



## Restoring island biodiversity: the reintroduction of endemic Mauritian reptiles

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## Mauritian reptiles

- Once one of the richest reptile diversities in the World
- In the absence of terrestrial mammals the reptiles evolved to occupy all available niches
- Allowed adaptive radiation of:
  - Tortoises
  - Nocturnal and diurnal geckos
  - Skinks
  - Snakes



## Mauritian reptiles

- This adaptive radiation caused the formation of a unique ecosystem dependent upon reptiles

- Reptiles occupied all main functional groups:

## Mauritian reptiles

- Predators:



## Mauritian reptiles

- Prey:



## Mauritian reptiles

- Grazers and browsers:



## Mauritian reptiles

- Seed dispersers:



## Mauritian reptiles

- Pollinators:



## Mauritian reptiles

- Human related disturbances over the past 400 years:
  - Extensive habitat destruction
  - Introduction of non-native predators and competitors
- More than 60% of reptile species lost from the main island through extinction or extirpation
- The majority of the extant species are now confined to offshore islands

## Mauritian reptiles

- Remaining island populations:
  - Restricted and/or fragmented distributions
  - The loss of ecological links and food webs
    - loss of stability
- Vulnerable to further disturbances
  - Purposeful and accidental introductions
  - Anthropogenic and stochastic events

## Restoration and research

- Round Island
  - Most intact reptile fauna of the Mascarenes
  - Never invaded by predatory mammals or reptiles
  - Habitat destruction caused by rabbits and goats - deleterious affect on reptiles
- 30 years ago:
  - Restore island communities
  - Translocate reptiles
  - Maintain Round Island for comparative studies



## Restoration and research

- 30 years ago:
- Recipient islands unsuitable and little known
- Donor populations too vulnerable
- Little known about the ecological requirements, distribution and taxonomy of the species
- The need for restoration & translocation repeated e.g. Hartley, Bloxam, Tonge, Bullock, Arnold, Cheke, Merton, Bell
- Forestry Service, DWCT, MWF and NPCS the driving force:
  - Habitat restoration
  - Eradication of mammalian predators and herbivores

## Restoration and research

- Extensive research on Mauritian reptiles over the 30yrs
- > 40 peer-reviewed publications
  - ecology
  - conservation
  - taxonomy
  - genetics
  - disease and health
  - past and present distributions
- Many unpublished reports
- Numerous academic studies Ph.D., M.Sc., B.Sc..



## Restoration and research

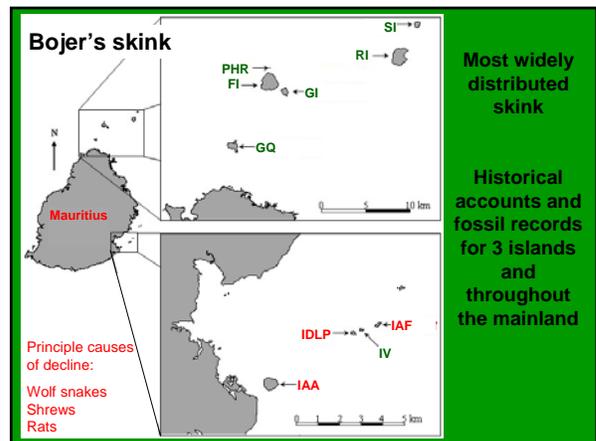
- The next step in the restoration process:
  - Re-establishing reptile communities

## Skinks and geckos

- Essential to start with the ecological building blocks (most widespread and abundant)
- The skinks
  - Bojer's skink, *Gongylomorphus bojerii*
  - Telfair's skink, *Leiolopisma telfairii*
- The geckos
  - Durrell's night gecko, *Nactus durrelli*
  - Lesser night gecko, *Nactus coindemirensis*

## Skinks and geckos

- Re-establishing populations of Bojer's skink, *Gongylomorphus bojerii*



## Skinks and geckos

- Freeman (2003) demonstrated
  - Bojer's skinks in high densities
  - Risks of inbreeding depression prevented by low level migration, thus maintaining genetic variation



- However:
  - no migration for Ilot Vacoas and a great risk of inbreeding depression

## Skinks and geckos

- Ilot Vacoas skink population
  - Show a significant genetic separation from other populations
  - Must treat as a separate conservation management unit



- At great risk from further disturbances
- Their future survival is dependent upon translocation
- With up to 490 skinks translocations will have to be small and repetitive

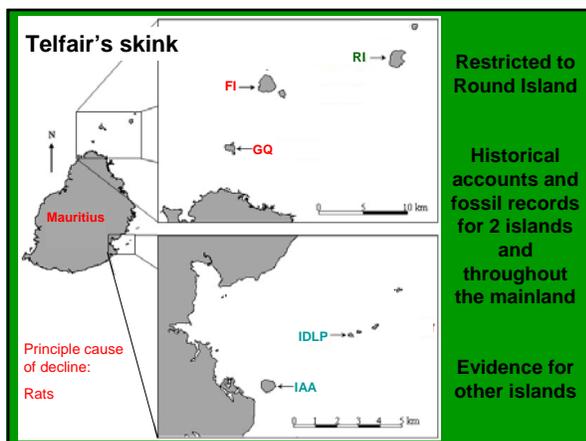
## Skinks and geckos

- Ile aux Fouquets
  - Most ideal site for first translocation
  - Skinks present until at least 1972
  - Shrews no longer present



## Skinks and geckos

- Re-establishing populations of Telfair's skink, *Leiolopisma telfairii*



## Skinks and geckos

- Highly abundant - 10-15,000
- Robust generalist along the three important niche parameters (Food, Space, Time)
  - Adaptable to change – an ideal candidate
- An important component of the pristine Mauritian ecosystem:
  - Predator / Prey / Seed Disperser / Pollinator

## Skinks and geckos

- Telfair's repeatedly identified for translocation to:
  - Ile aux Aigrettes
  - Gunner's Quoin
  - Flat Island
  - Ile Marianne
  - Ile aux Fouquets
  - Ile de la Passe



## Skinks and geckos

- Telfair's repeatedly identified for translocation to:
  - Ile aux Aigrettes
    - Ideal habitat (possibly more suitable than Round Is)
    - Cats and rats eradicated by 1991
    - An abundant food source: invertebrates, fruits and reptiles
  - Potential impact upon exotics:
    - Predation of African land snails and wolf snakes
    - Competitive exclusion of the shrew (may allow further re-introductions?)
  - Ecotourism & education - increasing awareness of biodiversity issues

## Skinks and geckos

- Telfair's repeatedly identified for translocation to:
  - Ile aux Aigrettes
  - Gunner's Quoin
    - Suitable diversity of habitat types
    - Rats eradicated in 1995
    - An abundant food source: invertebrates, fruits and reptiles
    - Replacement of a lost predator
    - Potential prey item for future reintroductions
    - Disperser of *Pandanus* seeds and pollinator of *Latania*

## Skinks and geckos

- Some have highlighted concerns for the lesser night gecko, *Nactus coindemirensis*

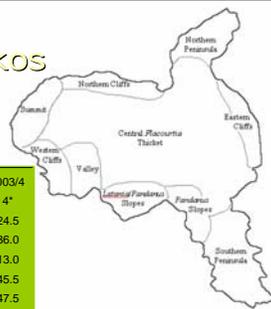


- Co-existed with Telfair's skink, then rats from the 1860s for 130 yrs
- Demonstrate anti-predatory behaviours
- Mostly active in different time niche
- Significant population growth post rat eradication

## Skinks and geckos

Encounter rates  
*Nactus coindemirensis*

Gunner's Quoin	1982	1993	1996	2003/4
Central <i>Flacourtia</i> thicket	-	-	0*	4*
Eastern cliffs	-	-	0*	24.5
<i>Latania/Pandanus</i> slopes	-	-	0*	36.0
Northern cliffs	-	-	0*	13.0
Northern peninsula	-	-	1*	45.5
<i>Pandanus</i> slopes	-	-	2.5	47.5
Southern peninsula	0.8	0.0	2.5	38.5
Summit	-	-	0*	35.5
Valley	-	-	0*	18.0
Western cliffs	-	-	0*	35.0
Ilot Vacoas	-	-	-	49.0
Pigeon House Rock	-	-	-	58.0



Bullock et al 1985  
Bullock 1986  
Arnold & Jones 1994  
Dulloo et al 1996  
Cole 2005

## Skinks and geckos

- Telfair's repeatedly identified for translocation to:
  - Ile aux Aigrettes
  - Gunner's Quoin
    - Cats, mice and rats eradicated 1998
  - Flat Island
    - Need sufficient time for recovery of orange tail skinks
  - Ile Marianne
  - Ile aux Fouquets
    - Management plan for the vulnerable population of lesser night geckos
  - Ile de la Passe



## Skinks and geckos

- Telfair's repeatedly identified for translocation to:
  - Ile aux Aigrettes
  - Gunnar's Quoin
  - Flat Island
  - Ile Marianne
  - Ile aux Fouquets
  - Ile de la Passe
- Habitat currently unsuitable
- Initially more valuable for establishing smaller reptile species



## Skinks and geckos

- Ile aux Aigrettes and Gunnar's Quoin most suitable sites for translocations



## Skinks and geckos

- Re-establishing populations of night geckos:
  - Three *Nactus* species

## Skinks and geckos

- The night geckos:
  - Lesser night gecko, *Nactus coindemirensis*



## Skinks and geckos

- The night geckos:
  - Durrell's night gecko, *Nactus durrelli*



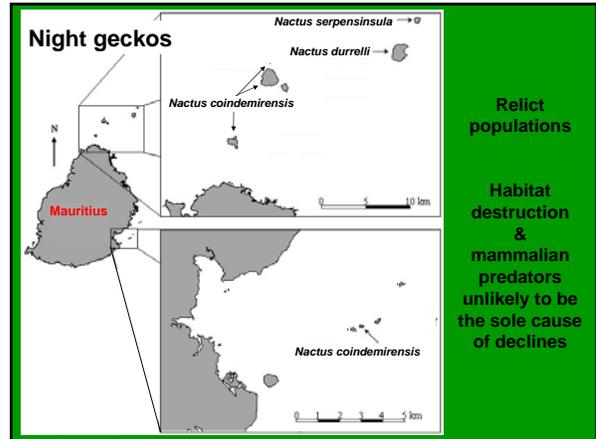
## Skinks and geckos

- The night geckos:
  - Serpent Island night gecko, *Nactus serpensinsula*



## Skinks and geckos

- The most abundant reptiles in pristine Mauritius
- Would have been an important prey item for other reptiles and birds
- Catastrophic reduction in range
- Now extremely fragmented distribution



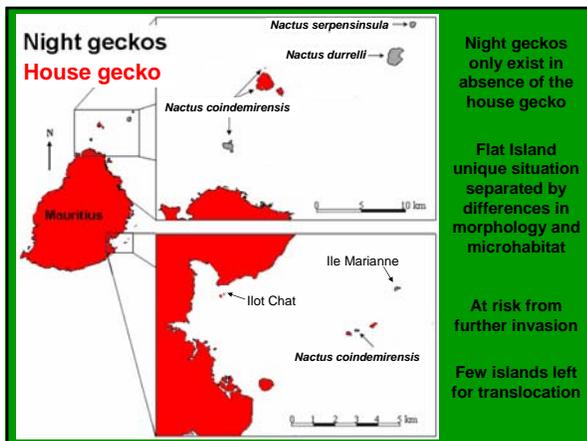
## Skinks and geckos

- Declines attributed to the introduced common house gecko, *Hemidactylus frenatus*



## Skinks and geckos

- Comparisons of habitat, diet and temporal activity:
  - Ecologically very similar to all night geckos
  - Competition for:
    - Refugia
    - Microhabitats based on thermal properties
    - Invertebrate prey
- Enclosure experiments
  - excluded the night geckos from refugia
  - attacked and predated the night geckos
- Responsible for the exclusion of night geckos



## Skinks and geckos

- Beneficial to translocate night gecko species to the same island
- Lesser night gecko would have existed with the ancestor of the larger two night geckos
- The ancestor was most similar to Durrell's night gecko

## Skins and geckos

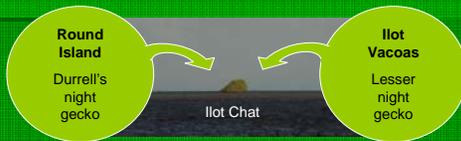
- Comparisons of habitat, diet and temporal activity
- Partitioning of these niches between the species }
  - past competition
  - past co-existence
- Serpent Island and Durrell's night geckos
  - Very little partitioning
  - Differences - 10,000 yrs of isolation on different islands
- Lesser night gecko and the larger night geckos
  - Partitioning of habitat and diet based on size
  - Evidence of past competition and thus co-existence
  - Could they co-exist today?

## Skins and geckos

- Enclosure experiments demonstrated:
  - The lesser and Durrell's night gecko did not compete
  - Had no impact upon one another
  - Experiment too short to demonstrate that competition may have been acting over a longer period
- Need to investigate the long term co-existence
- Ilot Chat is ideal for trial translocation of the two night geckos and test co-existence

## Skins and geckos

- Ilot Chat
  - No introduced competitors or predators
  - Suitable habitat and prey abundance
  - Small (0.036 ha) easily controlled and monitored



## The Darwin Initiative project



- Three decades of work to get to this stage
- An opportunity to take island restoration one step further

- DWCT years of translocation experience
  - Mark Stanley-Price – IUCN guidelines
- Support of numerous international experts:
  - Dr Nick Arnold, Dr Jeremy Austin, Anthony Cheke, Prof. Steven Harris, Dr Gordon Rodda, Dr Thomas Fritts, Dr Gerald Kuchling, Dr Julian Pender-Hume

## The Darwin Initiative project



- Purpose:
  - The re-establishment of sustainable reptile communities
  - Secure future reptile populations
  - Restore functional island ecosystems

## The Darwin Initiative project



- Outputs:
  - The establishment of
    - Telfair's on Gunner's Quoin & Ile aux Aigrettes
    - Bojer's on Ile aux Fouquets
    - Night geckos on Ilot Chat
  - Training of MWF and NPCS
    - Herpetological conservation
    - Island Species-Led Action course
  - To build capacity for further translocations
  - Obtain greater public awareness of biodiversity issues and the work by MWF and NPCS

## The Darwin Initiative project



- Seasonal Monitoring:
- Translocated and donor populations
  - Comparing:
    - Diet
    - Microhabitat use
    - Health
- Translocated populations
  - Survival and recruitment
  - Dispersal and home range



## The Darwin Initiative project



- Seasonal Monitoring:
- Resident vertebrate populations
  - Impact upon native and non-native species
- Invertebrate abundance
  - Comparison of prey selection between translocated and donor populations



## Project protocol and timetable

- Preliminary timetable:
  - July-September 2006
    - Set up transects and survey populations
  - October 2006
    - Translocate 80 night geckos to Ilot Chat (0.036ha)
    - 30 Telfair's to the aviaries for screening
  - December 2006
    - Release the 30 Telfair's on Ile aux Aigrettes

## Project protocol and timetable

- Preliminary timetable:
    - January 2007
      - 1<sup>st</sup> Bojer's translocation 10-20 to Ile aux Fouquets (2.5ha)
    - February 2007
      - Telfair's translocation 220 to Ile aux Aigrettes (26ha) and 250 to Gunners Quoin (76ha)
    - February/March 07/08/09
    - June/July 07/08
    - October/November 07/08
- } Monitoring of resident vertebrates & invertebrates, translocated & donor populations

