conducting such research. There are a number of local scientists or university students who are doing their degree both locally (by correspondence) or abroad, and would be willing to do their dissertations or theses, or some components of research on Aldabra, and they are not being informed of this possibility. As a young local scientist I would appreciate our local people getting the first chance to such research. This will help promote local scientists and give a chance to local students to have a 'taste of research' before entering university or when doing their dissertations or theses. The Seychelles Polytechnic has a "Work Attachment" scheme where students are attached to relevant work institutions to gain work experience before leaving for universities abroad, and too often students applying to do science degrees end up 'work-shadowing' administrative jobs. This could be a starting place for SIF to advertise the World Heritage site for local benefit.

1.2 Having read a number of papers and reports written or published by scientists who have conducted their research on Aldabra, and by speaking to some locals who have been involved in such research, a lot of the research had direct contributions or input from rangers, especially where field data collection are concerned. However, in reports or publications it is very rare that such locals are cited as major contributors to the research. In some reports they are listed in acknowledgments, but in a number of cases their contributions may have been more significant and worth having their names mentioned on the front page together with the main researchers or attached to data tables in the text. This is another way of promoting our local enthusiasts and a fair way of recognition for their immense support and devotion. SIF in the future should try to encourage foreign scientists to include Seychellois in their research, and where appropriate make sure that our locals are appropriately cited as major contributors.

## 2. Reports and Publications

2.1 Reports and publications of research carried out on Aldabra are still inaccessible to most of our population. Although a good number of these reports do appear in the library on Aldabra, very few are present in the Documentation Center in the Ministry of Environment, and virtually none exist at the National Library or Anse Royale Polytechnic Library, the key places where there should be copies of those reports and publications. It would be a way of informing our students and anybody interested on the progress and results of research done on that World Heritage Site.

2.2 In the future SIF may consider compiling all research documents, reports and publications resulted from research done on Aldabra (many are currently available in the library on Aldabra) in the form of a journal updated by editions. This can then be distributed to relevant institutions locally or even regionally as many of those institutions lack a good reference section to facilitate research.

2.3 Section 4.4 in the Aldabra Management Plan states that all publications resulting from research conducted on Aldabra must be submitted to SIF within six months of their publication dates. However, nothing is said about how unpublished data could be accessed. I suggest that in addition to that clause SIF may consider a policy where any field data collected on Aldabra are summarized and even a brief preliminary report of the findings provided to SIF before the researcher leaves the country (in the case of a foreigner). The report should reflect the findings from the data collected as closely as possible. To respect the researcher's right on the data collected SIF may consider not making this report available to any other parties while waiting for the publication to take place. In cases where publications are not made within that period of time stated in the Management Plan then SIF can use that report as required to further enhance knowledge and facilitate further research on that particular subject.

## 3. Training

3.1 Over the 10 days of the workshop I often needed assistance in identifying certain notable terrestrial plant species in the field, and I was struck how limited the staff's knowledge is of common plant species as well the rare ones. Although there is a guide to identify plants and a herbarium in the Library, it is still hard at times to identify some species. Hence, I would suggest field training for rangers and other field workers in naming and identifying terrestrial species on the atoll. This training could be done on Aldabra by a qualified and experienced botanist. Also a brief introduction to the physiology of these species would be a bonus and would be especially useful when conducting monitoring or research on terrestrial flora and fauna.

3.2 There is a lack of sufficient trained Rangers, especially in computer literacy, on Aldabra. A lot of the monitoring that takes place on the atoll requires data input on computer, designing forms, writing clear and concise reports as well as picking up simple trends and performing simple statistical tests. I suggest that a training program is put forward for rangers to be trained in basic computer packages such as Microsoft Word, Microsoft Excel, Access and other frequently used packages. Basic statistics is also encouraged to better understand data trends. This and other academic training would help in bridging the gap between the rangers and the Research Officer posts and, hence create a career path for the rangers which at present does not exist. The training

in question can be done on Mahe by various academic institutions at reasonable costs. These courses are normally made available at the beginning of each calendar year.

3.3 Having spoken to some management staff and other staff currently working on the atoll, no fire drill training has been done for staff currently working on Aldabra. Very few staff have had this sort of training before in their past jobs. Aldabra suffers from drought conditions every now and then, together with the rising number of electrical appliances being used on the island, it is with doubt that the island is susceptible to an accidental fire either induced by man or by lightning. It requires just one day in a million years for such an accident to happen and for a piece of the atoll to be destroyed. If that day does arrive it is essential for all staff and visitors to be allocated to an Assembly area, be given respective duties, be equipped with the right equipment (e.g. Fire proof clothing in case somebody need rescuing in the blaze), knowledge on how to use different types of fire extinguishers etc.,. Such training, although costly is worth undertaking and is available on Mahe at the Fire Brigade Unit upon request.

3.4 First aid training is essential for all types of work at any given place on earth. It is even more essential on remote islands where quick evacuation is difficult. Aldabra is about 2 hours away by boat from Assumption island which is itself about 3 hours away from Mahe by air, while navigation by night to both of these islands is pretty risky. At present very few staff on the island have been trained in first aid and I suggest this should be an urgent recommendation to SIF. Training can be done on site (i.e. Aldabra) by staff of Environmental Health, Ministry of Health at a small cost.

#### 4. Funding

4.1 Alternative means of funding for Aldabra are no doubt required for the day to day running of the island and to finance projects. So far Aldabra has mainly functioned on revenues obtained by the Vallee de Mai and grants offered by the local government and some international organisations. The question which is now being raised is: can Aldabra generate enough money to finance its own activities? Limited, low-impact nature conservation tourism mentioned in the Management Plan is in my opinion a very sensible approach if not the only way forward, however, limited is a very vague word and can be very subjective in its interpretation if strict guidelines are not established. Also I would like to suggest is the promotion of research for medical purposes and research for pharmaceutical products (bio-prospecting research) which is not mentioned in the Management Plan. I do understand that this type of research has few conservation objectives attach to it, but if done with precautions it could bring substantial revenue to the atoll in the forms of “Upfront Payment”, “Milestones Payment” and even royalties. This type of research has been carried in other sensitive areas of the world such as in Iceland, the Yellowstone National Park (USA), Costa Rica, some Caribbean countries and has just started in Madagascar and some other oceanic islands. Recipient countries for this type of research are legally protected from “biopiracy” under the CBD agreements. Micro-organisms and marine research are good examples where such research can be done sustainably without significant damage to the environment. However, it should be noted that propagation or cultivation of any living organism resulting from findings of bio-prospecting research need not necessarily be done on the atoll. This can be assisted by DOE legal officer and other staff trained in the sustainable use of

biological diversity.

4.2 I also suggest setting up a Trust Fund for Aldabra to finance small conservation works and day to day monitoring on the atoll. Donations of any size could be made, similarly to that of the Children Fund, or even operate in the form of a charity fund.

4.3 Funding for the essential training mentioned in Section 3 can be sought at foreign embassies based in Seychelles which are often willing to sponsor such small projects.

## 5. Others

5.1 Being on the island for more than a month now I have noticed that the system of patrolling the atoll is very limited. I do appreciate that this is an expensive operation which requires a lot of manpower and equipment. Nevertheless, I think it is a worthwhile operation if the objectives of the Management Plan are to be met and to stop poaching and other illegal activities.

5.2 The results of beach erosion and sand degradation is often seen around the outside of the atoll. On Aldabra beach erosion is naturally induced, but, nevertheless, could be catastrophic both in terms of investments and ecology if nothing is done about it, especially on Picard. It would be interested to get the views of Science Committee members on that subject. Could a more meaningful monitoring study be done? Is there a “green” way of reducing the degradation rate of the beaches outside the lagoon? What about planting Veloutier (*Scaevola sericea*) or creating dunes as artificial barriers?

## **4. REVIEW OF THE ALDABRA MANAGEMENT PLAN**

On 16 December, during a workshop session of all the participants, Katy Beaver provided an introduction to some key features of the *Aldabra Management Plan 1998 – 2005* which had been prepared for the Seychelles Islands Foundation by Katy Beaver and Ron Gerlach.

The Protection and Access zones (Management Plan Section 1, p.15 and Section 2, p.7 - 11) were discussed at length and it was agreed that they remained an effective zonation of the atoll. There is no requirement to modify the zoning system and the guidelines given in the Management Plan should continue to be followed closely.

It was agreed that it is highly desirable to re-invigorate a programme of research on Aldabra and the need for research work to be conducted in ways consistent with the Management Plan was considered essential. The procedure for submitting research proposals was discussed and clarified:

- Scientists proposing to undertake research work on Aldabra should submit a proposal to the Seychelles Islands Foundation using the format that is used for NRDC proposals. The Scientific Committee will consider research proposals and advise on whether they should go ahead.
- It was recognised that it is highly desirable to attract researchers to Aldabra and this means that the excellent facilities of the Research Station need to be publicised and made more widely known.
- In addition it is desirable to have a “Handbook for Visitors” to provide basic information to researchers at the early stage of planning their visit. This could be produced by updating the handbook that was written for the Royal Society Research

Station and which is available in the Library.

A world wide web page for the Seychelles Islands Foundation would soon be established, thanks to the assistance of the Starship expedition and this would be used as one important means of publicising the Research Station.

Section Two of the Management Plan, the Operations Manual sets out the monitoring programmes that are routinely undertaken on Aldabra and the opportunistic monitoring (for example, of flamingoes, caspian tern, frigates and the brush warbler). This report sets out revised proposals for the measurement of giant tortoises (see p. 6).

## 5. GENERAL DISCUSSION SESSION

On 16 December a general discussion took place to review the experiences of the Working Groups. The notes from this session form a supplement to the observations in Section 3 of this report.

### Group A

- The exceptionally dry state of the vegetation on Grande Terre was commented on. David Bourn pointed out that many coastal trees (particularly *Guettarda*) had died especially in the area between Cinq Cases and Dune Jean Louis. He noted that the tortoise population on Grande Terre had continued to decline since the 1970's (see p.7–13 of this report). However he and Stephen Blackmore agreed that the general appearance of the vegetation along the south coast of Grande Terre had changed little since the 1970's and, for example, sedges did not appear to have extended at the expense of grasses into the tortoise turf.
- It was agreed that a very worthwhile exercise would be to compare the aerial photography of 1960 with the images obtained in 1999. This should ideally form part of a GIS system for Aldabra.
- Very few feral goats were detected on Grande Terre, two a male and a female near Croix Blanc and a group of six near Takamaka Grove (seen by Maurice Lalanne). However, it was concluded that goats are far less apparent than they were in the 1970's (partly because they are now very reclusive) many more might be present and that only aerial observation is likely to confirm the real numbers.
- One cat was seen at Dune Jean Louis and cat tracks were abundant on raised beach sand along the south coast. It was concluded that the dry season would be a good time for trapping programmes or cats to be carried out. There was a discussion on the use of mammal specific poisons that might potentially be used against cats, rats and goats.
- Coccids were only seen in a few places, on *Avicennia* at La Gigi, Middle Camp and Ile Polymnie and on *Ochna* at Takamaka Grove. It was concluded that these dry season observations would underestimate the extent of the coccids and that there needs to be further investigation to follow up on their numbers and the effectiveness of the biological control programme.
- Green turtles were seen in much greater numbers along the coast of Grande Terre than in the 1970's. It was noted that they now frequently nest on Ile Picard, something that would have been a rare event when the Settlement was occupied in the 1970's. Jeanne Mortimer confirmed that green turtle numbers have increased

dramatically in the last twenty years.

- Maurice Lalanne noted that the numbers of pied crows appeared to be more or less constant on Aldabra.

#### **Group B**

- Communities of land invertebrates, such as snails, may be unstable and some species may become extinct without this being easily detected. One species of banded snail reported as common was not found by Justin Gerlach.
- Robert Prys-Jones commented that the *Acraea* butterflies that had been common on Ile Picard and elsewhere in the 1970's seemed to have disappeared although their food plant, *Passiflora*, is still available.
- David Stoddart pointed out that, out of the last ten years, only 1994 had seen average rainfall on Aldabra, with all other years being much drier than normal. It was agreed that it is important to record long term climate information both on land and in the sea. There was a discussion of automated recording equipment which for about US \$100 will record rainfall (and other ?) parameters. It was felt that local, ground based recordings from Aldabra would contribute usefully to international programmes such as NOAH that use remote sensing.

#### **Group C**

- Ross Wanless spoke about the different methodologies that have been used for monitoring flightless rails and the need for continuous standardised monitoring.
- This led onto a discussion of paths and an agreement that all paths needed to be accurately mapped. The advantages of using an automated laser range finder for mapping were discussed and it was agreed that paths should also be incorporated into any GIS system developed for Aldabra.
- David Stoddart emphasised the importance of only creating new paths when it was absolutely essential to do so, because paths opened channels for invasive species, such as *Stachytarpheta jamaicensis* to spread along.
- Robert Prys-Jones commented that most of his time during the workshop had been spent on Ile Picard and Gionnet, mainly between the Station and Anse Var and this had given him a feel for the relative abundance of land bird species compared to the late 1970's. He had searched for ringed birds at Anse Var but had found none (after a period of 14 or 15 years since the last ringing was done). He noted that turtle doves were much more commonly seen now at the Research Station than they had been but that this might not mean any change in the population, rather that the birds found a ready source of fresh water (for example from air conditioning units) and food.
- Other changes around the research station also made a difference to the bird communities, for example, there are now far fewer mature coconut trees (this also affected the number of available roosting places for fruit bats around the Station).
- Ross Wanless commented that he had seen turtle doves being killed by pied crows while they were distracted by foraging for food near the kitchen area.

#### **Group D.**

- Reporting on a visit to Ile Michel it was noted that there was abundant growth of sisal there (although it had been thought to have been eradicated in the late 1970's). Fruit bats had previously roosted on Ile Michel but were not observed. Relatively



few were seen during the workshop and their status is worthy of investigation. It was noted that their taxonomic status also needs further research to determine whether or not they are a distinct subspecies.

- A visit to Ile Espirit showed that giant tortoises were present, the animals themselves were not seen but tortoise droppings were fairly numerous. David Bourn commented that tortoises had definitely not been present on Ile Espirit in 1975 but that they might have drifted there, perhaps from the lagoon behind Anse Mais.
- Extensive damage to trees by rats was noted on Ile Espirit – bark had been stripped extensively from many trees. Robert Prys-Jones said that he had seen many more rats during daylight at Anse Var than would have been present in the 1970's.

## **General discussion**

- There was strong support for the establishment of a geographical information system (GIS) for Aldabra. This would serve to integrate the historical record of observations made at the Research Station with new observations. It might usefully be connected with the Environmental Management Plan of Seychelles (EMPS) which had a sum of US \$ 1m for biodiversity in the outer islands.
- The point was made that SIF might seek to play a role in the management of the other three islands in the Aldabra Group both because they contain related biodiversity and because of the threat that invasive species might reach Aldabra, especially from Assumption.
- Yvon Juliette commented on the energy use of the Research Station and noted that 30% of the electricity currently generated is used for air conditioning and fans. He will be preparing a report on the energy management options for the future.
- There was a discussion of the accuracy of tide tables used on Aldabra. David Stoddart pointed out that there had never been a careful study of tides and tidal lags on Aldabra. A very useful exercise to be undertaken when a large group was next on Aldabra would be to situate observers at key points around the atoll (especially at landing places inside the lagoon) to record tidal activity over a 24 hour period.
- Maurice Lalanne, the Chairman of SIF, thanked the participants for their contributions during the workshop which he noted had been a stimulating experience and a valuable sharing of experiences between the different members of the group.

## **6. CONCLUSIONS AND RECOMMENDATIONS**

Several of the preceding sections of this report contain recommendations for the future but these are gathered together here for more convenient reference. The recommendations are cross referenced to pages in the report where more detail can be found.

- Consideration should be given to re-instating carbon copy log books at each hut to record visits, work to be done, supplies used, etc. Copies of pages to be returned to the Research Station (p. 5).
- It may be helpful to mark the well at Cinq Cases more clearly and to leave notes at the hut on how to obtain fresh water from the Well (p. 5).
- Takamaka and Anse Cedre huts need rebuilding if needed in future (p. 6)
- Additional information should be collected on tortoise transects, to record the presence or absence of a cervical ("nuchal") scute (p. 6)



- To facilitate comparisons between tortoise sub-populations and museum specimens additional measurements should be recorded with large calipers (p. 6).
- A fully-automated, user-friendly data entry and database system is required to assist field staff and inform management on the status of the tortoise populations (p. 12).
- Rainfall figures should be reported regularly and major deviations from long-term mean values should be highlighted. (p. 12).
- Feral goats should be eradicated. Consider special measures, including use of military helicopters and sharpshooters, to eliminate the problem once and for all (p. 13)
- An early start needs to be made to establish a user-friendly GIS for Aldabra, to include records of previous work and past events, and provide a standard framework and guidelines for the monitoring of future activities and events (p. 13).
- The new aerial photographic coverage provides an excellent opportunity for assessing long-term changes in vegetation patterns by comparison with coverage obtained forty years earlier in 1960, which were the foundation of the most detailed vegetation map of Aldabra (Gibson & Phillipson 1983) (p. 13).
- Consideration should be given to the installation of a solar-powered, radio repeater-station on Dune Jean Louis to ensure reliable communications with the research station on Picard from all round the atoll (p. 13).
- Gather and assess data describing physical parameters associated with or believed to stimulate coral bleaching, including: water temperature, incidental UV radiation, current speeds and direction, sea surface temperatures, and sea levels. These are available on the internet and need to be monitored and evaluated (p. 15-16).
- Produce an Aldabra GIS defining marine ecosystems and habitat types using digitised colour and infrared aerial imagery acquired in 1998 to provide a quantitative estimate of marine and adjacent habitats, as well as bathymetric information (p. 16).
- Ground-truthing of aerial imagery so spectral signatures in imagery correlate with habitat types. This could be done by SIF Rangers during regular monitoring activities - with the aid of a hand held sonar depth recorder and a GPS device (p. 16).
- Compare the new GIS map with aerial maps produced in the 1960s to detect changes in the shallow marine habitats (i.e. reefs, mangroves, seagrasses). (p. 16).
- Continue and enhance long term monitoring and marine species inventory of corals and fishes, through: annual videography of permanent transects, production of fish lists by knowledgeable SIF staff, and visiting scientists/divers, and comparison of recent species inventories with results of older studies for a historical perspective.
- Simplify the "Diver Record Sheet (DRS)" to enable visiting divers to make significant contributions to the long-term data base. Information would then be entered into a computer database by SIF Aldabra staff (p. 16).
- Establish and conduct long term monitoring of the lagoon and passes (page 16-17).
- Conduct coral recruitment studies, within the lagoon and also on the outer reef slopes, using ceramic settlement plates oriented at various angles (p. 17).

- Initiate studies of mangrove ecosystem dynamics and linkages between mangroves, lagoon and outer reef system productivity (p. 17).
- Continue the sea turtle monitoring programme as described in the handbook “Marine Turtle Monitoring at Aldabra — 1997 version” (Mortimer, 1998) (p. 17).
- A key element critical to success will be the training of Aldabra rangers to maintain and develop the programme long into the future (p. 17).
- Maintenance of the preserved specimen collection is included in the Management Plan but should be more integrated into the Research Officer’s work (p. 18).
- The existing chemical store should be removed from the island and disposed of safely on Mahe. Aldabra should maintain a supply of appropriate chemicals, principally preservatives (ethanol and paraformaldehyde) (p. 18).
- The giant palm spider is presently recorded as *Nephila inaurata* but does not resemble the supposedly conspecific form in the granitic islands and may be *N. madagascariensis*, comparison of recent and historical material would be desirable.
- There is a need to complete the identification of existing collections and to survey the current terrestrial invertebrate fauna of the atoll (p. 18).
- Biodiversity surveys are needed on all islands of the Aldabra Group, comparative research across these islands should be encouraged (p. 20).
- Biodiversity studies on islets should record island size, altitude, vegetation, distance from other islands and distance to the nearest large island (p. 21).
- The fauna (and algae) of some bassins is of interest due to special ecological factors such as isolation, water temperatures and levels of salinity. Research into the fauna of bassins would provide interesting comparisons (p.21)
- Rat diet should be investigated, especially in more isolated parts of the atoll (p. 21).
- Research on bats is needed to assess population size for all species (p. 21).
- Research into pollinators of selected plants would be of interest, particularly in conjunction with invertebrate studies. Some could be volunteer projects (p. 22).
- The ecology of paves would be of interest in comparison with the glacial habitat of the granitic islands (p. 22).
- It would be of interest to investigate the extent to which social structuring is maintained in giant tortoises and whether this has an impact on reproduction (p. 22).
- Data on the chemical composition of the giant tortoise diet should be gathered, this could be incorporated into research carried out by NPTS in the granitics (p. 22).
- Rare plants: Several plant species have not been recorded for several years, searches should be considered a high priority of conservation related research (p. 22).
- The vegetation transects should be incorporated into monitoring schemes (p. 22)
- Predictive population models have been developed for tortoises and will be for rails. Such models would be of great value in interpreting population fluctuations identified by monitoring programmes (p. 23)
- Rails are monitored on a regular basis but the current system could be standardised. with quarterly censuses using tape playback of the same call and volume (p. 24).
- Future monitoring of Sacred Ibis should check for ringed birds breeding (noting numbers). (p. 25).
- Pied Crows are in need of research to understand their role in Aldabra’s ecology,

and the impact they have on its ecosystems – especially the breeding success of land birds and turtles (p. 25)

- Actively develop mechanisms for the involvement and promotion of Seychellois scientists on Aldabra, for example, through the Seychelles Polytechnic “Work Attachment” scheme (p. 26).
- Acknowledge the involvement of local people in research by their names being mentioned on the front page together with the main researchers or attached to data tables in the text. SIF should encourage foreign scientists to include Seychellois in their research, and where appropriate make sure that they are worthily cited as major contributors in reports or publications (p. 26).
- Reports of research on Aldabra are mostly locally inaccessible. Copies should always be deposited in the Documentation Center in the Ministry of Environment, the National Library or Anse Royale Polytechnic Library (p. 26).
- SIF may consider compiling research reports and publications from Aldabra in the form of a journal which can be distributed locally or regionally (p. 27).
- SIF may consider a policy where field data collected on Aldabra are summarized and a preliminary report sent to SIF before the researcher leaves (p. 27).
- Field training for rangers and other field workers in identification of terrestrial species on the atoll could be done on Aldabra by an experienced botanist (p. 27).
- Rangers need training in computer literacy using basic computer packages (p. 27).
- Fire drill training is needed for staff working on Aldabra which currently suffers from drought conditions and is susceptible to an accidental fire (p. 27).
- First aid training is essential and can be done on site (i.e. Aldabra) by staff of Environmental Health, Ministry of Health at a small cost (p. 28).
- To generate funds, consideration should be given to the promotion of bio-prospecting research (p. 28).
- An Aldabra Trust Fund could be set up to finance small conservation works (p. 28).
- Beach erosion is often seen around the outside of the atoll. Could a more meaningful monitoring study be done? Is there a “green way” of reducing the degradation rate of the beaches outside the lagoon? (p. 29).
- The facilities of the Research Station need to be publicised and made more widely known to attract researchers to Aldabra (p. 29).
- A “Handbook for Visitors” is needed (p. 29).
- It was agreed that a very worthwhile exercise would be to compare the 1960 and 1999 aerial images, ideally as part of a GIS system (p. 30)
- The use of mammal specific poisons should be investigated to see whether they might potentially be used against cats, rats and goats (p. 30).
- There needs to be further investigation to follow up on the effectiveness of the biological control programme against coccids (p. 30).
- To record long term climate information both on land and in the sea consideration should be given to the purchase of automated recording equipment (p. 31).
- A useful exercise to be undertaken when a large group was on Aldabra would be to situate observers at key points around the atoll (especially at landing places inside the lagoon) to record tidal activity over a twenty four hour period (p. 32).

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