Mauritian Wildlife Foundation
Olive White-Eye Recovery Program
Annual Report 2008-09

Mauritius Olive White-Eye chicks 'Zissou' and 'Shamrock', Ile aux Aigrette
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Summary

The overall aim of the Mauritius Olive white-eye *Zosterops chloronothos* project is to reduce the risk of extinction of this critically endangered passerine. Intensive management and the creation of an insurance population on Ile aux Aigrettes will enable us to broaden our understanding and working knowledge of the species and ultimately devise a long-term management strategy.

This season (April 2008 to March 2009) the Olive white-eye team aimed to continue intensive management of the wild upland population at Combo (Black River Gorges National Park) by finding as many nests as possible and rescuing nests which are at high risk of predation, artificially incubating eggs, rearing chicks (Gerald Durrell Endemic Wildlife Sanctuary) and releasing these birds onto Ile aux Aigrettes. Close monitoring of the Ile aux Aigrettes population continued.

Eleven pairs of Olive White-eye were closely monitored this season at Combo. One new pair was found though one was no longer present therefore the total remained consistent with last season. An additional 11 suspected pairs were observed this season though no breeding activity was seen. Twenty-two nesting attempts were found and monitored. Three chicks fledged from and a further nine juveniles were confirmed from nests that were not found. Three of the wild clutches were rescued providing six eggs for artificial incubation.

One Olive White-eye was successfully hand reared at GDEWS from the three nests rescued. No nests were rescued from Ile aux Aigrette during this season. All of the eggs rescued were fertile, Five eggs hatched and one chick was successfully reared to independence.

Following the success of the past two seasons releases were reduced this season. One bird rescued and hand reared this season was successfully released. The habituation techniques were modified to accommodate for only one fledgling. The overall release was a success.

Supplementary feeding techniques remained the same this season though adaptations were made to the feeding station design in order to eliminate unwanted species. There are now eight feeding stations located across the island designed to accommodate pairs that have established territories.

There were six breeding pairs of Olive white-eye on Ile aux Aigrettes this season. Forty seven nests were monitored between September 2008 and February 2009. Out of these nineteen reached clutch stage, seven reached brood and three successfully fledged five chicks. These are the first Olive White-eye chicks to fledge on Ile aux Aigrettes. No nest management was carried out on Olive White-eye nests this season. Attempts were made to increase invert availability to parenting birds using fruit fly cultures and a nesting camera was setup on selected nests to monitor provisioning rates and depredation.

The objectives for the 2009/10 season will be to continue monitoring and intensive management of the wild population at Combo aiming at increasing the genetic diversity in the Ile aux Aigrettes released population. Further establish the population on Ile aux Aigrettes with releases and expand on our current knowledge of this species' breeding biology to refine future management techniques. Close monitoring of the population on Ile aux Aigrettes and the provision of supplementary food will continue and intensive management of nesting attempts, where possible, will be applied.

Part One

Introduction

Mauritius Olive White-eye 'Pepito'
Photo: Gwen Maggs

Introduction

Mauritius is a small (1865km^2) island located in the Indian Ocean, approximately 890 km east of Madagascar. It is one of three main islands comprising the Mascarene archipelago, the others being Reunion and Rodrigues. Mauritius is thought to be the oldest of the Mascarene Islands, with the oldest lava flows being around 7.8 million years old (McDougall & Chamalaun, 1969).

The Mascarenes have never been connected to a continental landmass and this isolation allowed some of the richest and most extraordinary ecosystems to evolve. Since the first colonization by humans in the 17th Century, the native flora and fauna has been devastated by the effects of forest clearance, hunting and the introduction of exotic species (Cheke 1987a). Animals such as dodos, giant reptiles and flightless parrots were unable to adapt to the invasions and soon became extinct.

Only 5% of Mauritius is covered by native forest, mostly within the southwest (Safford 1997a), and even the best-preserved forest is degraded by exotic invasive species such as Chinese Guava *Psidium cattleianum* (Lorence & Sussman, 1986). Depredation by introduced mammals such as rats *Rattus rattus* and *R. norvengicus*, cats *Felis domesticus*, mongoose *Herpestes javanicus* and Crab-eating macaques *Macaca fascicularis* has also contributed towards the extinction of most of the Mauritian fauna and continues to be a limiting factor. Eleven of the native land-birds have survived extinction. The Mauritius Kestrel *Falco punctatus*, Pink Pigeon *Nesoenas mayeri* and the Echo Parakeet *Psittacula eques* have all recovered from below 20 individuals due to intensive conservation efforts (Jones *et al.*, 1994, Swinnerton 2001, Malham *et al.*, 2005). The Mascarene Martin *Phedina borbonica* and Mascarene Swiftlet *Collocalia francica* are not endemic to Mauritius or threatened with extinction globally. The remaining six endemic bird species are all forest-living passerines and are described below:

Mauritius Cuckoo-shrike *Coracina typica*

The Cuckoo-shrike is the only endangered passerine regularly found in the best-preserved native forest around Brise Fer. The population was estimated at 210-220 in 1974-75 (Cheke, 1987b), but had risen to 260 pairs in 1989-93 (Safford 1997b). The range of the Cuckoo-shrike is expanding into the lowlands and the subsequent rise in numbers means the population may now be as high as 600-700 birds (Switzer *et al.*, 2003). This species is currently listed as Vulnerable (Birdlife International, 2004).

The Cuckoo-shrike eats large arthropods and geckos (Safford & Beaumont, 1996), although the depredation of a Pink Pigeon nest (McKelvey, 1977) and fruit feeding (Cheke, 1987b) has been reported. Past declines have been linked to organochlorine pesticides (Safford and Jones, 1997) as well as predation by introduced mammals and habitat destruction.

The Cuckoo-shrike is not seen as a priority species as numbers seem to be slowly rising. It was last surveyed nearly 15 years ago and a new census would confirm the increase in numbers and range. A translocation to the Bambous Mountains in the east, where this species has not been seen since the 1930s, has been proposed (Safford, 1994). It is unlikely that any translocation project will be carried out in the near future as our focus for the moment is on the more threatened species.

Mauritius Black Bulbul or Merle *Hypsipetes olivaceus*

The Merle is distributed throughout the south of Mauritius with small numbers scattered over the central and southern plateau (Safford, 1997b). The density is generally very low even in areas where Merles are commonly found, such as the southwest and the Bambous Mountains in the east. The population was estimated at 280 pairs in 1989-93 (Safford, 1997b) from the 500 estimated birds in 1974-75 (Cheke, 1987b) and is currently listed as Vulnerable (IUCN, 2006). Threats include competition from introduced Red-whiskered Bulbuls *Pycnonotus jocosus* and Common Mynahs *Acridotheres tristis* as well as nest predation and habitat destruction. Casual observations by fieldworkers suggest the population and range of the Merle has remained stable since it was last surveyed in 1989-93 (Safford, 1994), however a new survey is required to confirm this.

Merles were originally thought to be frugivorous but Cheke (1987b) saw more feeding on animal matter, largely insects and geckos. They also eat flowers (Cheke, 1987b) and have been seen taking nectar from introduced bottlebrush *Callistemon citrinus* flowers (Cristinacce, 2004). They have recently been confirmed as predators of Grey White-eye and Mascarene Paradise Flycatcher nests (Hove-Sorenson, 2005 and Dave Wills, *pers. comm.*).

Mascarene Paradise Flycatcher *Terpsiphone bourbonnensis desolata*

Mauritius has an endemic subspecies of the Mascarene Paradise Flycatcher. The other subspecies is common in Réunion. Flycatchers were once widespread on Mauritius (Cheke 1987b) and are now found in scattered localities throughout the island. There are two main sub-populations located in the National Park in the southwest and at a forestry plantation at Bras d'Eau in the northeast. Other sub-populations may exist in valleys throughout the south (Safford, 1997b). The total population was estimated at a maximum of 250 birds in 1974 (Cheke, 1987b) and 100-223 pairs in 1993 (Safford, 1997b). Flycatchers are difficult to locate from a distance so it is hard to give an accurate population estimate.

Flycatchers are currently listed as Vulnerable. There are no immediate plans to work on this species; however any nesting attempts found are monitored.

Mauritius Grey White-Eye or Pic Pic (*Zosterops mauritianus*)

The Grey White-eye *Zosterops mauritianus* is the most abundant of the native forest birds and the only one that is not threatened. The population was estimated at around 34,000-68,000 pairs in 1974-75 (Cheke, 1987b) and has probably stayed at around the same level since then (Safford, 1994). This species has been used in captive care, breeding, nest harvest, artificial incubation and hand rearing practice as a prelude to the intensive management of the Mauritius Olive white-eyes *Zosterops chloronothos* (see Cristinacce *et al*, 2005 and 2006, also Cole *et al*, 2007). This species, although similar to the Mauritius Olive white-eye, appears to have a different social structure and is often found in foraging groups and is found all over Mauritius where there are enough trees and shrubs, but not on any of the offshore islets. A recent study conducted at Bel Ombre showed nesting success was low mainly due to predation by rats, monkeys, Mauritius bulbuls and possibly Red-whiskered bulbuls *Pycnonotus jocosus* and Common mynahs *Acridotheres tristis* (Hove-Sorenson, 2005). The reasons for the Grey White-eye's success compared to other native birds are unknown.

Mauritius Fody (*Foudia rubra*)

The Mauritius Fody *Foudia rubra* has been down listed from Critically Endangered to Endangered this season following the successful intensive management project being carried out. A significant decrease from 247-260 pairs in 1974 (Cheke, 1983) to 93-116 pairs in 2002-03 (Switzer *et al.*, 2003) plus change in distribution prompted the Mauritian Wildlife Foundation (MWF) to initiate a species recovery program in 2002-03. This wild population management was focused on a 6 hectare grove of *Cryptomeria japonica* trees at Pigeon Wood (Black River Gorges National Park) where the highest densities and greatest nesting success was found. Nests of wild pairs were rescued/harvested and the eggs and chicks hand-reared. A captive breeding program was initiated in 2003-04. The overall objective of the initial years' intensive management was to reintroduce the Fody to the predator-free restored offshore islet Ile aux Aigrettes and thus create an insurance population. Hand-reared birds rescued/harvested from wild nests along with captive-bred birds were released onto Ile aux Aigrettes between 2004 and 2006 and the birds began breeding in 2003/04. This management strategy has proved to be very successful. There is a population of around 50 breeding pairs currently on the island, which brings the total population estimate to 143-166 pairs. Ongoing year-round monitoring and provision of supplementary food for the Mauritius Fody on Ile aux Aigrettes ensure that all birds are ringed and survival and productivity are accurately recorded.

The next stage in the Mauritius Fody recovery program is further releases of Fodies to other offshore predator-free islets. Round Island, a protected nature reserve, free from introduced predators and currently undergoing restoration, appears to be the most suitable site for release. A recent feasibility study suggested that Round Island was a suitable site for the Mauritius Fody though no releases are planned in this coming season.

Mauritius Olive white-eye Recovery program:

The Mauritius Olive white-eye is the least known of all the endemic birds and is listed as Critically Endangered (IUCN, 2007). It is the most nectivorous of the native Mauritian passerines and has a long bill, seemingly adapted for nectar feeding, however they also forage for insects and fruit.

Three previous surveys have revealed the species' low numbers, localized range and continued decline. In 1975, Cheke (1987b) estimated the total population at 340-350 pairs, with the majority found in southwest Mauritius and 20 pairs in central Mauritius. By the early 1990s this had fallen to 150 pairs (Safford, 1991), however this estimate was later revised to 200 pairs, with only a few birds seen outside of the southwest of Mauritius (Safford, 1997b). The most recent survey, conducted from 1998 to 2001, showed further declines to 93-148 pairs and a significant range contraction to an area of less than 25 km^2 around Alexandra Falls and Combo (Nichols *et al.*, 2004). The highest densities of this species are found at Combo, where there were estimated to be 26-30 territories in 1998-99 (Nichols, 1999).

Prior to the initiation of a recovery program in 2005 there were only 8 known records of nesting episodes (Safford, 1991; Staub, 1993; Nichols 1999 and 2001). This species is likely to face the same threats as other native birds; degraded habitat, competition from introduced species and nest predation by rats, Crab-eating macaques, Red-whiskered bulbuls, Common mynahs and possibly Mauritian black bulbuls.

Season 2005/06:

A species recovery program was initiated by MWF in 2005/06. The wild population at Combo was closely monitored for the first time since the most recent survey in 2001 to find nesting attempts and collect behavioural observations. A total of nineteen nests were recorded and two of these nests were rescued/harvested. One brood of two chicks and one nest containing two eggs (one of which was infertile) and a one-day-old chick were transferred to the hand-rearing unit at the Gerald Durrell Endemic Wildlife Sanctuary (GDEWS) and all were successfully raised to independence. This was the first attempt at intensive management by bringing birds into captivity. This was also the first time that an Olive white-eye egg had been hatched and the chick successfully hand-reared (Cristinacce *et al.*, 2005). This preliminary work then paved the way for further intensive management in the following three years.

The four birds rescued/harvested in the 2005/06 season were held captive at GDEWS for a year in order to monitor their survival and learn more about the birds and their behaviour in captivity. All four thrived in captivity with no sign of disease and it was accepted that these birds are able to survive in the lowlands. The four captive birds were sexed (by DNA analysis from blood samples) and all were found to be males.

Season 2006/07:

Following the success of the re-introduction of the Mauritius Fody to Ile aux Aigrettes (2003-06), a trial release program was designed to investigate establishing a sub-population of Olive white-eyes on the island. Marooning on offshore predator-free islands has been identified as a strategy for increasing populations of Mauritian bird species (Safford & Jones, 1998). Ile aux Aigrettes offers the best prospects of supporting Olive white-eyes as it is a restored, predator-free, managed nature reserve. It is hoped that this strategy will help ensure the future of the species by creating an insurance sub-population.

In the second season of the recovery program, MWF continued intensive monitoring of the remaining wild population at Combo. Fourteen pairs were closely followed and a total of twenty-three nests were found. Nine nests were rescued producing 8 clutches and one chick for hand rearing.

Subsequent to the successful artificial incubation of a Grey White-eye egg from pre-incubation we were able to rescue Olive white-eye eggs at an earlier stage in incubation. Two of the rescued nests were taken between day 1 and 5 of incubation and the eggs were successfully incubated to hatching and the chicks reared. This is the first time that Olive white-eye eggs have been incubated from day 1 and will enable us to increase productivity in the coming season by further curtailing loss due to predation. A total of 12 chicks were reared to independence.

A trial release of 16 birds to Ile aux Aigrettes was conducted between December 2006 and March 2007. The release group comprised of the 12 birds hand-raised from nests rescued in the 2006/07 season plus the 4 adult males that were rescued the previous season. These birds were released in 5 cohorts of 3-4 individuals from purpose built aviaries located in the centre of the island and following release protocols used in the Mauritius Fody releases (Handschuh, 2004, Cristinacce *et al.,* 2005).

At the end of March 2007 nine birds remained on the island - consistent with survival seen in the first year following initial releases of other species such as the Mauritius Fody (Handschuh, 2004). Supplementary food was provided twice daily inside the release aviary.

Survival was monitored on a daily basis with aviaries and field observations. One pair was identified in February 2007 when one adult male and a juvenile were found nest building; unfortunately both birds were lost from the population when they were found dead from suspected poisoning. Two further pairs were suspected, but both involve juvenile birds and are therefore as yet unconfirmed. The discovery of a nesting pair was interpreted as a positive indication that further releases will succeed in creating a breeding population of Olive white-eye on Ile aux Aigrettes and this was confirmed in the proceeding season.

Season 2007/08:

Given the successes and progress made during the preceding season, the aims for the third season of intensive management were to closely monitor the breeding behaviour of the wild population and harvest/rescue as many nests as possible with view to yielding around 20 birds for release onto Ile aux Aigrette. Also, continue monitoring the released population on Ile aux Aigrette in order to assess productivity and collect behavioural data to enable accurate future management strategies.

During the third season of the project forty-two nesting attempts were found and monitored at Combo. The overall nesting success (including managed nests) was 53%. Twelve of the wild clutches were rescued/harvested, providing twenty five eggs for artificial incubation. Two Grey White-eye *Zosterops mauritianus* clutches were harvested, providing four eggs for artificial incubation and hand rearing training. One nest was also rescued from Ile aux Aigrette. A total of eighteen Olive white-eyes and four Grey White-eyes were successfully hand reared at GDEWS.

Following the trial release of sixteen Olive white-eyes to Ile aux Aigrettes last season (2006/07) further releases were conducted this season. Eighteen birds rescued and hand-reared were released in 8 cohorts between December 2007 and January 2008. The semi-soft release techniques used in the trial release were refined to accommodate the adult birds that have now established territories on Ile aux Aigrettes.

At the end of the 2007/08 season there were 14 Olive White-Eyes on Ile aux Aigrette, two breeding pairs and one nesting pair. Initial observations of newly released birds suggest further suspected pairings. Sixteen nests were found in this season on Ile aux Aigrettes and six clutches were laid. Unfortunately none of the nests successfully fledged.

Aims for Season 2008/09

Given the success and progress made during the preceding season, the aims for the fourth season of intensive management of the Olive white-eye are summarised as follows:

1. Maintain the high level of population monitoring of Olive white-eyes at Combo and search for nesting attempts and new pairs.
2. Rescue nests which are deemed under threat from depredation with view to yielding around 10 birds for release to Ile aux Aigrettes. Nests should preferably be taken at egg stage for artificial incubation.
3. Apply predator control for rats at all nest sites in order to reduce the risk of predation prior to rescue or fledging.
4. Artificially incubate eggs, hatch and hand-rear chicks to independence (GDEWS).

5. Release all wild-rescued, captive-raised Olive white-eye to Ile aux Aigrettes with the aim of further establishing a population on the islet.
6. Provide supplementary food for the Ile aux Aigrettes population and monitor survival of released birds.
7. Monitor breeding activity of suspected pairs of Olive white-eye on Ile aux Aigrettes. Closely observe any nests found to assess productivity and the possible need for nest management.
8. Collect behavioural data and study released birds on Ile aux Aigrettes to increase knowledge for accurate future management strategies.
9. Establish Fruit Fly Cultures on Ile aux Aigrette to increase invert populations and availability to brooding pairs
10. Use nesting cameras in order to establish provisioning rates of chicks or causes of failure

This report discusses in detail each of the above aims and is divided into sections that represent each stage of the recovery program.

Part Two

Intensive Management of Mauritius Olive White-Eyes Combo

Anna Reuleaux lowering Olive White-Eye nest, Combo
Photo: Rachel Tucker

Gwen Maggs, Rachel Tucker, Julie Cole, Kimberley Dawson, Walter Mangroo, Sandra Poongavanan

Introduction

The Mauritius Olive white-eye is a small (8-10 cm) forest-dwelling passerine. It is generally olive green-grey in colour, with hints of rich green on the tail, back and primary wing feathers, a pale breast and underbelly and sulphur yellow feathers around the vent. The most distinguishing features are a white eye-ring and long, fine, curved bill. Males and females show no signs of sexual dimorphism.

Field observations and population monitoring in recent years suggests that this species mainly utilises middle to upper dense canopy, in habitat where the non-native wet upland invasive *Syzygium jambos* is the dominant tree species, however clearings such as grassy meadows also appear as a common feature near to or within territories. They exist in what appears to be seasonally monogamous pairs and maintain exclusive territories that are aggressively defended by both birds.

The most recent passerine survey (1998-2001) estimated the population of Olive white-eyes to be as few as 93-148 pairs and also highlighted a significant range contraction to an area of less than 25 km^2 around Alexandra Falls and Combo (Nichols *et al.*, 2004), located in the southwest of the Black River National Park (Figure 2.1).

The greatest densities of Olive white-eyes are found at Combo and this location was therefore chosen as the site to begin applying intensive management efforts. The Combo region also supports populations of Mauritius Cuckoo-shrike, Black bulbul, Grey white-eye, Paradise-flycatcher and a supplementary fed sub-population of Pink Pigeons. The Mauritian National Parks and Conservation Service have a permanent field station at Combo, from which Mauritian Wildlife Foundation (MWF) staff work. Ongoing predator control in the form of a live-trap circuit and a rat poison grid are maintained to target rats, cats and mongooses.

This report describes the aims, outcomes and methods used throughout the 2008/09 breeding season and the advances made in understanding the species.

A note on terms used for rescuing or harvesting nests

The use of the words 'rescue' and 'harvest' with respect to the practice of removing a nest from the wild in order to artificially incubate or hand-rear the clutch or brood can be confusing. The term 'rescue' is applied when the nest is removed as a direct result of an observed risk to the nesting attempt such as a known predator seen at the nest, if the nest is going to fall from the tree or if the parent birds fail to incubate or feed chicks adequately. 'Harvest' is used more passively, when the nest is removed for management purposes, such as to yield birds for a release or to bring into captivity. A problem arises when a nest is removed from the wild due to a *perceived* risk of failure rather than an actual risk. In this case, although the species in question is critically endangered and therefore in need of management and there are known to be predatory species within the immediate area of the nest, if it is removed then the true outcome is never known. Once a nest is removed, of course the natural fate of the nest will not be known and in this case neither term can be accurately used to describe the event. This report therefore uses both terms when neither can be applied individually with certainty. This season we plan to focus more on rescuing nests rather than harvesting though due to reasons explained previously it is impossible to determine the outcome of the nest and therefore this term is used with an underline assumption of possible future outcomes.

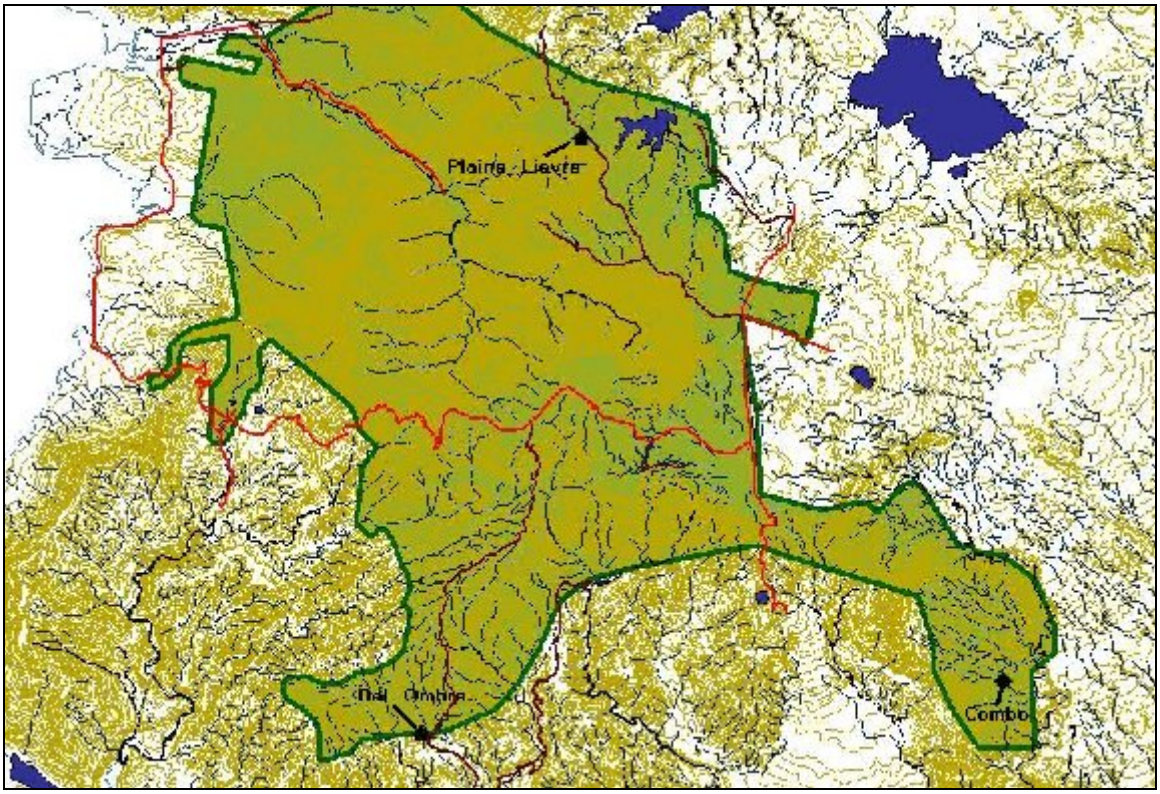

Figure 2.1 Map showing Black River National Park Boundary and the location of the Combo field site

Summary of previous season's Intensive Management

In 2005/06 a MWF field team began intensive management of Olive white-eyes at Combo. Twelve wild pairs were closely monitored and nineteen nest attempts were discovered. Of these, two nests were rescued/harvested in order to investigate *ex situ* management. The rescue, transfer and captive-rearing methods already used on the Mauritius Fody recovery program and trialed on the Grey white-eye were modified for use on Olive white-eyes. This initial year in the recovery programme assessed the feasibility of applying intensive management methods to the Olive white-eye and ultimately proved successful.

With this impetus the 2006/07 season's aim was to rescue/harvest enough wild nests to provide approximately fifteen birds for trial release to Ile aux Aigrettes. Nest finding was focused on the previously identified and well known pairs with emphasis on finding as many nests as possible to refine monitoring and management techniques.

Thirteen pairs were closely monitored and a total of twenty-three nesting attempts were found (nests that abandoned before clutch are included in this figure). The main aim was achieved with nine nests rescued/harvested, yielding twelve fledglings for the trial release. Efforts to rescue/harvest nests during incubation proved fruitful; eight of the rescued/harvested nests were clutches and all of these produced chicks for hand-rearing. Rescuing/harvesting wild nests during incubation not only reduces the exposure risk to predation compared to rescuing/harvesting chicks, but encourages the adult birds to recycle sooner thus increasing the overall productivity of the managed population.

Following the success of the 2006/07 season intensive rescuing/harvesting was continued into the 2007/08 season. Eleven pairs were monitored closely and a total of 42 nests were found. Out of these 12 nests were rescued/harvested for hand rearing. From the nests rescued/harvested 18 fledglings were reared to independence for release onto Ile aux Aigrette.

Rat predation was highlighted as one of the most apparent limiting factors during the 2005/06 season and so direct predator control was applied at all nest sites throughout the 2006/07 and 2007/08 breeding seasons. The quantity of rats caught, in particular the more arboreal Black rat *R.rattus*, suggested a high density within breeding pair territories. It is likely that this predator control conferred sufficient protection to enable a greater number of nests to reach a stage at which they could be rescued/harvested. However it is difficult to prove this effect due to the many confounding factors affecting breeding success in the wild.

Aims and Objectives for 2008/09

The main objective of this season's work at Combo was to locate and monitor breeding pairs of Mauritius Olive white-eye, with a focus on nest finding and rescuing threatened nests wherever possible. With the hand rearing team now competent at artificial incubation of eggs from early stage and hand-rearing chicks, we aimed to take all nests, where possible, during incubation rather than at chick stage in order to further reduce losses due to predation and shorten the recycle period, with the effect of increasing overall productivity. Our ultimate aim was to rescue/harvest enough nests to provide us with around 10 birds for release to Ile aux Aigrettes, a reduced number compared with the previous season. The reason for the reduction in rescuing/harvesting is due to the lower breeding productivity seen in the released population during the 2007/08 season. As a precaution the amount of birds released will be reduced incase Ile aux Aigrette is found to be unsuitable. Close monitoring on Ile aux Aigrette this season will aim to determine this for future management. Although primarily focusing on known pairs for nest rescue/harvest, we also aimed to investigate further areas at Combo and attempt to identify new pairings and expand on our knowledge of the wild population in this region of the national park. Predator (rat) control was applied to all nesting attempts that reached incubation. The field team also collected data on feeding habits in order to investigate the dietary requirements and possible environmental cues that control the breeding activity of this species.

The 2008/09 Field Season

A team of 1-3 staff were based at Combo between 11th August 2008 and 6th March 2009. The field team worked 6 days a week. Additional members of MWF staff, Anna Reuleaux and Heather Richards, as experienced tree climbers, accessed all nests for rescue/harvest, but were not part of the day-to-day monitoring team. Staff from other projects often assisted the Olive white-eye team for nest rescues/harvests. All core field staff underwent initial training upon arrival and were supervised by the project coordinator throughout the season.

The field season began approximately a month earlier to that of the previous year. Birds were thought to begin breeding early August however a fledgling was discovered with a pair shortly after arriving at Combo, suggesting that the population started breeding or exhibiting nesting behaviour in early July. Little is known about the environmental factors that could act as cues for breeding in Olive white-eyes, however, in comparison with the 2007/08 data, the birds began breeding approximately one month earlier and finished approximately two months later in the 2008/09 season. Nesting activity began to tail off in January, with the onset of the wet season and the last nesting attempt was found on the 13th February 2009. The monthly nest summary for 2008/09 (Table 2.1) reflects breeding activity throughout the season.

Table 2.1 Monthly nest summary of Mauritius Olive White-Eye nests found at Combo in the 2008/09 season

Month	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Total Nests Monitored	**5**	**8**	**5**	**5**	**5**	**7**	**4**	**1**
Continuing from previous month	0	5	3	2	2	3	2	1
New Nests Found	5	3	2	3	3	4	2	0
Successful Nests	**0**	**1**	**0**	**3**	**2**	**0**	**0**	**0**
Rescued/Harvested	0	0	0	1	2	0	0	0
Fledged (number of fledglings)	0	1(1)	0	2(4)	0	0	0	0
Nests Failed	**0**	**4**	**3**	**0**	**0**	**5**	**3**	**1**
Abandoned before completion	0	1	2	0	0	2	1	0
Abandoned after completion	0	1	0	0	0	0	0	0
Failed during Incubation	0	0	1	0	0	3	1	0
Failed during Brood	0	2	0	0	0	0	1	1
Nests ongoing to next month	**5**	**3**	**2**	**2**	**3**	**2**	**1**	**0**

Intensive Monitoring and Management Methods

Nest finding

Nesting episodes are located by close observation of birds' behaviour. Increased territoriality and aggression towards other bird species, in particular Grey white-eyes, Paradise-flycatchers and Red-whiskered bulbuls is often a precursor to nest prospecting and building. Materials used in initial stages of nest building include spider's web, fine moss and filaments usually found on understorey shrubs. Latter stage nest building involves the addition of grass, palm fibres and feathers to form the inner cup. Both birds are involved in the nest building process and generally follow a distinct pattern of activity around the nest area, they are very vocal and are seen repeatedly collecting nest material and can therefore be followed to the nest. Once a nest has reached incubation, the birds behave more erratically around the territory and are silent when around the nest which makes nest-finding far more difficult.

Once located, each nest is watched to confirm the stage and the pair. The location of the nest tree is noted along with the height of the nest and tree and a general assessment of the surrounding habitat. Nest observations are taken from ground level and from a suitable distance as so not to disturb the nest or alarm the birds yet still see the nest clearly enough to accurately record the bird's activity. Behaviour of birds is used to determine the stage of the nest and daily watches were conducted for around 30 minutes or until the stage of the nest could be confirmed.

This season a reduced amount of nests were found (22) compared with last season (42). During mid-September a period and heavy torrential rain was experienced, this caused the evacuation of the field station and due to the river flooding at the entrance of the area no searches could be carried out on a majority of the territories. When access was possible following the worst period it was extremely difficult to see and hear the Olive White-Eyes. Following this few nests could be found for around one month to the frustration of the field staff. During the beginning of November the quiet behaviour of the Olive White-Eyes was explained when within two weeks 5 pairs were found with fledglings. This would indicate that these pairs started nesting during the time access to the Combo was restricted and when accessible again were already at incubation stage so therefore extremely difficult to find. The number of fledglings is very promising for the wild population at Combo, unfortunately it is unknown if the weather conditions may have aided their success.

Incubation

Incubation is confirmed if a bird is seen to sit on the nest for over 10 minutes in a single interval and the pair change-over on the nest. Once the start of incubation is confirmed, the hatch date can be predicted, as incubation is known to be 12-13 days. From this point predator control is applied in the form of rat snap-traps. A grid of 10 traps is set in the immediate vicinity of the nest tree, with a ring of traps beneath the tree itself and other traps at the base of trees whose canopies interlock with that of the nest tree. Traps are baited with a mixture of peanut butter and rolled oats and a polyglass roof-tile cover placed over the trap in order to prevent trapping birds. Traps are checked daily following a nest observation, any dead animals recorded and removed, bait is changed when necessary and all traps set. No further nest protection can be applied as it would risk disturbing the birds.

With this season's objective to rescue nests if deemed at risk of failure, all clutches laid were assessed for predation risk based on surrounding habitat, such as thick canopy or exposed nests, and observations taken during watches. If deemed at risk the nest is then assessed for intensive management. The accessibility of each nest is gauged and if accessible, the method of nest rescue/harvest is devised to take into account any equipment or extra staff needed. If the nest is inaccessible or where attempts to access would risk the safety of the climber or the clutch then no further management is applied, however daily observations and predator control continues.

This season we aimed to rescue a maximum of 6 nests at incubation as taking nests as early as possible reduces the exposure to failure. Pairs with a previous history of repeated failure were highlighted as having a higher risk to failure. In this case the clutch was rescued at approximately day 5, which allows a sufficient period of natural incubation to confer higher fitness to the chick(s). All nests this season were rescued during incubation. They were from high risk pairs and therefore rescued at approximately day 5.

The Rescue/Harvest Procedure

The following procedure for nest rescue/harvest was developed based on the similar techniques used for the Mauritius Fody harvests (see Cristinacce *et al.*, 2006) and adapted to fit the smaller, open-cup nests of Olive white-eyes and the smaller, more fragile eggs.

The portable incubator (Figure 2.2) is set up the day before the rescue/harvest to transport the eggs to the hand-rearing unit at GDEWS. The inside of the incubator plus all the plastic trays are cleaned with Virkon virucidal disinfectant and dried thoroughly. One

plastic tray within the incubator is lined with dry clean sponge with three indents cut to fit Olive white-eye eggs. Alongside the egg indents is a thermometer which is used to accurately measure the temperature and also as a back-up in the event of a power failure, which would render the digital thermometer inoperable. In a second plastic tray is a sponge soaked in F10 disinfectant solution (1ml of F10 : 125ml deionised H_2O), that maintains humidity and a clean environment within the incubator. Once cleaned and set up the incubator is run via the 12volt output in the 4WD vehicle and the temperature set at 37°C. The internal thermometer is used to calibrate the digital thermostat. The incubator is always warmed 30 minutes before the rescue/harvest.

The rescue/harvest is conducted in the morning and in fair weather conditions. All nests are accessed and removed from the nest tree by an experienced climber(s). The nest is cut from the tree, transferred to a foam-lined container and the eggs are covered with tissue paper to stop them knocking together. The container is then placed in a cotton bag and slowly lowered to staff at ground level. From here the nest is carried, still in the container and bag to the waiting 4WD vehicle. In cases where the vehicle is more than a 5 minute walk away, a disinfected, pre-warmed, foam-lined thermos flask is used to transfer the eggs to the vehicle.

Once at the vehicle the eggs are carefully removed from the nest and transferred to the incubator. The incubator is held by a passenger throughout transport to the hand rearing unit at the Gerald Durrell Endemic Wildlife Sanctuary (GDEWS) and often carried when the track is particularly bumpy to avoid knocks and shakes that could damage embryos.

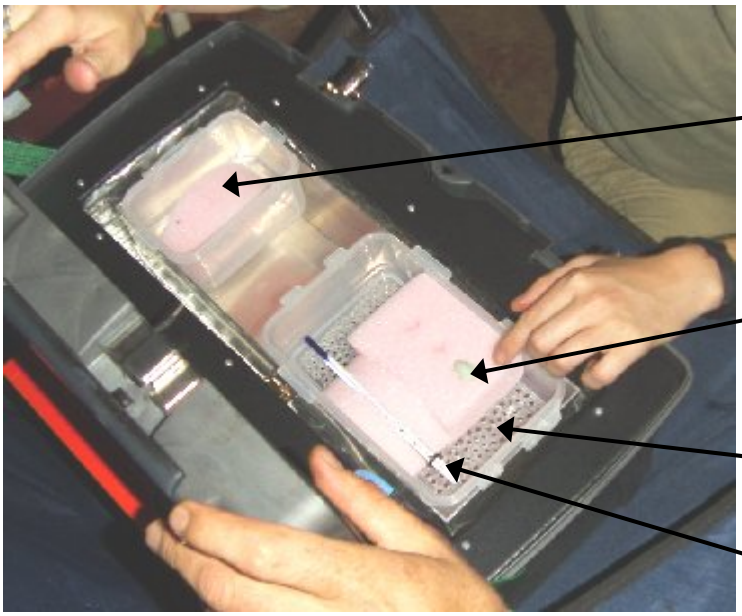

Figure 2.2 The portable incubator set up for transferring Olive white-eye eggs from Combo to GDEWS (Photo: Denise McGowan)

Brood and fledgling

In cases where the start of incubation cannot be accurately predicted, the nest is not rescued/harvested at clutch stage as there is chance the eggs could be rescued during hatch or young chicks - this is a particularly sensitive period and would no doubt jeopardise their survival. It is difficult to confirm day of hatch as the parents will brood young chicks in a similar pattern to incubation and feeding is very swift and often missed. It is possible to age nestlings when they are seen begging, however accuracy depends on how easily the nest can be observed. Once the parent birds are seen feeding chicks, the nest if accessible, can be rescued/harvested following the procedures used for chick transfers in 2006/07 (see Cristinacce *et al,* 2006 and Cole *et al* 2007). At the beginning of the season a rescue was planned for nest ZC09COM02 as Mauritius Black Bulbuls and Indian Mynar birds were seen around the nest. Unfortunately due to the shortage of incubating equipment in the hand rearing unit at GDEWS we were unable to rescue the clutch at incubation. As an alternative it was planned to rescue the nest at Brood. The nest reached chick stage but unfortunately failed before the rescue could take place.

Inaccessible nests at brood stage are observed daily until either failure or the chicks fledge.

Nest Outcomes

Nest outcomes were categorised as follows:

Abandoned before completion – the pair cease visiting the nest prior to completion. The nest is not finished and no eggs are laid.

Abandoned after completion – the nest is completed, with the birds seen taking lining material to the nest, however incubation is not observed and the birds cease visiting the nest.

Destroyed before incubation – where the nest is destroyed by a predator (usually monkeys), however incubation has never been observed. The nest appears torn apart. This term is not applied if the nest is blown from the tree following abandonment.

Failed during Incubation – if incubation is not seen for at least an hour of nest observation. '*Depredated'* is added if depredation is seen, it is not writen unless the eggs are seen being physically taken from the nest by a bird, rat etc. If not seen it can cause inaccurate and presumed outcomes.

Failed during brood – if brood or feeding is not observed for at least an hour of nest observation and no fledglings are seen. *'Depredated'* is added if the chicks are seen being physically taken from the nest. If not seen it can cause inaccurate and presumed outcomes.

Fledged – the nest is successful and fledglings are seen, off the nest, with the parent birds feeding them. The number of fledglings is recorded.

Rescued/Harvested – the nest has been removed from the wild for intensive management purposes.

In cases of nest failure or abandonment, the nest is watched following suspected failure or if the observer suspects the nest may not have finished for a further two weeks. This is to ensure the nest has defiantly been abandoned or has failed. It has been known for nest watches to cease and those nests to still be active. If another nest is found for the pair watches are then stopped and the outcome noted. Pairs that have abandoned/failed or have

had a nest rescued/harvested are targeted for early morning observation as pairs can recycle and begin nest prospecting or even building as early as the following day.

2008/09 Season - Results

Pairs

Eleven breeding pairs of Olive white-eye were closely monitored this season we confirmed an additional pair but an old pair is no longer in its territory so the total number has remained the same. GPS waypoints taken at observed territory limits were used to create a territory map for the breeding pairs (Figure 2.3). Points were also taken for another eleven suspected pairs, whose breeding status was not confirmed (Figure 2.4). The average territory size was found to be 0.44 hectares (STDEV=0.22, n=11). The average size in 2007/08 season was 0.57 hectares, the size has dropped slightly though no obvious changes have been seen in the territory formation and habitat selection when looking at the bird behaviour at Combo. There are no clear signs to indicate a cause for a territory size decrease. When including the suspected pairs, the total possible number of known territories at Combo is Twenty-two.

During this season we have recorded sightings of pairs and individuals outside of the Combo area (Figure 2.4). There have been sightings at Pigeon Wood and also in the middle of the Sugar Cane and Tea fields. The forest at Pigeon Wood is very different to that of Combo. The Pigeon Wood forest is dominated by *Cryptomeria japonica* and *Pinus ellioti*. Olive White-Eye's have been recorded here during the breeding season but mainly out of breeding season (pers ob, Lucy Garrett). This season a group of three Olive White-Eyes were observed. Based on the behavioural knowledge of this passerine this would indicate a pair and fledgling. The possibility of breeding pairs in Pigeon Wood is likely though further observations would be needed to confirm this. Another possibility could be that the Combo population disperses towards Pigeon Wood during the non-breeding season resulting in the increase in sightings and sightings of more than one individual. This season is the first season where Olive White-Eye pairs have been found outside of the National Park breeching into commercially cultivated areas (CCA). Pairs have been monitored on the outskirts of the National Park for the past two seasons, such as Meadow Pair, though they have not been observed flying into the CCA. In-between the Sugar Cane and Tea fields are pockets of forest. This is not native forest but does resemble that of the Combo habitat. We have had two definite sightings of Olive White-Eye pairs, Sugar Cane pair ~2.6km from Combo field station and Tea Pair ~3.7km. This is much further than the pairs which are usually monitored which lie between 0.1-1.3km. It is extremely encouraging for the population that pairs can be found in such degraded habitat and could indicate that the Combo population is dispersing out of the Combo area. Close monitoring of these pairs will be carried out to observe their breeding success and behaviours in the different habitat.

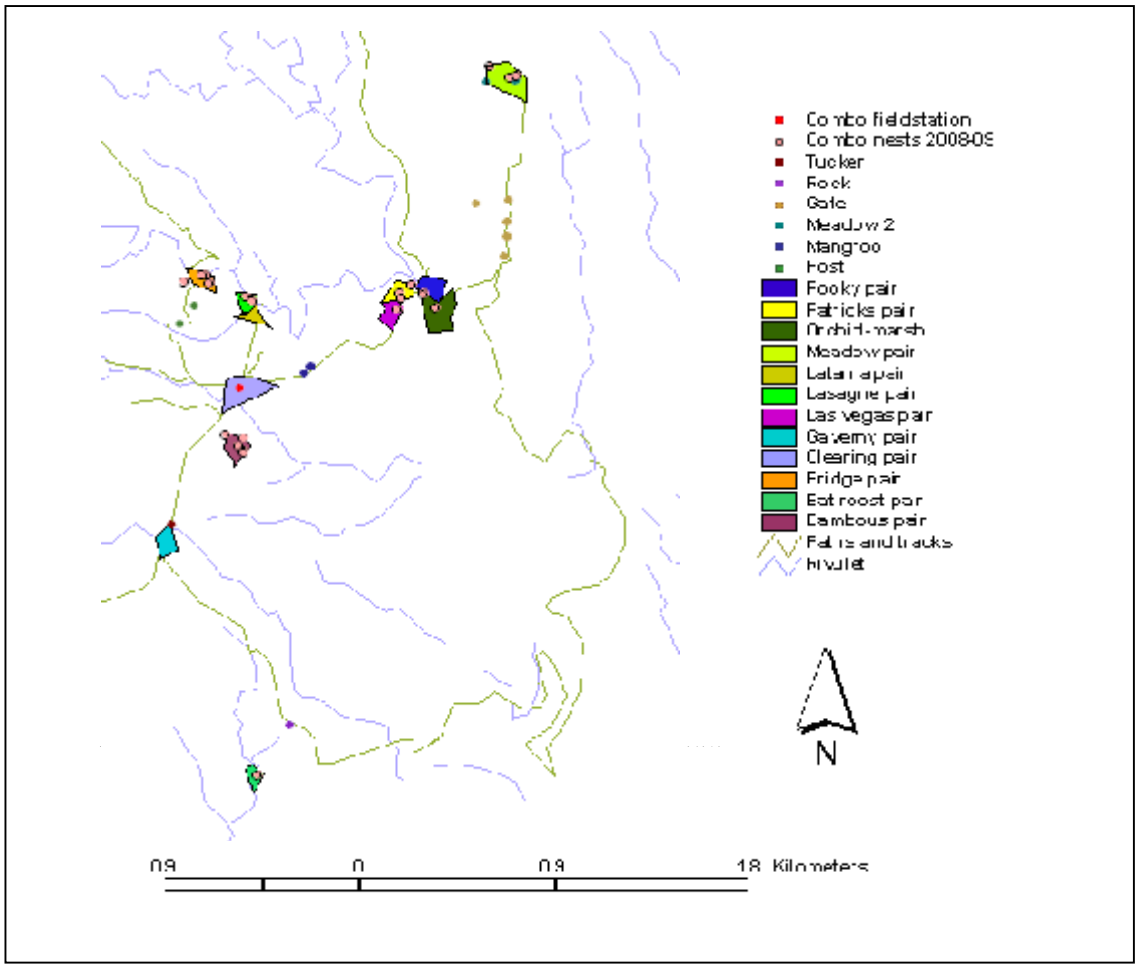

Figure 2.3 Olive white-eye territories monitored at Combo during the 2008/09 season. Colour blocks show mapped territories, with points indicating single sightings, known nest sites and landmarks.

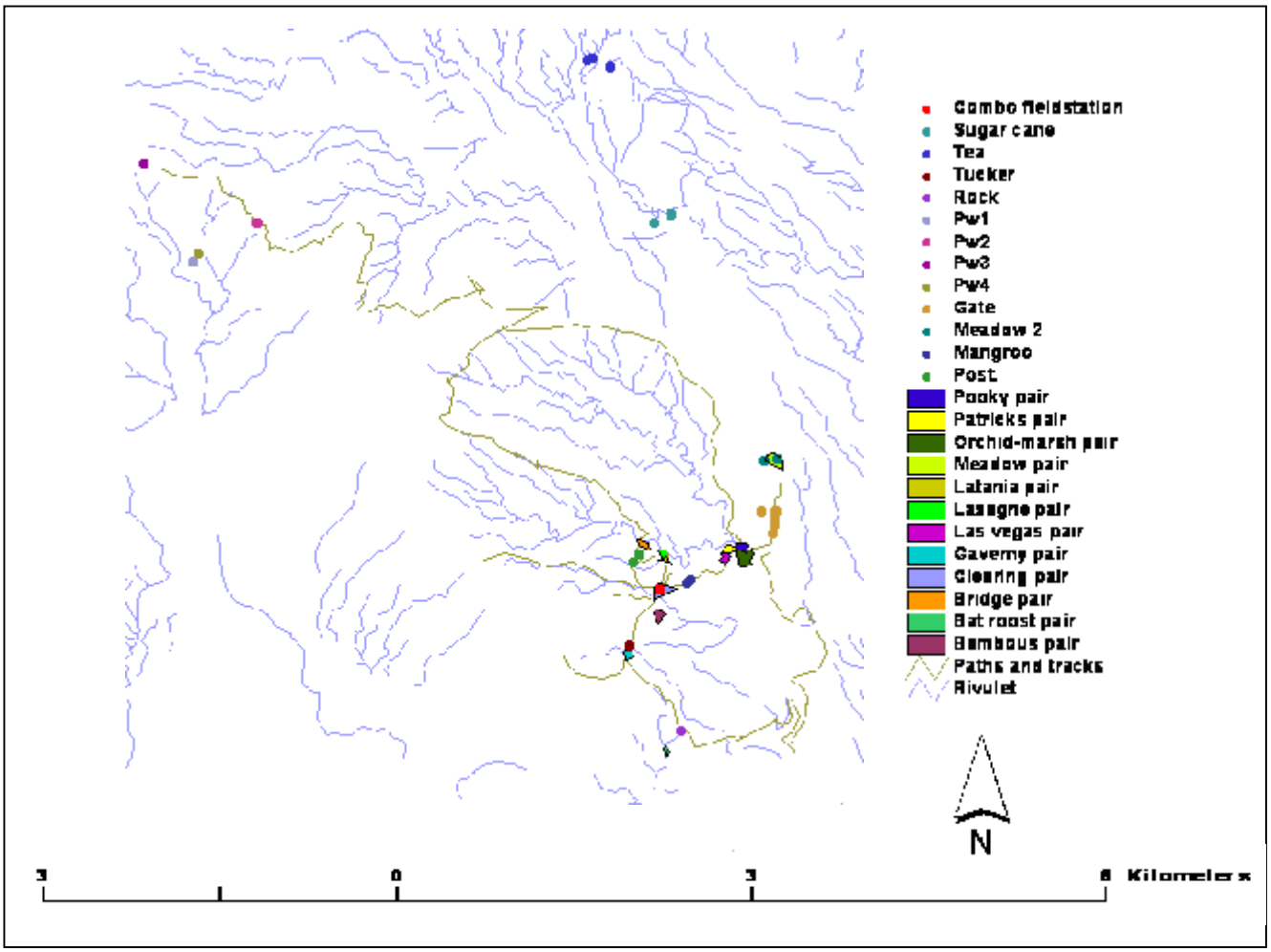

Figure 2.4 Olive white-eye territories monitored at Combo during the 2008/09 season. Colour blocks show mapped territories, with points indicating single sightings, suspected pairs and landmarks

Nesting Success

A total of Twenty-two nests were found from nine of the pairs monitored. Fourteen of the nests found reached incubation stage. Tables 2.1, 2.2 and 2.3 present the outcomes of all Olive white-eye nests that were discovered this season and Appendix 1a-c gives details of all nests found.

Of the total number of nests found this season, seven were abandoned (one after completion and six prior to completion) and fifteen proceeded to clutch stage. Of the fifteen clutches laid only five were accessible. Three were rescued, one failed and one could not be rescued due to weather conditions though proceeded to fledge. Two nests were inaccessible one of which proceeded to fledge and the other failed at brood. Of the eight remaining nests one failed before it could be rescued (due to the shortage of incubating equipment at GDEWS), one was found at day 14 and fledged the following day, and the remaining six were found too late in the season for intensive management to be applied.

Table 2.2 Summary of all Olive white-eye nests rescued/harvested from Combo in 2008/09 season and the result following rescue as number of birds reared to independence at GDEWS.

Nest Reference	Pair	Date Found	Nest Tree	Start of Incubation	Date Rescued	Clutch Size	Birds Hatched	Birds Fledged
ZC08COM10	MEADOW	29.10.08	*Litsea monopetala*	02/03.11.08	06.11.08	2	2	0
ZC08COM12	MEADOW	21.11.08	*Litsea monopetala*	27.11.08	03.12.08	2	2	0
ZC08COM13	BRIDGE	25.11.08	*Syzygium jambos*	27.11.08	02.03.08	2	1	1

Calculating nesting success of the wild population is difficult when considering natural outcomes and managed nests, because by rescuing/harvesting a nest the chance of its success (that is the nest producing fledged offspring) is greatly increased. Only nesting attempts that proceeded to clutch stage are included in calculating productivity - nests that are abandoned or had no record of incubation (i.e. destroyed nests) are not considered as breeding attempts. Of the fourteen nests which reached incubation Mayfield analysis (Mayfield 1961, 1975) was followed to calculated nesting success. This takes account of the number of failed nests in relation to the exposure time and so can be used for nests that were rescued or found after incubation started. If the rescued/harvested nests could be excluded, however this is not an accurate reflection of the productivity of the wild population. The nesting success of the wild population was 18% for the 2008/09 season. Fertility was high with all the eggs rescued being fertile (100%). The low rate of nesting success indicates the need for management in order to avoid such high levels of failure.

Fledglings and Overall Productivity

Wild fledglings are distinguished from adults by behaviour and appearance. It has been discussed in previous literature that lack of an eye ring may be a good indicator of juvenile birds, but developmental observations during hand-rearing falsified has shown that fledglings gain the eye ring fairly soon after fledging (Cristinacce *et al*., 2006). Although the eye ring appears absent in newly fledged wild birds, a faint eye ring can bee seen with good binoculars after a week of fledging and is a good means of confirming birds of this age. Tail length appears a better indicator as short tails are observed in fledglings that have fully fledged eye rings, though one would have to be careful not to confuse this with a bird that has lost its tail or is in moult. Clumsy flight typical of a juvenile bird and observations of the bird(s) receiving feeds or preening from adult birds can also be used to confirm juvenile status.

Plumage and calls appear the same in juveniles and adults and it is very difficult to distinguish between them two weeks after fledging. Olive white-eye are very defensive of flowering food trees within their territory and will chase other Olives and other species from the tree (*Pers. obs.* Gwen Maggs) and therefore if other birds are tolerated in the same feeding tree as the pair and are seen following the pair between trees then it is likely that they are offspring of that pair.

From the fifteen nests that proceeded to incubation, discounting the three that were rescued, three were successful and produced five fledglings. A further nine fledglings, thought to originate from seven pairs were recorded but nests were not discovered in these cases and so unfortunately this data is not included in the calculation of productivity.

Fifteen wild fledglings were recorded in the 2005/06 season before intensive management began. The lower number of wild fledglings seen in the last two seasons (2006/07 (5) and 2007/08 (9)) may have been as a result of removing nests. Nest management may superficially reduce wild productivity however the fledglings artificially-raised from rescued/harvested nests increases productivity of the population as a whole. In 2007/08 season if the total number of birds is considered (i.e. wild and artificially raised birds) the total production from Combo was twenty-seven. This is more than recorded in any other season. This season there was minimal rescue/harvesting and the number of wild fledglings recorded was twelve, this is similar to that seen prior to intensive management but is still less than half the production of 2007/08 season. This could indicate that intensive management practices used in the past do have a positive effect on the Olive white-eye population when looking at overall survival of clutches and should be considered in future intensive management.

Nest trees and Feeding Observations

The introduced invasive *Syzygium jambos,* a riverside tree species that produces nectar-rich flowers in abundance throughout the breeding season and appears to be the most commonly used nesting tree by Olive white-eyes in Combo (Table 2.3). *S. Jambos* is the dominant species in most of the Olive white-eye territories and is universally present throughout Combo which may explain why there has been a bias towards nests found in this tree species in past seasons. This year although a majority of the nests were found in *S. jambos* a similar amount were found in *Litsea monopetala* (Table 2.3). *L. monopetala* although not as wide spread as *S. jambos* is common in a lot of the Olive White-Eye territories which may also explain the bias to this tree species. It is easier to search *S. jambos* thickets for nests as the understorey tends to be sparse and the canopy is generally lower and areas with *L. monopetala* tend to be meadows so again easier to search. *S. jambos* appears to be a significant food source for Olive white-eyes at Combo (Table 2.4) which may also be a contributing factor to the suspected preference for nesting in this species. Although *L. monopetala* doesn't appear to be a major food source for the Olive White-Eyes they have been seen to defend the trees when there have been no nests within them and the trees are in fruit (*pers.ob* Gwen Maggs) so these may also we a favoured tree species.

Nests in *S. Jambos* have proven easy to rescue/harvest in the past as the branches are very strong and flexible, thus allowing the climber to access nests built in high, spindly canopy as opposed to other non-native species such as *Litsea* sp. which is often dangerous to climb as the branches break easily. Other non-native species that were identified as nest trees this season include *Cinnamonium camphora* (camphor), *Ligustrum robustum* var. *walker* (privet) *Psidium cattleianum* (Guava) and *Michellia champaka*. A fewer amount of nests were found in native species this year (1) than in 2007/08 (9). This season the first cases of *Psidium cattleianum* being used as nesting trees by Olive white-eye were observed. No feeding observations were made in native tree species this season though in past seasons when they have they haven't appeared to be an important food source for the wild Olive white-eyes.

Table 2.3 Fates of Mauritian Olive white-eye nests found at Combo in 2008/09 season, with reference to nest tree.

Outcome	Nest tree species					Total
	Exotic			Native		
	Syzygium jambos	***Litsea sp.***	**Other**	***Warneckea trinervis***	**Other**	
Abandoned before completion	4	0	1	1	0	6
Abandoned after completion	0	0	1	0	0	1
Failed Incubation	2	0	3	0	0	5
Failed Brood	0	3	1	0	0	4
Fledged in wild	1	1	1	0	0	3
Recued/Harvested	1	2	0	0	0	3
Total	8	6	7	1	0	22

Table 2.4 Feeding observations of Olive white-eyes recorded *Ad lib.* at Combo throughout 2008/09 breeding season.

Tree species	Number of Feeding Observations			Total
	Nectar	**Fruit**	**Invertebrate**	
Syzygium jambos	99	0	41	140
Litsea monopetala	2	0	8	10
Rubus alceifolius	8	1	1	10
Michelia champaka	0	0	5	5
Cinnamomum camphora	0	0	1	1
Clidemia hirta	0	0	1	1
Ligustrum robustum	1	0	3	4
Mangifera indica	0	0	4	4
Cordia curassavica	0	0	2	2
Eucalyptus robusta	0	0	1	1
Total	**110**	**1**	**67**	**178**

Predator Control

Two of the main predators affecting nesting success of Olive white-eyes at Combo were identified as Crab-eating Macaques *Macaca fascicularis* and Rats *Rattus* spp (Cristinacce *et al*, 2006). This season, the Mauritius Bulbul *Hypsipetes olivaceus*, Red-whiskered bulbul *Pycnonotus jocosus* and Common mynah *Acridotheres tristis* were identified as highly probable predators of Olive white-eye nests due to frequent sightings of these species at nests that went on to either abandon or fail. The importance of these three bird species with respect to nest survival is not yet clear. There are no known methods of protecting wild nests from these birds, especially considering that the Mauritius Bulbul is endemic. It should also be considered that the actual cause of nest failure is, in most cases unknown. Broken eggshell can be analysed, with larger chewed holes indicating rat predation and punctures indicating bird predation. But shell is not often recovered. Nests that are torn from the tree or pulled apart confirm monkey predation. The only way to truly determine the significance

of each predator species is to fit nest cameras, however this may create too much disturbance for the nesting birds and due to the height of the canopy would require specialised tree climbers.

Olive white-eye nests are usually built in the middle-upper parts of interlocked canopy. This plus the sensitivity of the birds to disturbance around the nest area makes completely predator proofing individual nest sites by isolating trees and attaching plastic rat-guards practically impossible. It is however, possible to apply predator control for rats at ground-level around the nest area. This was first applied in the 2006/07 season and the number of rats trapped indicated that there was a need to continue this control.

Nest building birds are frequently visiting the nest during construction and are more susceptible to disturbance at this time, which increases the chance of abandonment. Therefore, rat control was only applied to nests reaching incubation stage. Once incubation is confirmed, a grid of ten rat snap-traps is set in the area around the nest tree, concentrating on the base of the nest tree itself and where possible traps were set at the bases of trees that interlocked with the nest tree or along fallen trunks or banks. Snap traps are baited with a mixture of peanut butter and rolled oats and covered with a plastic (polyglass) cover to protect the trap from rain and prevent birds from getting caught. Traps are checked daily, dead animals recorded and removed and bait is replaced when necessary.

Predator control was applied to twelve of the fifteen nests that reached incubation. Of the remaining three nests one was found close to fledging and setting traps was deemed too risky in terms of force fledging the chicks. The others were both found at chick stage so it was decided not to apply control considering the stage the nests had already reached. Table 2.5 summarises the results of the predator control applied to nests this season. Black rats *R. rattus*, Brown rats *R. Norvengicus*, Indian musk shrews *Suncus murinus* and tenrecs *Tenrec ecaudatus* (although the shrew and tenrec are not thought to predate nests) were caught. The total number of black rats caught (20) is a lot less compared with the 2007/08 season (100) although fewer nests were found this season. It still indicates that this species is present at Combo. *R. rattus* is very arboreal and often seen foraging in trees and is thought to be the most significant predation risk to a nesting Olive white-eye. Of the nests that were subjected to predator control 41% survived to be rescued/harvested. The outcomes of the failed nests with respect to predator control should be treated with caution as the failure may not have been as a result of rat predation.

It is difficult to determine how effective this predator control is in direct relation to nest success as other factors such as rescuing/harvesting also contribute towards overall success. Nests still suffered predation despite this control, therefore the method is not 100% effective, but it may reduce the overall risk of failure.

In the Seychelles similar population management is being carried out on the endemic species of Endangered White-Eye *Zosterops modestus.* As part of their management they have setup a poison grid within the territories of the known pairs. They use rat traps within the areas before and after poisoning to determine rat species and numbers. It has proved extremely effective in reducing overall numbers of rats within the territories. This technique has also been applied to Pink Pigeon populations. In 1991 a trial 50m poison grid was set up at Pigeon Wood to combat *Rattus* egg depredation. The grid proved effective by reducing the amount of depredation by rats from 31% between 1989 and 1991 to 12% in 1992. The technique was also considered for the released population of Pink Pigeons at Plaine Lièvre (Jones., et.al, 1992). Following further studies in the Seychelles on the White-Eye species it has been found that they can successfully breed with the presence of *R. norvegicus* and also

where there are both *R. rattus* and *R. norvegicus* but not where there is solely *R. rattus.* This knowledge could allow us to predict which nests at Combo require rescuing depending on the species of rat found in the territories (along with other factors). If an area is populated solely with *R. rattus* then the nest would be at a higher risk than those with only *R. norvegicus*.

In the past when predator control has been applied to nests at Combo it has be considered that the trap bait may actually attract predators to the nest area where they may not have been present prior to trapping. This can be seen in trapping records when rats have been caught following a few days of setting. If poison grids were set up in our known breeding pair territories it could eliminate this potential problem and reduce the amount of rats in the area as a whole. This would benefit all the endemic birds breeding in the area. As well as this if trapping was carried out before and after poisoning a comparison could be made on the techniques effectiveness and also on the percentage of rat species in the area, which as previously mentioned could aid in rescue prioritising.

The technique which would be applied based upon those used in the Seychelles, by Jones. et al, 1992 and the Echo Parakeet Project. Prior to poisoning, rat snap traps would be set up in a grid at 50m intervals throughout the Olive White-Eye territories. The traps would be monitored for around 5 days and the results recorded. Following this a poison grid would be set up using the 'Hockey Stick' method. The 'Hockey Stick' method is designed so that the rat must eat the poison from the tube and not remove it. If a rat is able to remove the poison they will continue to do so until the site is empty wasting a lot of poison and requiring regular baiting. A grey tube (gutter piping cut to approx 2ft) with curved piping on the end would be placed on the ground. Within the curved piping a mesh basket is attached containing wax based poison. The enclosed pipe will be inviting to rats and they will have to consume the poison on site reducing waste and increasing the mortality rate. The poison grid would be in place between 2-4 weeks. Following this rat trapping would be carried out for a further 5 days and the results compared with those taken prior to poisoning. The comparison will show if the grid has been effective in reducing the *Rattus* spp population.

Poison Grids could reduce the amount of time needed for predator control as the tubes would be checked weekly and replaced if necessary. The benefits to this grid would be great as it would enable protection within the whole territory throughout the breeding season. As well as this if a nest is not found for a pair the nest would still be protected and the success rate increased.

Initially the grids would be set up in the territories of priority pairs, those with a history of high predation and those where *R. rattus* populations are dominant. The first trials would be carried out on Bridge pair, where the presence of *R. rattus* is apparent and who have a high rate of failure and Bambous who have the highest catch of *R. rattus*. If it proves successful the techniques can be refined and applied to all the breeding territories during the breeding season.

Table 2.5 Summary of predator control applied to Olive white-eye nests at Combo 2008/09

Nest Reference	Pair Reference	Date control started	Number of trap nights	Number of rats caught		Nest Outcome
				R. ratus	*R. norvengicus*	
ZC08COM02	LASAGNE	25.08.08	160	0	0	Failed Brood
ZC08COM03	BRIDGE	26.08.08	310	0	11	Failed Brood
ZC08COM04	POOKY	24.09.08	168	0	4	Failed Brood
ZC08COM05	ORCHID-MARSH	29.08.08	96	2	0	Fledged
ZC08COM09	PATRICKS	03.11.08	199	1	7	Fledged
ZC08COM10	MEADOW	03.11.08	28	0	2	Rescued
ZC08COM12	MEADOW	27.11.08	47	3	0	Rescued
ZC08COM13	BRIDGE	27.11.08	40	3	1	Rescued
ZC08COM15	BAMBOUS	23.12.08	75	4	2	Failed INC
ZC08COM16	BRIDGE	22.12.08	97	2	0	Failed INC
ZC09COM01	BAMBOUS	05.01.09	110	0	2	Failed INC
ZC09COM04	BAMBOUS	29.01.09	250	5	0	Failed INC
Total			1580	20	29	

Breeding Biology and gaps in our current knowledge

Aspects of the life history of the Mauritius Olive white-eye are discussed below, however it should be noted that much of the behavioural data collected to date consists of anecdotal observations. There have been huge advances in our current knowledge of this species since the initiation of the recovery program; however work has been focussed on intensive management and less on in-depth study. Possible subjects for future investigation, with view to a more structured study of the Mauritius Olive white-eye in the near future, are presented alongside our current understanding of this species.

Breeding season

The breeding season had already started when staff moved to Combo on 11th August 2008 as a nest was found on the first morning of field work. The pairs are estimated to have started breeding in early July as a pair was found with a fledgling in mid August. This season there were no patterns seen between plants flowering and breeding behaviour. As well as starting early this season the breeding also finished later with the last nest found mid-February around two months later than the last two seasons. The actual start to the breeding season and duration for an average year remains undetermined. Next season staff will be monitoring the Combo population from the beginning of July in order to get a more accurate idea of when the breeding season begins. Analysis of phenology data, along with meteorological information may provide indictors for the start of annual breeding of upland Olive white-eyes.

Historically flocks of up to 8 Olive White-Eyes (Safford 1991) are commonly seen towards the end and outside of the breeding season. This season single birds and groups of two to four birds were often seen during territory watches from December onwards. Pairs were seen to be flying higher and further around their territories towards the end of the season. It is postulated that breeding pairs leave their territories and range great distances in search for food (Cheke 1987b, Safford 1994). From observations, pairs in Combo appear to use and defend a greater area at the end of the breeding season but largely remain in their territories. Pairs are frequently heard in their territories during the winter months (*pers obs,* Kelly Edmunds, Cassie Ridley). It is suspected that flocks may consist of unpaired juveniles and pairs at Combo remain in their territory until at least March.

Territories and habitat use

Over the past two season's of intensive monitoring it has been noted that the Olive white-eyes defend small territories that often exist in clusters (see territory map, Figure 2.2). Certain features seem common in territories, these include; rivers or streams, flowering plants (commonly *Syzygium jambos*), also open areas and at least a small patch of grassland. The birds use the grassy areas to collect material to build the inner cup of their nests; this is supplemented with palm fibres from species such as *Latania* sp., which are also commonly found within territories. Birds from more than one pair have been seen to aggressively defend these open spaces this season. This suggests that this species may not be so dependent on closed canopy forest and actually requires patches of open meadow. *S. jambos* was identified as a major food source, providing both nectar and invertebrates (see Table 2.4), however whether this species supports the Combo population or confers greater survival and productivity is unclear.

Habitat analysis within Olive white-eye territories at Combo would no doubt lead to a greater understanding of the habitat requirements of this species as would a more detailed analysis of feeding ecology. Following newly ringed juveniles and investigating territory establishment and pair formation would prove fruitful. The information gained from such studies could be applied in future management such as designing Conservation Management Areas at Combo to include native flowering plants as a food source for Olive white-eyes and possibly translocations of birds to other managed sites within the National Park.

Nest building

Nest prospecting is commonly seen prior to building. During this period the birds are seen to fly repeatedly to an area of a tree, although no nest material is evident. Both birds flutter their wings and produce a subtle 'purring' call, similar to that of begging chicks. Birds are also seen pecking at surrounding twigs and leaves and will often bring material, usually spider's web, to one of the chosen areas. A pair will often prospect in more than one area prior to building and may also initiate nest building, only to relocate the material to a new site. The pair is very defensive during prospecting and nest building and observations of Olive white-eyes displacing Grey white-eyes, Paradise flycatchers, Red-whiskered bulbuls and other Olive white-eyes has proven a useful indicator of impending nesting activity.

Olive white-eyes build cup-shaped nests that are woven onto the branches of the chosen nest tree. Initial nest construction consists of weaving spider's web to the braches that will support the nest. The birds then collect fine moss and filaments from tree branches and understorey shrubs and along with more spiders' web they build the outer shell of the cup. The pair then collects fine grasses, palm fibres (including *Latania* sp) and/or bamboo fibres to create the inner cup. The nest is then loosely lined with feathers.

Nests are usually constructed over a 1-3 day period but can take up to 8 days if interrupted by poor weather. Both birds participate in nest building. They collect material and make frequent visits to the nest, one bird may sit in the nest and weave material in as the other bird collects it, however during early nest building this is not always the case. During lining, one bird will often remain on the nest for a couple of minutes and then weave material in as if trying the nest for size. Birds were also observed adding lining material to the nest after they had started incubating. Copulation is likely to be observed during late nest building and often following a period of nest defence. Incubation normally commenced 1-3 days after completion.

Clutch size and Incubation period

Clutch size is typically two eggs, rarely three and one to two nestlings. All the nests rescued this season contained two fertile eggs which all but one hatched. In past seasons it has been known for nests to contain 3 fertile eggs. The hand-rearing of three chicks in a nest proved problematic. There did not appear to be enough room for all three chicks during later stages of development and it seems unlikely that wild birds would be able to raise three fledglings in the wild. It is thought that laying a clutch of three may be over-investment to ensure maximum breeding success. If this is true, then rescuing/harvesting clutches of three eggs may increase productivity by hatching and rearing beyond the capability of the parent birds. This has possible implications for future management. For more easily accessible nests the third egg in a clutch of three could be removed for artificial incubation and rearing. This could increase fitness of parent raised brood and maximise productivity though this would have to depend on individual circumstances.

The incubation period, estimated through artificial and natural incubation records, is 12-13 days. As clutches of most wild nests could not be viewed, it was difficult to estimate exact dates of incubation and hatching. The interval between laying consecutive eggs is not known, nor whether Olive white-eyes lay a full clutch before initiating incubation. Nest cameras could be used to gain more knowledge on this process though the time and skills it would take would require this to be an independent study from the existing management. An alternative technique could be used which has been applied to the Seychelles White-Eye. In the Seychelles they use a telescopic mirror in order to see into the nest cup with as little disruption as possible. The telescopic mirror is basically a mirror placed on the end of an extendable pole. The design enables it to be carried in the field with ease. It requires two members of staff to operate, one holding the mirror over the nest the other viewing the mirror through binoculars. The use of a telescopic mirror would enable an accurate date for the start of incubation and brooding which would allow us to rescue/harvest nests on exact dates and also enable us to identify failed nests much earlier without the need for precautionary watches for two weeks. The use of the telescopic mirror will be implemented in the 2009/10 season in order to assess its effectiveness and assist in collecting as accurate data as possible.

Nest recycling and fledgling dependency periods

Olive white-eyes appear to have a fairly short recycle period as pairs were often seen nest prospecting or building the day after failure, depredation or rescue/harvest. This season one pair was still seen tolerating their fledgling with them one month after fledgling. Previously the dependency period was thought to be two to three weeks though after watching pairs this season it has been seen to be at least three-four.

Ringing birds

Ringing birds, especially known pairs, would provide a great amount of information and insight into the territoriality, pairing, dispersal and the general biology of the Olive white-eyes at Combo. Ringing birds with ID rings and colour bands would enable daily sightings of known individuals and thus provide accurate information on pairings within and between seasons, roles of males and females in nest prospecting/building, territory defence, feeding behaviours and activity of birds out of the breeding season.

Mist netting birds by tape lure appears to be the easiest method of entrapment as the birds are very vocal and responsive to calls from other birds made near or within their territories. Mist netting birds during the breeding season is likely to have a negative effect on nesting activity and management efforts, but could be done once breeding activity is seen to cease. Catching birds would also provide the opportunity to take blood samples and determine sex of individuals and genetic diversity of the Combo population. Taking measurements of birds would help indicate possible morphometric differences between otherwise indistinguishable males and females. Rescuing/harvesting from known, ringed, birds would also improve accuracy of the studbook and enable future management planning with respect to maintaining genetic diversity in introduced populations.

Following observations of released Olive White-Eyes on Ile aux Aigrette it is highly likely that the pairs change between seasons depending on male and female availability. One breeding pair on Ile aux Aigrette paired for one season, successfully fledged two chicks but has now separated following the male pairing with a different female. We have yet to see if this occurs regularly or if they return to their original pairs but the behaviour indicates that they are not as monogamous in their pairs as previously thought.

Range and possible sub-populations

The current range of the Olive white-eye within the National Park is not accurately known. Sightings of birds at Bel Ombre (*Pers obs.* Jason Malham) and at Pigeon Wood (*Pers obs.* Kelly Edmunds, Lucy Garette and Sarah Loveibond) suggest that other sub-populations may exist. This season pairs were seen and heard on a number of occasions at Pigeon Wood and GPS points made (Figure 2.4). As well as different field sights, Olive White-Eyes have also been identified on the outskirts of the Combo area. Two pairs have been found within the Sugar Cane fields and within the Tea plantations which border the Combo area (Figure 2.4). They have been found in the same sights on more than one occasion indicating that these are territories. They inhabit small fragments of forest which remain in-between the sugar cane and tea fields. Investigating these areas to search for more Olive white-eyes using staff that can recognise the birds by call and have experience in finding the birds at Combo may provide further sites for management in the future and a source of potentially genetically distinct birds and would no doubt broaden our knowledge of the species.

Behaviour out of breeding season

Very little is known about the habits of Mauritius Olive white-eyes out of the breeding season. Staffing shortages in recent years has meant that there has been no trained passerine staff based at Combo between the months of February and July, field staff are usually required to monitor the Ile aux Aigrettes population during this period. Having a single member of staff present at Combo to monitor the behaviour of known pairs during these months may result in a greater understanding of this species and would also be a means of determining the beginning of breeding activity at the beginning of the season. Having ringed birds would enable more accurate monitoring. Collection of feeding observations during this period would also help determine key plant species that may govern movements of birds out of the breeding season and trigger the beginning of the breeding season.

Other species

Whilst conducting nest searches for Olive white-eyes, any nests of the other four endemic passerines resident at Combo were monitored and outcomes recorded. Nests are monitored from the ground every other day where possible but priority is given to Olive white-eye nests. There were no nests found from other passerine species this season though focus will be put into Grey White-Eye nests next season to assist in hand-rearing training and dietary trials.

Part Three
Incubation, Hand Rearing and Captive Care
Gerald Durrell Endemic
Wildlife Sanctuary

Mauritius Olive White-Eye chick, GDEWS
Photo: Gwen Maggs

Amanda Ladkoo, Harriet Whitfield[2], Sally Baross[1], Anne Morris[1] and Julie Cole

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Introduction and Summary

This season the objective of the hand rearing team was to artificially incubate, hatch and rear to independence only those Olive white eyes that were in obvious need of rescue. The fledglings were then to be released onto Ile aux Aigrettes. The techniques used for incubation from early stage and rearing from hatch that were trialed and developed during the 2006/07 season were applied in this season in order to facilitate the early rescue of threatened wild nests. A team of between one and four hand-rearing staff was based at the Gerald Durrell Wildlife Sanctuary (GDEWS) in Black River.

Between the months of November2008 and December 2008, three nests were rescued and transferred to GDEWS for artificial incubation and hand-rearing. This season, all the rescued nests originated from the Combo population and none from Ile aux Aigrettes. All nests were rescued as clutches.

The hand-rearing of Olive white-eye clutches was unfortunately less successful this season, with a greater number of deaths than in 2007/08. Of the six fertile eggs rescued/harvested, 5 hatched, one died at pip (separate clutches). There were four chick fatalities this season, all pre fledge. Only one Olive White eye was successfully fledged and raised to independence.

No clutches of Grey White-eye *Zosterops mauritianus* eggs could be found this season. This was unfortunate as in past seasons, the hand rearing of Grey eyes provided new staff, with no previous experience of rearing small passerines with the knowledge needed to raise Olive white-eye chicks.

This report first describes the methods used for artificial incubation and hand rearing followed by the work conducted by the hand rearing team at GDEWS and the results of the 2008/09 season.

Artificial Incubation and Hand Rearing Methods applied in 2008/09

Artificial egg incubation

It is preferable to rescue/harvest eggs at late incubation stage as moving eggs during early incubation may reduce hatching success. This is because the young developing embryos are more susceptible to bumps and jolts that may occur during transfer from the field to the hand rearing room and are also more sensitive to variations in humidity and temperature. However some nests have to be rescued as early as possible due to a high risk of nest predation and are therefore taken as early as possible (see part 2). In cases of early incubation rescues/harvests extra care is taken to minimise damage to the eggs and developing embryos. Past success in artificially incubating and hatching from early incubation (see Cole *et al.*, 2007) suggest that our methods are effective and this strategy confers greater success and productivity to wild nests. The procedure for artificially incubating Olive white-eye eggs is described below.

Prior to receiving eggs the Brinsea Octagon® incubator is set at 37.2°C, humidity 65% and the eggs are manually turned three times a day. A 1:125 solution of the disinfectant F10 to de-ionised water is used in the humidity dish of the incubator in order to provide a sterile incubation environment and help prevent exposure to harmful bacteria and fungi that could compromise the health of the unborn chick.

Following the nest rescue/harvest and transfer of the clutch to GDEWS, eggs are brought to the hand rearing room and are removed from the portable incubator. A small coloured dot is made on the side of the eggshell in order to distinguish between eggs. Each egg is then placed into the pre-set warmed incubator and left to settle after the journey. All eggs are candled and weighed and weight losses and embryo development are recorded daily at 19:00 throughout the incubation period. When the eggs reach internal pip, turning of eggs ceased.

In cases of clutches of more than a single egg, eggs are spaced as far away from each other as possible in order to avoid any contact and possible disease transfer. Meticulous cleanliness is maintained when handling eggs. Hands are thoroughly washed and dried and any equipment that was used to weigh and measure eggs is disinfected after each use.

Hatching and Post-Hatch Care

Hatching times for a clutch of more than one egg are generally spaced a few hours apart. It is important to minimize fluctuations in the environment around hatching eggs. However a newly hatched chick requires feeding every 40 minutes, which requires opening the incubator which causes unavoidable drops in humidity and temperature. This is not harmful for the chick but may have a detrimental affect on hatching eggs, which could incur a dry hatch, or at worst, hatchling death. Therefore newly hatched chicks are first allowed to rest and dry until the down on the top of the head appears 'fluffy', this usually takes 3-4 hours and are then transferred to a Hatcher set at 37°C and 65% humidity. If the chick's yolk sac appears particularly prominent then the first feed may be delayed for an hour, provided the chick doesn't appear dehydrated. This allows the second/third egg to hatch within a more stable environment.

Newly hatched chicks are put back into the original nest that was rescued and they remain in this for the duration of the hand-rearing period. The nest is kept in a freezer for 24 hours prior to use in order to kill any nest mites and subsequently brought up to temperature within the hatcher. The nest is lined with a thin layer of soft tissue. This is replaced when soiled to ensure the nest is kept as clean as possible. A textured mat is often placed at the centre of the nest to provide grip for the chicks and help prevent splayed legs.

A note on the evolution of the Hand Rearing Protocol

The hand rearing protocol was first devised in the breeding season of 2001-02 by Andrew Owen (Switzer *et al.,* 2003). With his expertise in passerine hand rearing he established the first Mauritius Fody hand rearing diet. The diet contained all the nutrients essential for the development of Fody chicks and was supplemented with Vitamin B, Nutrobal and Nekton 1 and this proved to be very successful. During the breeding season of 2004/05, the first Mauritius Fody eggs were rescued and hatched at GDEWS. Modifications to the diets and feeding frequencies were made in accordance with the young age and begging responses of the chicks (Cristinacce *et al.,* 2005).

Throughout the seasons of Mauritius Fody hand rearing, the principle food substances used have always been cooked egg and papaya soaked in Ringers lactate, bee larvae also soaked in ringers lactate, cricket guts and pinkie mice. This diet also proved to be successful in hand rearing other passerines. In 2004/05 Grey White-eyes were reared for the first time using a combination of these food items and on differing times and frequencies (Cristinacce *et al.,* 2005). In 2005/06 the diet used on Grey White-eyes in 2004/05 proved suitable for rearing Olive white-eye chicks.

The diet was once more reviewed in 2006/07 to allow for modifications based on observations made during previous years, such as the effect that certain food items have had on chicks' digestion and begging responses. Feeding times and frequencies, combinations of food substances and the ideal age at which a chick is introduced to certain food items were further adapted to suit Olive white-eye chicks. Appendix 2 gives the hand rearing diet for Olive white-eyes and Grey white-eyes.

In 2007/08 the diet remained unchanged from that used in the previous season except for two alterations. Firstly, a shortage in the GDEWS breeding stock of pinkie mice occurred mid-season. The diet was adjusted in response to this shortage, with egg and papaya used as a substitute. Secondly, the wax moth culture at GDEWS died out and this component of the diet was substituted with egg and papaya and bee. Neither of these changes appeared to affect the rearing of any chicks.

Hand Rearing Diet, Feeding Routines and Combinations

In 2008/09 the diet remained unchanged from that used in the previous season. Therefore chicks were fed on pinky mice, bee larvae, cricket guts, egg and papaya.

A chick's feeding response and digestion is optimal early in the morning and by late afternoon it will start to become more lethargic. In order to synchronize with this, as well as imitate the conditions that would occur in the wild, the first feed was given at 05.00- 05.30 am and the last feed varied between 20.30 and 21.00 pm.

It is essential to keep chicks well hydrated. In order to achieve this, every chick hatched was initially started on a 40 minute feeding interval. Following initial feeds, enthusiastic begging responses seen in some chicks indicated that an interval of 40 minutes between feeds was necessary. However this was adjusted to suit individual chicks as some could not be woken and begging was lethargic and feeds had to be spaced out into 50-60 minute intervals. Decisions on feeding times were therefore made based on the begging responses of individual chicks. In some cases, particularly with sick chicks, a very flexible time table had to be kept. Table 3.1 gives the set number of feeds and the approximate feeding times according to the age of the chick. Bee larvae (with supplements) were given for the first two feeds of the day and as the chicks easily digest bee larvae, their crops were usually empty within an hour. It should be noted that from Day 8 to Day 19 the first and second feeds are just one hour apart and all feeds given thereafter are spaced out at the given intervals.

Table 3.1 Feeding times for hand reared Mauritius Olive white-eye chicks. Times and intervals are approximate and were adapted to suit individual chick's behaviours.

Age (days)	**1-3**	**4-7**	**8-13**	**14-15**	**16-19**
Time of first feed	5:00	5:00	5:30	6:00	06:00
Time of last feed	21:30	21:30	21:00	20:00	18:00
Interval between feeds	40min	1hr	1.5hrs	2hrs	2hrs
Feeds per day	24	16	11	9	8

Day 1-3 chicks are particularly susceptible to aspiration, especially when fed bee larva as this is a very liquid food. Feeding such small chicks can be difficult, as some will open their bill for only a few seconds within which food must be placed inside. Difficulty also arises when the chick has a particularly enthusiastic begging response and sways its head rapidly from sided to side. Although very small finely pointed tweezers are used to feed chicks, occasionally the chick's beak is missed and food is smeared on the chick's head. This could not only cause aspiration but liquid food can potentially dry inside the chick's nostrils and block the air passage. To guard against this any liquid is wiped away from the chick's beak and face using a small length of soft tissue paper, which is finely rolled up and placed at the entrance of the nostril. This is done at every feed throughout the duration of hand rearing.

Feeding combinations

The diet and routine devised to suit Olive white-eyes which proved effective in the 2008/09 season was followed for this season's hand rearing. The principle foods used this season for hand-rearing nestlings were bee larvae, egg and papaya, pinkie mice and crickets. The diet for fledglings contained all the above with the addition of nectar, insectivorous soft-bill mix and fresh soft fruits. Vitamin B, Neckton and Nutrobal were given routinely as dietary supplements and additional supplements such as Critical care and Poly Aid were given to chicks showing signs of sickness. The principle foods are described in turn below and full feeding combinations can be found in Appendix 2.

Bee larvae

Bee larva is the first food substance given to newly hatched chicks. They are a good source of fluid and are easily digested. This enables feeds to be spaced out at frequent intervals, which helps to prevent dehydration. The first and second bee larva feeds are supplemented with Vitamin B and Nutrobal respectively. A diet of only Bee larvae is given to one-day-old chicks in order to allow the yolk sac to be completely absorbed whilst ensuring the chick is kept well hydrated. It is important that the yolk sac is absorbed as this prevents yolk sac infection and encourages regular begging responses. Bee larvae are also fed alongside more complex food such as egg and papaya and mice to ensure that each meal adequately hydrates as well as nourishes the chicks.

Egg and Papaya

Cooked egg (scrambled) contains many nutrients essential for growth making it an important component of the diet. Papaya is a good source of fructose and contains important digestive enzymes. The hydrophobic properties of egg are overcome by soaking in Ringer's lactate solution and this is then combined with ripe papaya. The supplement Necton is also added to this feed in solution, but care must be taken to make the correct concentration as too strong a solution can lead to dehydration. Bee larvae are also fed alongside the egg and papaya mixture until Day 13 in order to add plenty of moisture and increase the digestibility of this feed for younger chicks.

Pinkie mice

Day-old mice or 'pinkies' provide a good source of calcium and protein for growing chicks and are introduced to the diet at Day 5. For the first two days of feeding, only the internal organs of the mouse are given to chicks. The harder to digest cartilage, skin and head are only added to the feeding routine from Day 7. No supplement is given with this feed as most of the essential vitamins and nutrients needed are already found in the pinkie feed alone.

Crickets

Cricket guts are fed to chicks from Day 1. It was noted in the 2005/06 season, that small hard balls and cricket eggs could lead to problems such as strained defecation (Cristinacce *et al*., 2006). As a result, female crickets (distinguished by a long ovipositor) are excluded form the diet. The head of the cricket is pulled out as it is attached to the rest of the entrails at the end of which is a rock hard "ball" like organ, which can also lead to digestive difficulties.

Nectar, Insectivorous soft-bill mix and fresh soft fruits

These are given from fledging to encourage weaning and comprise the main components of the captive diet. Nectar is artificial, prepared from the powdered formula Avesnectar® which is designed for small nectivorous passerines. Soft, juicy fruits such as mango, kiwi, grapes, watermelon and papaya are cut to cubes and spiked on branches in the fledgling cage. Insectivorous soft-bill mix (Witte Molen® Universal Food) is provided in a dish – this is mixed with grated carrot and grated hard-boiled egg to provide additional nourishment.

Treatment of Sick Chicks

Differing degrees of laboured breathing has been seen in chicks throughout past and current seasons. Some chicks show mild symptoms such as quickened breathing only after feeds, which usually resumes a normal rate shortly afterwards. But other chicks show more acute symptoms with noticeably laboured breathing and lethargic behaviour with no begging response.

The first course of action taken when a chick first shows respiratory distress is to take a moistened cotton bud and gently wet the nostril and surrounding area in order to remove a thin film of food or mucus that may be obstructing it. Sick chicks are always separated from their siblings, not only to prevent contamination but also because sick chicks require very flexible feeding times to suit a fluctuating appetite and treatment, which would disrupt the regular feeding of a healthy sibling.

If a chick's begging response falters it will not wake up and feeding becomes almost impossible. In response to this, opening the hatcher abruptly often stimulates a quick begging reflex. By "surprising" the chick into a quick begging reflex a tweezer-full of food can usually be given and the chick is fed within the hatcher. A normal feeding regime is followed as far as possible, however if the chick's condition deteriorates then the focus is put on re-hydrating the chick. At this point the chick is fed only bee larvae soaked in a solution of Critical Care formula and PolyAid.

If bacterial infection is suspected the sick chick is placed into a hatcher that has been set up with a humidity dish containing a solution of F10 in de-ionised water (1:125) for 30 minutes. This treatment is repeated up to 3 times a day.

Fledging and Weaning

When chicks are near to fledging typical behavioural changes are noted. These include stretching of wings and legs, increased awareness of their surroundings and a drop in body weight, especially in heavier than average birds. Pre-fledge chicks will also stop producing faecal sacs and tend to shuffle up the side of their nest in order to defecate outside of their nest. Fledging was usually confirmed when the bird(s) were found perching on the edge of the nest or on the Hatcher floor. This usually occurred at around Day 14. The newly fledged birds are then transferred, with their nest, from the Hatcher to a small well-vegetated cage with ply-board rear and sidewalls, which provides a secure environment. A nectar drinker, fresh juicy fruit and insectivorous mix were provided from the second day after fledging. Fledglings are usually kept in the small cage until they show good perching and balance and appear settled into their new environment (typically 2-3 days) and are then transferred into a larger $1m^3$ cage.

In previous season's work, newly fledged chicks were seen to vary in their reaction to the new environment (i.e. the fledgling cage); they were either shy, remaining in the nest and had to be coaxed to eat, or became very agitated and flighty, scrambling around the floor of the cage. Much patience was needed when giving feeds around this time as some chicks became shy of the tweezers and the feeding schedule often became irregular. This procedure was therefore modified slightly this season following the difficult fledging of the second brood. Changes were made in order to reduce the distress experienced by chicks during this transition.

As mentioned previously, fledging usually occurs on day 14, although chicks may start to show behavioural changes related to fledging from day 11. It was decided that chicks would be moved, whilst still in the nest, from the Hatcher to a darkened fledging cage as soon as they showed consistent pre-fledging behaviours. As the chicks were still at a fairly naïve stage of their development and less aware of this change in environment, this allowed them to acclimatise to the new surroundings prior to fledging. Careful observation and great care was required to ensure that each chick had reached a sufficient stage of development to be transferred to the cage with no adverse consequence. Therefore, the age at which chicks are transferred varied with individual broods. This change in practice effectively

reduced the extremes in behaviour seen in previous years and decreased the level of stress on newly fledged chicks.

The birds generally weaned themselves by exploring the cage and picking at fruit that is spiked on branches. During this period birds are tweezer-fed from a dish inside the cage, which encourages them to pick at the food. The weaning period varies with each brood, but is typically 1.5 – 2 weeks. During this time the birds are closely monitored and feeds adjusted to encourage weaning, no bird was given a full feed in order to encourage them to become independent.

Captive Care and Transfer to Ile aux Aigrettes

Once independent, the birds were transferred to a small cage within an outdoor aviary and introduced to the new environment. After being released into the aviary they were fed nectar, fresh fruit and insectivorous mix twice daily. On the morning of transfer to Ile aux Aigrettes, the birds were trapped inside the fledgling cage within the aviary, hand-caught and put into a small transport box. The transport box was sparsely vegetated and covered with a cloth to keep the birds calm. Birds were driven to Ile aux Aigrettes, a journey of approximately one hour and checked every fifteen minutes. Regular sprays with a fine water mist kept them cool and hydrated, no birds showed any ill-effects from the transfer journey.

Results of Artificial Incubation and Hand Rearing of Mauritius Olive white-eyes in 2008/09

Clutches and hatching

The notes for artificial incubation and hand rearing of all clutches rescued can be found in Appendix 4. Table 3.2 summarises the results of this season's hand rearing at GDEWS.

Table 3.2 Summary of Olive white-eye hand-rearing for 2008/09.

Nest Reference (Parental Pair)	Date Rescued	Clutch Size/fertility	Age when rescued	Hatch Date	Outcome and Date	Fledgling ID Number
ZC08COM10 (Meadow Pair)	6/11/2008	2 fertile	3-4 days	13/11/08	chick 1 died day 7 chick 2 died day 15	
ZC08COM13 (Bridge)	2/12/2008	2 fertile	3-4 days	9/12/2008	1 egg died at pip 09/12/08 Fledged 1 chick 23/12/08	GA78270
ZC08COM12 (Meadow pair)	3/12/2008	2 fertile	3-4 days	11/12/08	chick 1 died day 14 chick 2 died day 17	

Of the three clutches incubated at GDEWS this season, all three contained two eggs and all were fertile. Of the six fertile eggs, one died at hatch, due to externally piping beneath the cell membrane at the narrow end of the egg. All of the remaining eggs successfully hatched. Appendix 5 gives the outcome of all eggs artificially incubated this season and Appendix 6 gives the weight losses for all fertile eggs.

Chick Fatalities

A total of five eggs hatched. Four chicks, all of which came from Meadow pair died at chick stage. When rescued the eggs were noticeably smaller than usual with thin shells and when hatched the chicks were on the lower range of the weights chart though they still appeared healthy. Figure 3.1 illustrates daily growth rates of Olive white-eye chicks by body weight (g). The chicks from the first nest ZC08COM10 both died at different ages. One chick died at day 7, this was taken by Andrew Greenwood back to the International Zoo Veterinary Group in the UK for analysis. The other chick died later at day 15, due to stunted growth we were unable to carry out a post mortem on the chick to try and determine the cause of death. The second nest rescued from Meadow Pair ZC08COM12 had very similar outcomes, again both chicks died but at similar ages. One chick died at day 14 though again was too small to post mortem. The second chick died at day 17 and although it was underdeveloped we were still able to collect necropsy samples. With both nests the begging began to reduce at which point the feeds were increased though they gained only a small amount of weight. Even at the later stages around day 11 the weight remained at ~5g when it should be between 5.5 and 8g and they showed little signs of development. For example GA78271 died at day 17 (past fledging age) though appeared to be only day 9. As well as the developmental problems the second clutch showed signs of gapping and 'clicky' breathing primarily through the mouth. The nostrils were cleaned but this had no effect. The circumstances for all these chicks were very unusual. All the techniques used this season for hand rearing were based upon past seasons work and in the past there have been no problems. In future seasons rescuing from this pair will be avoided. The raw data for daily weights of all chicks hand reared this season is given in Appendix 7.

Socialising broods at fledging stage

This season we had only one chick fledge from Bridge Pair nest ZC08COM13. The chick was hand reared alone until fledgling and once fledged it was placed in the fledgling room alongside Mauritius Fody fledglings. This was done to try and socialise the fledgling with other birds. Although the Olive White-Eye fledgling was behaving normally, feeding and calling properly it was still oblivious to human contact. Following this a mirror was placed into the cage to get the fledgling associated with an Olive White-Eye. This had a positive effect as the fledgling would perch by the mirror preening though it would 'fluff' its feathers to be preened with not result. Due to the imprinted behaviour of the Olive White-Eye fledgling it was decided to translocate the fledgling to Ile aux Aigrette on day 15 an earlier age than usual. This would enable the fledgling to be kept in the Olive White-Eye release aviaries where it can become socialised with released birds already on Ile aux Aigrette. The feeding of the fledgling was continued whilst in the release aviaries until the bird was independently feeding. Following this strategy, post release the hand reared Olive White-Eye is still extremely tame and close monitoring of the bird will continue to observe its behaviours.

Part Four

Release and Post-release Monitoring of Mauritius Olive white-eyes

Ile aux Aigrettes

Mauritius Olive White-Eye chicks 'Whoopi' and 'Bang Bang' in nest
Photo: Gwen Maggs

Gwen Maggs, Sandra Poongavanan, Aurélie Chowrimootoo, Walter Mangroo, Kimberley Dawson and Rachel Tucker

Introduction

Establishing populations of Critically Endangered birds on offshore predator-free islands, a technique known as 'Marooning', has been identified as a strategy for increasing populations of Mauritian bird species (Safford & Jones, 1998). This technique has been applied to two endemic species of Mauritian birds, the Pink Pigeon *Nesoenas mayeri* and Mauritius Fody *Foudia rubra*, which were successfully re-introduced to Ile aux Aigrettes in 1994 and 2003 respectively.

The Mauritius Olive white-eye *Zosterops chloronothos* is a Critically Endangered passerine (IUCN, 2007) endemic to Mauritius and is only found in small numbers in the upland of the Black River Gorges National Park. The last population survey conducted between 1998 and 2001 highlighted the species' continued decline and need for conservation (Nichols *et al.*, 2004). An intensive management program was initiated in 2005. As with all Passerine species that suffer from the effects of habitat degradation and nest predation, effective management of upland populations is difficult given the extensive predation issues and the nature of the bird's nesting habits. For example applying predator-proofing techniques to nest trees is near impossible. Current predator control is not effective enough to protect these relic populations from continued decline and it is therefore sensible to establish populations of birds in predator-free refuges, such as offshore islets, where predators can be effectively excluded. We therefore focussed our efforts on bringing Olive white-eyes into captivity at nest stage with view to creating a population of birds on the offshore island nature reserve, Ile aux Aigrettes. A trial release of sixteen birds was conducted in the 2006/07 season followed by another release of eighteen birds in 2007/08 to establish a breeding sub-population. Further releases continued into this season (2008/09) though with reduced numbers in order to allow close monitoring of the current population and assess habitat suitability.

Release Site – Ile aux Aigrettes

Ile aux Aigrettes is a small (26 hectare) coralline islet located in Mahébourg bay and is approximately 800m from the southeast coast of mainland Mauritius. The island is a protected nature reserve, is free of mammalian predators and is currently undergoing forest and animal restoration projects. This islet offers a refuge and the best prospects of supporting a population of Olive white-eye. Establishing an insurance population of Olive white-eye on Ile aux Aigrettes would help reduce the level of threat of extinction from Critically Endangered to Vulnerable and enable us to increase our knowledge of this species and design a future management strategy. A field staff team lives on site seven days a week. The island is divided into a 12.5m x 12.5m grid system, with each corner of a grid square marked with a metal peg. This enables easy location of nests and observations. All double letter and number references (e.g. BB27) in this report refer to grid peg references on Ile aux Aigrettes.

The Mauritian Wildlife Foundation also manages a successful ecotourism project on the island which aims to increase awareness of the conservation of endemic Mauritian plants and animals. This also includes an environmental awareness and education campaign which aims to raise the profile of the Mauritian Wildlife Foundation's projects and generate funds.

Summary of 2006/07 and 2007/08 Releases

Following the successful re-introduction of the Mauritius Fody to Ile aux Aigrettes (2003-06), a trial release program was designed to investigate establishing a sub-population of Mauritius Olive white-eye on the island. The protocols and project design that proved successful for the Fody program were applied to the Olive white-eye program (see Cole et al., 2007). The first step in investigating Ile aux Aigrettes as a release site was to bring Olive white-eyes into captivity at the Gerald Durrell Endemic Wildlife Sanctuary (GDEWS) and determine whether the species is capable of existing in the lowlands. Four birds were rescued from wild nests in 2005/06 (Cristinacce et al., 2006); hand-reared at GDEWS and were then kept in captivity for a year. These birds did well in captivity and all birds survived.

The Olive white-eye recovery program was further intensified in the 2006/07 season with more effort on rescuing/harvesting wild nests from Combo. Nine nests were rescued/harvested, producing twelve hand reared birds. These plus the four birds rescued during the 2005/06 season were released onto Ile aux Aigrettes between December 2006 and March 2007.

At the end of the 2006/07 reporting period (March 2007) nine of the sixteen Olive white-eyes released on to Ile aux Aigrettes remained, giving an initial survival of 56%. This compared favourably to the observed survival of Mauritius Fody's following trial release.

Prior to the 2007/08 season's releases, six of the trial release birds remained on Ile aux Aigrettes. During the 2007/08 season a further 12 nests were rescued from Combo which resulted in 18 birds being successfully hand-reared at GDEWS and released onto Ile aux Aigrette. At the end of the reporting period (March 2008) sixteen birds remained on the island. Following the unsuccessful breeding attempts of the Olive White-Eyes during the 2007/08 season plans were made to reduce the level of intensive management to allow for close monitoring of the released population on Ile aux Aigrettes. Population monitoring by daily field observations showed that these birds had established territories and had formed two breeding pairs and six suspected breeding pairs.

The trial release of Olive white-eyes to Ile aux Aigrettes was deemed successful given the establishment of territories and nineteen nesting attempts, eight of which reached incubation stage. The released birds were seen to forage in native coastal vegetation for nectar, invertebrates and fruits. Supplementary food was also provided.

Aims for 2008/09

Following the two successful releases of Olive white-eyes to Ile aux Aigrettes in past seasons the work of this season is largely focussed on intensively monitoring the breeding attempts of the released population. Only vulnerable nests will be rescued from Combo for hand-rearing at GDEWS and release onto Ile aux Aigrettes. As well as successful releases in past seasons breeding success observed in the past has also influenced the nature of project this season. Out of the twenty nesting attempts monitored in 2007/08 none were successful in fledgling. It was seen that the feeding rates of island reared chicks was lower than that of wild reared chicks. This could indicate an insufficient supply of inverts available to brooding adults. Work will be carried out attempting to increase invert densities and calculate if this is a problem for the population. As a result the focus of Ile aux Aigrettes work will be on nest monitoring to establish whether the released birds are capable of becoming a breeding population. The project aims for 2008/09 season on Ile aux Aigrettes are as follows:

1. Post-release monitoring of birds released in 2007/08, taking daily observations to monitor survival, feeding ecology and monitor suspected pairs for signs of nesting behaviour.
2. Close monitoring of all breeding attempts to modify nest management procedures for breeding pairs
3. Collect provisioning rates of brooding pairs to compare with wild pairs and establish if Ile aux Aigrette can support a breeding population
4. Use a nesting camera to help collect detailed provisioning rates and also identify predators
5. Continue supplementary feeding and modify techniques in order to prevent invert infestation and territorial behaviour from Mauritius Fody's and between Olive White-Eye pairs.
6. Release hand reared juveniles in cohorts of up to five birds from November 2008.
7. Add feeding stations to provide supplementary food for newly released birds.
8. Establish fruit fly cultures throughout breeding pair territories to increase invert populations for brooding pairs.
9. Closely monitor survival, pairing, territory establishment and behaviour of newly released birds and Ile aux Aigrette fledglings.

The following report gives the details of survival, breeding observations, nest management and success, supplementary feeding, release protocols, species interaction and feeding observations for the third season of releases of Mauritius Olive white-eyes to Ile aux Aigrettes. It also covers suggestions for future management and topics for study.

Survival and Success of Releases

Survival is monitored by the collection of daily observations of birds at feeding stations and in the field. Each bird seen is identified from its unique colour band combination and recorded on an attendance sheet. Birds are said to have gone missing from the population if they have not been seen for a whole calendar month. The date the missing bird was last seen can be found on the attendance sheet and the number of day's survival from date of release is calculated.

At the beginning of the reporting period in April 2008, there were sixteen Olive white-eyes alive on Ile aux Aigrettes originating from the 2006/07 and 2007/08 season's releases. Only one bird was released onto Ile aux Aigrettes this season in February 2009. By the end of the reporting period in March 2009 a total of seven birds had been lost from the total population. This number consisted of two birds from the 2006/07 releases and five birds from the 2007/08 releases. The total number of Olive white-eyes alive on Ile aux Aigrettes at the end of March 2009 is sixteen. Five wild pairs are represented by breeding birds on Ile aux Aigrettes only one of which was unsuccessful to fledge this season. Five different wild pairs are currently represented by birds on Ile aux Aigrettes Table 4.1 gives the fates of all birds that were alive and free living on Ile aux Aigrettes this season. There are no reliable differences in appearance between males and females. Sexes are given with a '?' when sex has been estimated given observations of typical behaviours such as singing. Otherwise sex is confirmed in breeding birds, following observations of copulation.

Table 4.1 Fates of all Olive white-eyes on Ile aux Aigrettes between April 2008 and March 2009 and status of existing birds at the end of March 2009.

ID NUMBER	NAME	RINGS		PARENTAL PAIR	DATE HATCHED	DATE RELEASED	DATE LAST SEEN	SEX	DAYS ON IAA	CURRENT STATUS
		LEFT	RIGHT							
GA78219	PETIT POIS	ID	LG	LAS VEGAS	12/09/06	06/12/06	31/03/09	♀	846*	PAIRED WITH GA78226
GA78221	JOSIE	ID	MV	GAVERNY	11/10/06	06/12/06	18/07/08	♂	590	MISSING
GA78225	BASS	ID	YL/YL	HOUSE	05/11/06	9/1/2007	18/07/08	♀	544	MISSING
GA78226	HYPO	ID	RD/RD	PATRICK'S	15/11/06	25/01/07	31/03/09	♂	796*	PAIRED WITH GA78219
GA78229	BROOKLYN	ID	YL/LB	BRIDGE	03/01/07	02/03/07	31/03/09	♂	760*	PAIRED WITH GA78247
GA78233	WHOOPI	ID	WT/O	GA78254 x GA78249	03/12/08	IAA	31/03/09	♂?	118*	SUS PAIRED WITH GA78245
GA78235	SHAMROCK	ID	WT/CS	GA78243 X GA78239	27/10/08	IAA	31/03/09	♀?	155*	SUS PAIRED WITH GA78268
GA78236	ZISSOU	ID	WT/MV	GA78243 x GA78239	27/10/08	IAA	31/03/09	♂?	155*	SUS PAIRED WITH GA78267
GA78237	PEPITO	ID	WT/WT	LAS VEGAS	11/09/07	04/12/07	17/03/09	♀?	500	DEAD
GA78238	TRICKSTER	ID	DB/DB	BRIDGE	22/09/07	04/12/07	06/01/09	♂?	399	MISSING
GA78239	GONZO	ID	LB/LB	BRIDGE	23/09/07	20/12/07	31/03/09	♀	467*	SUS PAIRED WITH GA78243
GA78240	ELVIS	ID	CS/CS	LAS VEGAS	26/09/07	05/12/07	31/03/09	♀?	482*	SUS PAIRED WITH GA78254
GA78242	DOLLY	ID	DG/DG	LAS VEGAS	26/09/07	05/12/07	31/03/08	♂?	117	MISSING
GA78243	TILLOVICH	ID	WT/RD	ORCHID MARSH	22/10/07	19/12/07	31/03/08	♂	468*	SUS PAIRED WITH GA78239
GA78244	YAWA	ID	RD/BK	ORCHID MARSH	23/10/07	19/12/07	11/08/08	♂?	236	MISSING
GA78245	GRAND	ID	LB/LG	ORCHID MARSH	23/10/07	19/12/07	31/03/09	♀?	468*	SUS PAIRED WITH GA78233
GA78247	MAMMATUS	ID	WT/LG	LAS VEGAS	26/10/07	19/12/07	31/03/09	♀	468*	PAIRED WITH GA78229
GA78248	NIMBUS	ID	WT/YL	LAS VEGAS	26/10/07	04/01/08	10/10/08	♂?	280	MISSING
GA78249	UVAVU	ID	BK/WT	POOKY	29/10/07	04/01/08	31/03/08	♀?	452*	SINGLE BIRD
GA78252	BABYBEL	ID	BK/LG	MEADOW	10/11/07	15/01/08	28/11/08	♂?	318	MISSING
GA78254	SQUAREPANTS	ID	DB/YL	POOKY	02/12/07	24/01/08	31/03/09	♂?	432*	SUS PAIRED WITH GA78240
GA78267	BANG BANG	ID	WT/DG	GA78254 x GA78249	03/12/08	IAA	31/03/09	♀?	118*	SUS PAIRED WITH GA78236
GA78268	MONSTER	ID	BK/DG	GA78229 x GA78247	06/01/09	IAA	31/03/09	♂?	104*	SUS PAIRED WITH GA78235
GA78270	VENUS	ID	MV/MV	Bridge	08/12/08	26/02/09	31/03/09	♀?	33*	SINGLE BIRD

*Birds still exist on Ile aux Aigrettes, number of day's survival on Ile aux Aigrettes is therefore calculated up until the end of the reporting period i.e. 31/03/09.

Only one of the seven birds lost from the Ile aux Aigrettes population this season was recovered. This bird GA78237 'Pepito' an adult suspected female, released in early December 2007, was healthy when last seen on 13/03/09. The body of this bird was found in feeding station four on the 17/03/09. The carcass was still intact and a post mortem showed no sign of disease or fatal injury. It is suspected that the bird was attacked by a territorial pair, causing the death.

Introduced bird populations often have a period of high mortality following release due to stress, injury or inexperience (Armstrong and Craig 1995; Castro *et al.,* 1995) and most deaths are not accounted for (Wolf *et al.,* 1996). This was true of the trial releases of

Mauritius Fody's to Ile aux Aigrettes, where only 40% survival was seen (Cristinacce *et al.*, 2004) and was also true of releases of other birds within Mauritius (Mauritius kestrels, Pink pigeons and Echo parakeets). Subsequent releases of Mauritius Fody were more successful as released birds were able to learn from the existing population. This trend has also been observed in Mauritius Olive White-eyes on Ile aux Aigrettes. An accurate measure of Mauritius Olive White-eye survival is calculated using the Kaplan-Meier Method measuring the survival of birds which reach breeding age, approximately one year. The 2006/07 releases showed a survival rate of 27%. This increased considerably in the 2007/08 releases when survival was calculated at 57%, 30% higher that the previous season. This increase in survival is very encouraging though doesn't take into account the modification of release techniques, post release monitoring and management techniques and variations in weather. This increase is very similar to that seen during the first two releases of Mauritius Fody. The survival of Mauritius Fody's increased by 33% between the 2003/04 and 2004/05. This comparison is encouraging for the Olive White-eye survival as the Olive White-eye population face obstacles the Fody population did not. When the Olive White-eye releases commenced the Fody population was already well established so the released birds have to compete with a strong population.

Aside from calculations of survival, the establishment of six breeding pairs, four more than last season, is very encouraging and suggests that the unique lowland coastal forest found on Ile aux Aigrettes is suitable nesting habitat for Olive white-eyes. The six breeding pairs all laid clutches on more than one occasion; four of the pairs reached brood stage, and five chicks were fledged. Nesting and breeding is discussed in detail below. There is no doubt that close monitoring during the initial establishment of a population of Olive white-eyes on Ile aux Aigrettes is essential. This species is very different to others that have undergone successful recovery in Mauritius and its requirements will be gauged from the success of this introduced population.

Factors affecting survival

Potential Dispersers

During this season three birds have been reported as missing and returned to the population. The first birds to return were GA78254 and GA78245. This suspected pair went missing during April 2008, they both returned within one day of each other after five months during September 2008. The third bird to return, GA78252 went missing during January 2008 only twelve days after release onto Ile aux Aigrettes and returned eight months later also during September 2008. GA78252 went missing at just two months old and was suspected to have died following the stress of the release but returned to the population. The return of birds which were reported as missing has never been observed with the Olive White-Eye population. The reason for all three returning during September 2008 is unknown though the automatic pairing and beginning of breeding activity could indicate that they returned for the breeding season. It has been recorded at Combo that pairs will disperse out of breeding season and return to their territories when the breeding season commences. Leaving the island could be a form of dispersal. As well as this the birds were juvenile and a combination of these factors could have caused the birds to disperse to the mainland. GA78252 has since gone missing following three nesting attempts with GA78245. Daily searches on Ile aux Aigrettes by field staff will determine accurate dates if any birds return again. Mainland observations were carried out during both the breeding and non-breeding

season but nothing was observed. Previous sightings of Olive White-Eye have been made on the mainland (*pers.ob.* Rich Dale) and a pair was seen to fly to the mainland in 2007/08 though no positive identification was made. During this season both female and juvenile Mauritius Fody observations were made on the mainland increasing the possibility of Olive White-Eyes surviving there also. Further monitoring of the mainland will continue to determine any mainland dispersers. Ile aux Aigrettes is approximately eight hundred metres from the mainland and it is suspected that if birds disperse during calm weather they could face problems when returning if the conditions become more active. If an Olive White-eye had to fly against the wind it could become exhausted and fall in the sea. A Mauritius Fody has been found in the lagoon in a previous season and so this could be a potential problem faced when using off-shore islets. Evidence of this has not been found for the Olive White-eye and has yet to be identified as a major threat.

Disease

The only disease observed in the Olive white-eyes this season were temporary cases of avian pox. It was noted in GA78219 in the 2007/08 season and appears sporadically. The mature female shows signs of small, slightly swollen patches of skin near the gape and lower mandible which appear dry and crusty. She also shows signs on her feet and is unable to perch securely. Both of these symptoms persist for around a fortnight. Another case has been positively diagnosed this season in GA78270 who was released in February 2009. This juvenile suspected female has been seen with small lesions around her gape and is see to scratch persistently. In both cases it did not appear to affect the bird's behaviour as they were both seen feeding and interacting with others as usual. The diagnosis of avian pox was made based on observations of the disease in the Mauritius Fody on Ile aux Aigrettes; there was no means of taking a sample of the affected tissue without causing considerable stress to the bird and possibly aggravating the lesion.

Various forms of Leucocytozoon parasitaemia have been identified in an Olive White-eye fledgling recovered from Combo in 2006/07 and could be the cause for unidentified fatalities of chicks on Ile aux Aigrettes. In 2007/08 a chick died on the nest following ringing, when ringed it was in a healthy state and died following a quick deterioration. Unfortunately samples were not taken from the chick for testing. During this season (2008/09) chicks from the same pair died under very similar circumstances. One was recovered and samples sent for analysis. Results from these samples will help to rule out causes of death in young chicks. Blood smears will be taken from all Olive White-eye chicks on Ile aux Aigrettes and all those rescued and hand reared this coming season. This will assist in our understanding of disease in the Olive White-eye and allow us to rule out causes of chick fatality.

Little is known of the diseases affecting Mauritius Olive White-eyes. Screening for Leucocytozoon in blood samples is possible and may indicate the prevalence of this disease and at what stage the birds contact the parasite. Most birds are rescued as eggs from the wild and so, assuming that the sterile hand rearing procedures are adequately maintained, the birds should first encounter the disease upon leaving the hand rearing room. In this case the hand rearing period may delay exposure until the birds are fledged, weaned and stronger. Considering this alone, hand rearing birds from eggs may further increase chance of survival compared to wild, parent raised birds.

Cyclones

The cyclone season in Mauritius extends from December to April. Only one cyclone passed close to Mauritius this season; it had a mild influence on the weather in mid-February, causing heavy downpours and moderate winds. There was one Olive White–eye in captivity on Ile aux Aigrettes at this point and was released once the cyclone had passed. There were no changes made to the feeding routine this season as weather conditions did not affect the stations considerably. All the birds were not seen to use the feeding stations much and were difficult to find in the field during the poor weather due to the wind. No birds were seen to be effected by the cyclone and were all accounted for following the strong weather.

Chemical and Human Hazards

Chemical and human hazards pose a huge risk to small, naive passerines on Ile aux Aigrettes. This was unfortunately highlighted by the loss of two Olive white-eyes in December 2006 to poisoning, whilst they were collecting nesting material from spider's webs in a bedroom. The majority of hazards are avoidable and the others minimised by correct management, vigilance and cooperation from all staff.

The use of all potentially harmful chemicals, such as insecticides, has been stopped in the warden's house, visitor centre and nursery since the Mauritius Fody releases in 2003 and there are strict rules for managing harmful substances and general activities such as the use of disinfecting agents such as Virkon, covering buckets of water and checking buildings for birds before closing them. All birds are discouraged from entering buildings however it is difficult to completely exclude birds from these areas. The potential serious risks of using dangerous substances on Ile aux Aigrettes are continually highlighted and a high level of vigilance applied by all passerine staff.

Predation

The introduction of Telfair skinks to Ile aux Aigrettes in December 2006 has not presented any issues to date. The skinks are however very adept predators and have been seen to prey on a variety of animals such as shrews, invertebrates and land crabs. These observations question the significance of this predator on Ile aux Aigrettes and the potential for skinks in high densities to affect the establishment of a small passerine such as the Olive white-eye. Skinks are also able to climb into the trees on Ile aux Aigrettes and many observations have been made by field staff that record skinks climbing over 2m high. The Olive white-eyes regularly forage at ground level for both food and nesting material and have shown an average foraging height of 2.3m. They would present an easy meal for a well-camouflaged, opportunistic skink. Skinks would also be capable of predating nests that are built near to or beneath a main branch. Regular communication is maintained between passerine staff and the Durrell Initiative Reptile Team, who monitor the skink population on Ile aux Aigrettes in order to study the interactions of these two species.

Predation of eggs and chicks is an important limiting factor for an establishing population. This season saw the first Olive white-eye chicks fledge on Ile aux Aigrettes, although twelve nests failed during incubation and four nests failed during Brood. It is very difficult to know the details of predation without witnessing the event itself; however some observations strongly indicate that Mauritius Fody's and Common mynahs may predate Olive

white-eye nests. Measures can be applied to control mynahs however this is not the case when considering the Mauritius Fody. The success of three nests producing five fledglings does indicate that the Olive White-eye population is able to breed successfully with these limiting factors; this is very promising for the released population.

Behavioural Observations

The release of the Mauritius Olive white-eye on to Ile aux Aigrettes has given us the valuable opportunity to study this species at closer range. The behaviour of these birds in native lowland habitat has never been recorded and the interaction of Olive white-eyes and Mauritius Fody's and other species has not been studied. There have been many new insights into the biology and behaviour of the Olive White-eye which have presented questions on future management of this species.

Intra-species Interactions

The formation of pair bonds seems central to the behaviour of the Olive white-eye and may confer greater chance of individual survival. In previous years' work it appeared important to form social groups early on in the hand rearing process so that birds learned adequate communication skills, bonded with their kind and were not imprinted. Although important, this has lead to increased stress in certain individuals through forced grouping. Olive white-eyes can be very aggressive and when defensive, will chase other birds persistently and noisily until the weaker bird has been chased to the ground or cornered. At this point the dominant bird or birds are often seen to relentlessly peck the other. This season, due to only one bird being hand reared to independence forced grouping was not an issue though problems were encountered regarding imprinting. The hand rearing of individual birds is avoided were ever possible though at times it is unavoidable. Various techniques were trialed this season to socialise the fledgling GA78270 (See Part 3, Socialising Fledglings and Part 4, Evolution of Release Method). There have been occasions in past seasons where birds were reared singularly with less interaction with others. In all cases the birds were released on to Ile aux Aigrettes, GA78219 was the first female to lay a clutch of eggs on the island, GA78239 parented two of the fledglings this season and the other successfully paired. This indicates that singular hand raised birds are capable of socialising and forming a healthy breeding pair following release.

It is now thought that no effort should be made beyond fledgling to force-bond birds and singular juveniles should be released to Ile aux Aigrettes as soon as possible. This method limits stress and allows for natural pairing and socialising.

Olive white-eyes form pairs from as early as post-fledging and, based on past seasons observations, birds that remain in or form pairs following release do better in terms of survival than those who do not. Pairing is typified by repeated observations of the two birds together, feeding, mutual preening and remaining in vocal contact. Territory establishment usually follows, with birds displaying highly vocal and aggressive behaviour to others that enter the area. Both birds defend the territory, often together and with equal commitment. Once another bird has been displaced from the territory, the pair often engages in a mutual preening session which can often last over ten minutes. Mutual preening appears to be an important bond-reinforcing behaviour. Wild observations at Combo report more observations of mutual preening in pairs of Olive white-eye and virtually none in the closely related Grey white-eye.

This season observations have been made between adult Olive White-eyes and fledglings. It was observed that young fledglings grouped in one main area and were seen socialising together and with single adults. On one occasion a juvenile male was seen copulating with an adult female following encouragement from the adult female (*pers.ob* Sandra Poongavanan and Walter Mangroo). This was only seen on one occasion and no further breeding behaviour was observed. When the fledglings are first independent they are seen to be tolerated within the territories of adult pairs though once they have paired or matured are defended against. As well as fledglings single birds are also seen to be tolerated. When GA78240 became single following the disappearance of her male she was seen in neighboring territories. GA78240 was observed around nesting pair GA78226 and GA78219 and was not aggressively chanced merely displaced from the immediate area. It would appear that Olive White-eye pairs have individual preference to defensive behaviour. Where some pairs are seen to tolerate single adults others are seen to strongly defend against them. This indicates that pairs will only defend against birds which they see as a threat. This would appear to vary between pairs and the time of season. Breeding activity this coming season will extend our knowledge of breeding and fledgling/juvenile behaviour.

Inter-species Interactions

The interaction between Mauritius Fody's and Olive white-eyes has not been studied prior to the trial release of Olive white-eye to Ile aux Aigrettes, as the ranges of the mainland populations of these species show very little overlap. Both species were closely monitored during the trial and this year's releases. Typically, neither species shows much interest in the other. The Olive white-eye and Fody's are often seen feeding alongside one another. The implementation of the feeding stations has had the effect of attracting Mauritius Fody's which have previously been able to access the supplementary feed. Most cannot fit through the mesh holes though the ones which can will chase Olive white-eyes from the station. It has been observed that nesting Mauritius Fody's will defend a feeding station when the male will defend and the female will access to feed fledglings or take fledglings with her. This has been discouraged following new station designs (See Evolution of Supp. Feeding method).

Mauritius Fody's are known egg predators and have been observed taking other Mauritius Fody's eggs from active nests. Mauritius Fody's were suspected as possible nest predators of Olive White-eye nests following the loss of twelve clutches, with observations of Fody's nearby or at the nests prior to failure. Although Olive white-eyes are capable of displacing Fody's from their nest area, this often takes both birds and any lapse in vigilance would present an opportunity for a Fody's to take eggs.

Nesting behaviour has highlighted other interspecies interactions, as Olive white-eyes have been seen to chase Red-whiskered bulbuls and Madagascar Fody's from nest areas. The Olive white-eyes can effectively displace both of these species.

Mynah Birds have been observed predating Mauritius Fody chicks and are suspected of also predating Olive White-eye nests. Four nests failed at brood, two under suspicious circumstances when the nest cup was left completely empty. Mauritius Olive White-eye are capable of displacing Mynah birds but are unable to physically defend against them and can attract attention from other bird species whilst doing so which could potentially predate the nests. Mynah control will be implemented this coming season.

Calls, Song and Mimicking

Olive white-eyes are a very vocal species and easily identified from their distinct repertoire of calls. They make a regular "pit-pit-pit" contact call whilst foraging or moving short distances through the forest. Paired birds make these frequently in order to keep track of their partner's whereabouts. Birds also make a louder warbled call upon leaving an area, which is usually returned by the other bird, this appears to be a loud contact call used in flight or to gain the immediate attention of the other bird.

A quiet purring call is made when mutual preening or nest prospecting, which is similar to that of begging chicks and fledglings. A loud buzzing call signifies alarm, and this is often reinforced by any other birds nearby the one that made the original alarm. Alarm calls are also heard during territory disputes and contact fights.

Single male birds are very often found singing. These birds would often be found singing whilst feeding or just moving through their territory. The song was typically very subtle and quiet, warbled but with distinct repeated elements which were likened to the calls of other birds, mostly calls of Red-whiskered bulbuls. In the wild population elements of the song have been likened to Madagascar Fody's which are common in the wild territories (*pers.ob*. Gwen Maggs). It is hypothesised that singing and the ability to mimic other sounds is a reflection of fitness and serves to present the level of individual quality to a potential mate. It is thought they call to attract a female. None of the confirmed or suspected female Olive white-eyes have been heard singing. A similar, much louder song is often heard in Combo birds, but this appears to be more of a territory call and is broadcast from high trees and at multiple positions around a known territory. This has only been observed from males and while the male territory sings the females will sit quietly in neighboring canopy preening. The Olive White-eye do not display a territory call like the Mauritius Fody but will either 'declare' its territory through songs or chance birds away with defensive calls, from both the male and females.

Recording the calls and song of the Ile aux Aigrettes Olive white-eyes and the Combo birds would both document these differences and serve as a comparison. This would allow us to study behavioural differences that are related to sound production between the two populations and may have future management implications, such as play backs to hand-reared birds.

Feeding Observations

All feeding observations made in the field are recorded in as much detail as possible in order to document habitat use and plant species interactions of Olive white-eyes in lowland native forest. Date, time, weather, location, habitat, plant species, height of foraging, method of feeding, part of plant and food item were recorded for each observation. Observations are taken on opportunity and not at specific times. The information gained is very confounded and should only be considered as preliminary findings and observations.

Between 09/04/08 and 18/02/09, three hundred and fifty eight feeding observations were made in the field showing foraging interactions with twenty different plant species (see Appendix 11). Table 4.3 gives the number of feeding observations broadly categorised into food type for each plant species recorded. The plant species highlighted in green appear to be important food trees for Olive white-eyes as they not only have high numbers of feeding observations, but also provide the birds with a variety of different food types. 97% (n = 358) of observations were on native plants.

The birds forage by probing leaves, branches and flowers, by gleaning and pecking and have also been seen fly catching. 53% of feeding observations were of birds probing, gleaning or pecking in leaves and branches for invertebrates, whilst 31% of observations were of birds probing or drinking nectar from flowers. This indicates that Olive white-eyes may be more insectivorous than previously thought. Olive white-eyes were also seen feeding on fruits, tree sap and flying insects. The Olive white-eyes generally feed in mid-canopy vegetation at an average height of 2.3m, but are often seen at ground level and in understorey vegetation.

It is difficult to gain information of prey items of Olive white-eyes. Observations made this year have shown feeding on caterpillars, larvae, aphids, ants, small spiders and moths. More emphasis on identifying prey items is needed in the future.

This collection of data only covers one part of the year. It should also be noted that there are less staff present to collect feeding observations throughout the winter months (April to July) which is likely to heavily bias the data collected for the whole season. A continuous, longer study, over multiple seasons, with a more analytical outlook will no doubt result in a clearer understanding of the feeding ecology of Olive white-eyes on Ile aux Aigrettes. The recent initiation of an in-depth phenology study on Ile aux Aigrettes (*pers. com* Amruta Rane) could be used to identify relationships between flowering and fruiting plants and feeding ecology, survival, productivity and seasonal patterns in feeding and breeding. This may confirm certain plants as key species which can then be planted in abundance or introduced at other sites intended for release of this species. Studies on feeding can also be linked to dietary requirements and the importance of Olive white-eyes in pollination and seed dispersal for native plant species.

Table 4.2 Feeding observations recorded for Olive white-eyes between 09/04/08 and 18/02/09 on Native and non-Native plants on Ile aux Aigrettes. Plants highlighted are thought to be significant food plants for Olive white-eyes. Observations of fly-catching are not included as they are not plant specific.

	Plant Species	Number of Feeding Observations				TOTAL
		Nectar	Fruit	Tree Sap	Invertebrates	
Native and Endemic Spp.	*Diospyros ergrttarum*	2	0	20	25	47
	Dracaena concinn	0	0	0	2	2
	Eugenia lucida	1	1	0	2	4
	Ficus rubra	0	0	0	4	4
	Gagnebina pterocarpa	2	0	0	0	2
	Gastonia mauritiana	2	0	0	1	3
	Hibiscus tiliaceus	1	0	0	24	25
	Hilsenbergia petiolaris	45	26	0	83	154
	Lomatophyllum tormentorii	4	0	0	0	4
	Premna serratifolia	0	0	0	1	1
	Scutia myrtina	0	0	0	1	1
	Scaevola taccada	9	0	0	8	17
	Tarenna borbonica	1	4	0	19	24
	Turraea thouarsiana	35	6	0	18	59
Non-Native Spp.						
	Flacourtia indica	1	0	0	0	1
	Leucaena leucocephala	0	0	0	2	2
	Passiflora subrosa	6	0	0	0	6
	Tounefortia argentea	2	0	0	0	2

Pairs, nesting and productivity

Following the release of birds during the 2006/07 and 2007/08 season further information has been gained into the nesting, pairing and territory formation behaviour of the Olive White-Eye. With the conformation of six breeding pairs this season and the successful fledging of five birds from three pairs indicates that Ile aux Aigrettes is capable of supporting a breeding population. The initiation of nesting and breeding behaviour on the island has also highlighted some important questions and considerations for future management of this species. This section describes the nesting activity throughout the season, the breeding pairs and the establishment of new territories and pairings.

Nesting

The breeding season of Mauritius Olive White-eye on Ile aux Aigrettes began in September 2008 an exact month earlier than last season (2007/08) though finished around two months earlier at the beginning of February 2009. Six breeding pairs (pairs that are known to have laid eggs) were identified this season. This is a large increase on the two pair's identified in 2007/08 and only one nesting pair in 2006/07. There were a further eight suspected pairs this season, though only three remained on Ile aux Aigrettes at the end of the reporting season (March 2009). These are suspected pairs owing to observations of the birds forming a definable territory and being seen exclusively together.

It has been confirmed that Olive white-eyes are capable of breeding in their first year. The youngest female to lay eggs this season was GA78249 at just under 12 months old (352 days) a month younger that last year. The suspected pairs on Ile aux Aigrettes at the end on the 2008/09 season only include one potential breeding pair (though no nesting attempts were seen), the remaining three comprise of juvenile birds which would not be capable of breeding in the 2008/09 season. All pairs are discussed in turn, later in this report.

To summarise the nesting activity of Olive white-eyes on Ile aux Aigrettes, a total of forty-seven nesting episodes were found and monitored between September 2008 and February 2009, this is over double that of the 2007/08 season. Of these, twenty-eight were abandoned (fifteen before completion and thirteen after) and nineteen proceeded to clutch stage. Twelve clutches failed during incubation, four failed at brood and three successfully fledged five birds. This is the first time Olive White-Eyes have successfully bred on Ile aux Aigrettes and shows that they are capable of breeding in the lowland, coastal habitat. Of the nineteen nests which reached incubation Mayfield analysis (Mayfield 1961, 1975) was followed to calculated nesting success. This takes account of the number of failed nests in relation to the exposure time and so can be used for nests that are found after incubation started. The nesting success on Ile aux Aigrettes was 12% for the 2008/09 season. Although the survival rate for nests is low the successful fledgling of five chicks shows that it is possible. The success of nesting may increase as the population density does so. This season we observed the first record of double clutching on a nest. Nest ZC08IAA38 failed during incubation following suspected predation by the Mauritius Fody (based upon field observations) the pair proceeded to lay another clutch though this failed when the nest was discovered on the ground. Table 4.1 summarises all nests found on Ile aux Aigrettes this season.

Table 4.3 Summary of all nesting episodes of the Mauritius Olive white-eye on Ile aux Aigrettes in the 2008/09 season.

Nest Reference	Pair	Discovery Date	Location	Stage when found	Nest Tree	Current status/outcome and date
ZC08IAA10	GA78229 x GA78247	23/09/08	BC26	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 24/09/08
ZC08IAA11	GA78229 x GA78247	24/09/08	BB26	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 26/09/08
ZC08IAA12	GA78226 x GA78219	25/09/08	AM05	ENB	*Hibiscus tiliaceus*	Abandoned after completion 06/10/08
ZC08IAA13	GA78238 x GA78240	25/09/08	AQ06	ENB	*Ficus rubra*	Abandoned after completion 06/10/08
ZC08IAA15	GA78243 x GA78249	30/09/08	BC28	ENB	*Hilsenbergia petiolaris*	Abandoned after completion 13/10/08
ZC08IAA16	GA78229 x GA78247	30/09/08	BD25	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 01/10/08
ZC08IAA17	GA78229 x GA78247	01/10/08	BC25	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 03/10/08
ZC08IAA18	GA78252 x GA78245	03/10/08	AU29	ENB	*Tarenna borbonica*	Abandoned after completion 17/10/08
ZC08IAA19	GA78229 x GA78247	03/10/08	BA26	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 06/10/08
ZC08IAA20	GA78238 x GA78240	06/10/08	AR06	ENB	*Ilsenbergia petiolaris*	Abandoned before completion 08/10/08
ZC08IAA21	GA78229 x GA78247	06/10/08	BC25	LNB	*Hilsenbergia petiolaris*	Abandoned after completion 11/10/08
ZC08IAA22	GA78226 x GA78219	07/10/08	AM05	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 10/10/08
ZC08IAA23	GA78254 x GA78249	07/10/08	AZ04	LNB	*Diospyros ergrettarum*	Failed during Incubation 20/10/08
ZC08IAA24	GA78238 x GA78240	08/10/08	AR05	ENB	*Hilsenbergia petiolaris*	Abandoned before completion 10/10/08
ZC08IAA25	GA78226 x GA78219	10/10/08	AM08	ENB	*Ficus rubra*	Failed during Incubation 24/10/08
ZC08IAA26	GA78238 x GA78240	10/10/08	AR06	ENB	*Hilsenbergia petiolaris*	Abandoned after completion 15/10/08
ZC08IAA27	GA78229 x GA78247	11/10/08	BC27	ENB	*Hilsenbergia petiolaris*	Failed during incubation 22/10/08
ZC08IAA28	GA78243 x GA78239	13/10/08	BC28	LNB	*Hilsenbergia petiolris*	Nest successfully fledged two chicks GA78236 and GA78235 10/11/08

ZC08IAA29	GA78238 x GA78240	15/10/08	AQ06	ENB	*Ficus rubra*	Abandoned before completion 16/10/08
ZC08IAA30	GA78252 x GA78245	17/10/08	AQ25	ENB	*Hilsenbergia petiolaris*	Failed during incubation 23/10/08
ZC08IAA31	GA78238 x GA78240	21/10/08	AT07	INC?	*Hilsenbergia petiolaris*	Failed during incubation 29/10/08
ZC08IAA32	GA78229 x GA78219	24/10/08	AM05	ENB	*Hilsenbergia petiolaris*	Abandoned after completion 30/10/08
ZC081AA33	GA78254 x GA78249	28/10/08	AZ02	LNB	*Hibiscus tiliaceus*	Abandoned after completion 05/11/08
ZC08IAA34	GA78238 x GA78240	30/10/08		ENB	*Hilsenbergia petiolaris*	Abandoned before completion 04/11/08
ZC08IAA35	GA78238 x GA78240	04/11/08	AS06	LNB	*Ficus*	Abandoned after completion 05/11/08
ZC08IAA36	GA78254 x GA78249	05/11/08	AZ01	ENB	*Hibiscus tiliaceus*	Nest successfully fledged two chicks GA78233 and GA78267 on 16/12/08
ZC08IAA37	GA78226 x GA78219	10/11/08	AL06	ENB	*Hibiscus tiliaceus*	Abandoned before completion 11/11/08
ZC08IAA38	GA78238 x GA78240	07/11/08	AQ06	ENB	*Ficus rubra*	Failed during incubation 13/11/08 paired re-laid but also failed during incubation 24/11/08
ZC08IAA39	GA78226 x GA78219	10/11/08	AL06	LNB	*Hibiscus tiliaceus*	Failed during Brood 10/12/08.
ZC08IAA40	GA78229 x GA78247	12/11/08	BC26	LNB	*Hilsenbergia petiolaris*	Abandoned after completion 28/11/08
ZC08IAA41	GA78252 x G78245	12/11/08	AX17	ENB	*Hilsenbergia petiolaris*	Failed during incubation 28/11/08
ZC08IAA42	GA78229 x GA78247	17/11/08	BC27	ENB	*Diospyros ergrettarum*	Failed during incubation 05/12/08
ZC08IAA43	GA78254 x GA78249	25/11/08	AR04	ENB	*Hilsenbergia petiolaris*	Failed during incubation 21/12/08
ZC08IAA44	GA78243 x GA78239	04/12/08	BC28	LINING	*Diospyros ergrettarum*	Failed during brood 27/12/08
ZC08IAA45	GA78229 x GA78247	05/12/08	BB26	ENB	*Ficus reflexa*	Failed during incubation 22/12/08
ZC08IAA46	GA78226 x GA78219	10/12/08	AM06	ENB	*Hibiscus tiliaceus*	Failed during brood 29/12/08
ZC08IAA47	GA78238 x GA78240	15.12.08	AS06	ENB	*Hilsenbergia petiolaris*	Failed during incubation 22/12/08
ZC08IAA48	GA78254 x GA78249	21/12/08	AS02	LNB	*Hilsenbergia petiolaris*	Abandoned before completion 30/12/08

ZC08IAA49	GA78229 x GA78247	24/12/08	BC27	ENB	*Tarenna borbonica*	Abandoned before completion24/12/08
ZC08IAA50	GA78229 x GA78247	24/12/08	BC27	ENB	*Diospyros ergrettarum*	Abandoned before completion 27/12/08
ZC08IAA51	GA78243 x GA78239	27/12/08	BC30	ENB	*Ficus reflexa*	Abandoned after completion 06/01/09
ZC08IAA52	GA78238 x GA78240	30/12/08	AS02	ENB	*Hibiscus tiliaceus*	Abandoned before completion 10/01/09
ZC09IAA01	GA78226 x GA78219	04/01/09	AL06	LNB	*Hibiscus tiliaceus*	Failed during brood 26/01/09. Chick day 10-11 found dead on nest. No clear signs of death
ZC09IAA02	GA78229 x GA78247	06/01/09	BC26	LAY / INC	*Hilsenbergia petiolaris*	Successfully fledged one chick GA78268 20/01/09
ZC09IAA03	GA78243 x GA78239	06/01/09	BC28	ENB	*Diospyros ergrettarum*	Abandoned before completion 07/01/09
ZC09IAA04	GA78254 x GA78249	13/01/09	AY02	ENB	*Hibiscus tiliaceus*	Nest failed on day of hatch. Chick was attacked by ants and had be euthanised 01/02/09

All birds suspected to be paired are closely monitored for signs of nesting behaviour such as increased territoriality, nest prospecting and collecting nest material. Once found, nests are watched on a daily basis to determine the stage. When incubation is observed (a bird remaining on the nest for at least ten minutes and a 'change over' seen between the pair) the nest is accessed (if possible) for confirmation and clutch size. The nests are then accessed again on day 10 of incubation when 5% Carbaryl powder is applied. This is used to eradicate all nest fly larvae and mites in the nest which could harm young chicks. When the adults are seen to exhibit feeding behaviours (perching on the rim of the nest and 'bobbing') the nests are accessed again. This is also done for stage confirmation and brood size. On day four chick the nests are accessed and the chicks are weighed. This allows a comparison between parent reared chicks and those hand- reared at GDEWS. We monitor chick development incase nest management is needed. On day 10 the nests are accessed a final time to ring all chicks. They are issued with a metal identification ring and an individual colour band combination. This enables future identification to monitor survival and breeding behaviour of individual birds. See Part Two for full description of nest outcome terms used. No predator control is applied on Ile aux Aigrettes as there no mammalian predators.

Nest failure and Nesting Cameras

Confirming reasons for nest failure is difficult without witnessing the event itself. Attempting to manage the problem of failure without knowing the true cause can often lead to unnecessary or miss-directed efforts. Knowing the true cause of failure will enable the development of a suitable management plan that effectively targets the real source of the problem.

During this season a nesting camera was set up on selected nests to observe brooding and incubation. The nesting camera was loaned to the Mauritius Olive White-Eye Project by the Royal Society for the Protection of Birds (RSPB). The nesting camera consisted of a small camera attached to an adjustable copper rod, the cable from the camera extended down to a water proof control box. The box contained a data recording unit which recorded images using a memory card and a timer for the infra red lights. Through the clear lid three LED lights are visible; one indicates the power supply, one that the camera is on standby and one which switches on and off when the camera is recording. A cable also runs from the control box down to a 12V battery which powers the system. Adaptations have been made to the camera to make it more efficient on power and memory. Attached to the camera are motion sensors which activate recording when movement occurs in the chosen area (usually on the clutch or nest cup). This reduced the amount of unusable data reducing analysing time. As well as this the camera has infrared lights in order to record images during the night. The memory cards used enable minimal disturbance to the nest. The box can be situated metres away and cards easily switched. As well as this the memory cards are programmed with the recording settings and allow alterations to be made to image quality, motion sensor activation perimeter, time delay between activation and image recording and much more. The whole system is designed for outdoor use so can be left in place during all weather conditions.

The camera was applied to two nests. In both cases it was positioned onto a branch separate from the nest which prevented disturbance to the clutch. The camera was attached using malleable wire which allowed manoeuvrability with the positioning and stability. The first nest monitored was ZC08IAA36. The nest had reached brood and was easily accessible. The camera was successfully applied and recording commenced (Figure 4.1). The foliage around the nest was moved in order for a clear view of the nest cup and the chicks though this unfortunately exposed it to direct sunlight. Due to the young age of the chicks with a lack of plumage and the intensity of the sun it was decided to remove the camera so not to jeopardise the clutch. They proceeded to fledge and provisioning rates were taken from daily nest observations.

Figure 4.1 Nesting Camera setup on nest ZC08IAA36. The camera is positioned above the nest which is hidden within the foliage of a *Hibiscus tilaceus* (Photo: Gwen Maggs)

The second nest monitored was ZC08IAA43. This nest was monitored during incubation. The nest camera was setup and recording commenced. The camera remained setup until the nest was finished so not to disrupt the nest a second time. Unfortunately the nest failed during incubation. When the memory cards were retrieved from the camera following the initial 24 hours of recording a problem was encountered. The images recorded onto the cards were reported as corrupt and unable to be viewed. On enquiry it was revealed that the batteries which were used were not outputting at a high enough Amp so the images were not being recorded properly. This problem hasn't been encountered with the system since 2006 and is avoided by using highly charged batteries. The batteries obtained for the monitoring on Ile aux Aigrettes were brand new maintenance free sealed batteries. The batteries were not used until they were applied to nest ZC08IAA36. Following only a few hours of use one battery was empty and the other (which had not even been used) was also indicating low charge. The problems encountered were not the fault of the camera system but that of the batteries. Following the effort made to obtain the camera and the effort put into obtaining the batteries and putting it all in place it was very unfortunate not to gain any images. Following the failure of the second nest it was too late to attempt anymore nests as the season was coming to an end.

This is the first attempt made on the passerine team to use cameras to monitor nesting behaviour. The nest cameras are designed for ground birds so it is unsure whether any images would have been gained as the trees can move considerably and images may have been taken of the surrounding environment instead of the nest itself. The techniques used when setting up the equipment were successful and caused little stress to the birds. The brooding pair at nest ZC08IAA36 continued to visit the nest and feed the chicks even when we were close to the nesting site. The incubating pair defended nest ZC08IAA43 considerably, this is seen when accessing to confirm incubation and when applying Carbaryl so was of little worry. The application of the camera was quick and unproblematic. The only

problem with the whole procedure was the battery performance. In the future a reliable source would be found and experienced advice needed into the most appropriate power source for the equipment in use.

Aside from the nesting camera, observations were made this season of potential nest predators. The Mauritius Fody has been seen to a potential cause for nest failure during incubation. Predation from Mauritius Fody's was also seen in 2007/08 when three clutches were suspected of predation. Another major threat identified this season is the Common Mynah *Acridotheres tristis.* The Mynar has been seen to predate Mauritius Fody nests at chick stage and are suspected of waiting until nests reach brood before predating. To combat this, Mynar nesting boxes have been set-up on Ile aux Aigrettes. This coming season Mynar predator control will start to try and reduce the numbers on the islet during the Passerine breeding season. The Mauritius Fody cannot be controlled though the success of three nests this season indicates that the Olive White-Eye can breed alongside the Mauritius Fody and as Olive White-Eye numbers increase the high density of Mauritius Fody will have less of an effect on the nesting success.

Pairs

This season six breeding pairs and nine suspected pairs of Mauritius Olive White-Eye have been monitored on Ile aux Aigrettes. At the end of the reporting period (March 2009) there are three breeding pairs and four suspected pairs. GPS waypoints have been taken for each breeding pair at observed territory limits to create a territory map (Figure 4.1). The average size of the territories on Ile aux Aigrettes is averaged at 0.73 hectares (STDEV= 0.19, n=6). This is larger than that calculated for the wild pairs monitored during this season at Combo, they averaged at 0.44 hectares (STDEV= 0.22, n=11). The average size of territories calculated on Ile aux Aigrettes were calculated using sightings taken throughout the year. Points taken only during the breeding period could indicate a more accurate territory size and would be more comparable with those of Combo, as we do not monitor the wild population out of the breeding season. Using the average territory size calculated on Ile aux Aigrette during 2008/09 Ile aux Aigrettes could support 35-36 pairs, 70-72 individual birds. If the average sizes of territories at Combo (which are taken only in the breeding period) are applied to Ile aux Aigrettes then the carry capacity of the islet is higher at 59 pairs, 118 individuals (though this is not an accurate comparison due to varying factors between the sights). Factors influencing territory formation could vary between Ile aux Aigrettes and Combo. Continuing the close monitoring of habitat use by both populations in future seasons will help in identifying these and predicting a more accurate carry capacity of Olive White-Eyes on Ile aux Aigrettes. All pairings recorded this season and a summary of their behaviour, nesting and nest management is as follows:

Breeding Pairs - Pairs that have built nests and laid eggs

♂GA78226 'Hypo' x ♀GA78219 'Petit Pois'

This breeding pair holds a territory around the Warden's house. The pair defend feeding station one at AL06. They are seen feeding and preening around the whole area from AL04 to AJ06 and behind the warden house. They are also seen defending there territory around the bunk house at AN09.

This pair is the only remaining breeding pair from the previous breeding season (2007/08). This season they have had eight nesting attempts all of which where situated

within one grid square of feeding station one. There could be a correlation between the feeding station and chosen nesting sights though further monitoring would be needed in order to prove this. Four of the nests were abandoned (two before completion, two after completion). The remaining four nests all reached clutch stage, one failed during incubation and three hatched. All three nests which hatched contained two eggs but only hatched a single chick. Two chicks were ringed but all failed to fledge.

When the nests were accessed prior to hatch all the nests contained two eggs. After the first two nests only contained one chick the following nest was accessed and the eggs were candled to confirm fertility. Both were fertile but again only one chick hatched. This indicates that the cause is not likely to be infertility. Another possibility could be predation by birds especially the Mauritius Fody. The Mauritius Fody has been seen to predate eggs from nests (*pers obs* Sophie Bell, Pushpa Seepaul) and as this territory is close to the Fody aviaries, they are present in greater number in this part of the island. Despite three nests reaching chick none of the nests successfully fledged. One nest reached day 14 (GA78234) but went missing from the nest and no fledgling was seen with the adults. The second nest failed on day 3 brood and the third (GA78263) was found dead on the nest on day 10. A post mortem was carried out on GA78263 but no clear signs were found to indicate cause of death. Analysis of the samples taken will reveal any causes of death. This pair was also unsuccessful in fledging during the previous season. They had one chick (GA78231) hatch on Ile aux Aigrettes during the 2007/08 season but it died on the nest on day 8. The following nest was rescued and transferred to GDEWS for hand-rearing. The chick was seen to have deformities and stunted growth and died before ringing. The feeding rates for GA78231 were the basis of the breeding management for the 2008/09 season but looking at the attempts this season it could indicate that this pair is incapable of fledgling (see Parental Provisioning Rates p.70). They may experience the same problems as 'Meadow' at Combo whose chicks this season all died during hand-rearing. It is suspected that certain pair combinations are unable to produce healthy chicks which could indicate that either one or both birds in 'Meadow' pair have changed since last season based on their previous success in 2007/08.

Close monitoring of this pair and all the nesting attempts will be carried out in the coming season. All eggs will be candled and blood smears will be taken from the chicks to identify if blood parasites could cause the death of the chicks. Based on the success of other breeding pairs it would be unlikely that the management techniques used have a negative effect on the breeding success.

♂GA78221 'Josie' & ♀GA78225 'Bass'

This pair was one of the two breeding pairs in the 2007/08 season and was released in 2006/07. They held a territory around the Olive White-Eye release aviary. Following the release in 2007/08 their territory became restricted with the establishment of a new pair. During July the pair went missing. They went missing on exactly the same day so it is suspected that either they died of non-natural causes or they left the island. It is possible that the pair could return to the island following the return of a missing Olive White-Eye pair after five months during this season. Population monitoring enables us to detect the return of birds with very accurate dates if this does arise. Mainland searches will be continued to identify any birds who leave the island.

♂GA78229 'Brooklyn' & ♀GA78247 'Mammatus'

This pair has been seen together since the release of GA78247 in 2007/08 season. GA78229 was a mature male released in 2006/07 season and once paired with GA78247

they established a territory around the Olive White-Eye release aviary. The existing pair in this territory, GA78221 and GA78225 was recorded as missing following this establishment. There territory also expands to feeding stations two, three and four. They strongly defend feeding stations two and four and are suspected of attaching and causing the death of GA78237 in feeding station four in March 2008 following previous observations of aggression between the birds.

This pair was the first to commence breeding this season during September, a month earlier than last season (2007/08). They have had fourteen nesting attempts. Ten nests were abandoned (eight before completion and two after) and the remaining four all reached clutch stage. Out of the four clutches three failed during incubation and one successfully fledged one chick (GA78268). There nest attempts were all concentrated around the Olive White-Eye release aviary at BB27.

♂GA78243 'Tillovich' & ♀GA78239 'Gonzo'

This pair has been seen together since there release in the 2007/08 season. Out of breeding season they are seen in various places on the eastern side of the island though mainly around feeding station six and the Green Canon. During the breeding season there territory restricted and they remained around the sick pigeon aviary at BB29 whilst also visiting feeding station six. There territory borders onto that of GA78229 and GA78247 and they nested within one grid square of each other at times with no physical aggression seen, only aggressive calling and frequent displacement. The line between the territories was very fine reaching within a few meters during the peak season.

They have had five nesting attempts this season. Three were abandoned (one before and two after completion) one failed during brood and one fledged two chicks (GA78235 and GA78236). These birds were the first pair ever to fledge chicks on Ile aux Aigrettes and they succeeded on their first attempt. The other nest which reached brood failed on day 10, when the nest was hanging out of the tree. The nest was not built into the tree securely and following two days of heavy rain it is suspected that the nest fell out of the tree and the chick disappeared. All the nesting attempts for this pair were concentrated around the sick pigeon aviary at BB29. There is nothing observed that indicates the reason for this.

♂ GA78238 'Trickster' & ♀ GA78240 'Elvis'

This pair has been seen together since the disappearance of GA78242 in April 2008. They initially held a territory around the Plant Nursery at AY08 though during the breeding season they moved towards the visitor's centre and warden's house.

They have had twelve nesting attempts this season. Nine nests were abandoned (five before completion and four after) and three reached clutch stage. Unfortunately this pair was unable to hatch any chicks as all the nests that reached incubation failed before the hatch date.

This breeding pair is the first pair to be record to double clutch on a nest. Nest ZC08IAA38 failed at incubation on 13/11/08. It was suspected that the nest was predated after a Mauritius Fody was seen on the nest during a watch the day of failure and egg shell was found on the ground. The nest remained active with the male bringing nesting material and the female bringing feathers. Four days following the failure one egg had been laid. Unfortunately the nest failed on 24/11/08 when the nest was found on the ground, empty. The pair was a young pair from the 2007/08 release and their behaviour could be a result of inexperience. All nests are watched following suspected abandonment/failure for two weeks

or until an alternative nest if found. The close monitoring of nests will continue into next season to observe for any similar behaviour.

All the nesting attempts from this pair were situated between the Visitors centre, the Warden's house and the Pink Pigeon Aviary. Their nesting breeched onto two other territories though little confrontation was seen and no physical aggression was recorded.

♂ GA78252 'Babybell' & ♀ GA78245 'Grand'

This pair was established following the return of GA78252 to the population in September 2008. They were seen in various areas on Ile aux Aigrettes. They were initially seen around AU30, later around AQ25 and finally around feeding station three.

They have had three nesting attempts. One was abandoned after completion and two reached clutch stage. Both nests which reached incubation failed. One of the nests ZC08IAA30 was suspected to have been predation by a male Mauritius Fody. The Mauritius Fody was seen at the nest, GA78252 and GA78245 were defensive but the next day the egg was found in pieces within the nest with the contents in the cup. Plans were made to rescue the nest following the clear signs of threat to the clutch though it is possible that the nest was predated the same day or early the following morning which made us unable to rescue the nest in time.

The three nesting attempts seen from this pair were positioned differently to the other breeding pairs. Their nests were all located in different areas of their territory and not concentrated in one specific place. The nesting attempts moved with their territory movement. Following the third breeding attempt GA78252 went missing again which could indicate that the pair were not an established pair hence their irregular movements and low nesting rate, compared with other pairs. It will be interesting to observe if GA78252 returns for the next breeding season which could indicate dispersal of Olive White-Eyes during the non-breeding season. This would contradict the monogamous behaviour of the Olive White-Eye and indicate the possibility of survival on the mainland.

♂ GA78254 'Square Pants' & ♀ GA78249 'Uvavu'

This pair has been seen together since the disappearance of GA78244 in August 2008 and the return of GA78254 to the population in September 2008. They hold a territory on the West coast of Ile aux Aigrettes and are seen using feeding station five regularly.

This pair has had four nesting attempts this season. One was abandoned after completion and three reached clutch stage. Of the three nests that reached clutch one failed during incubation and two hatched. One clutch successfully fledged two chicks though the other unfortunately failed on day one brood. The chick in nest ZC09IAA04 was discovered in the nest being attacked by small red ants and the adults were not seen visiting the nest. Carbaryl was applied to the nest which successfully eradicated the ants though by this point the chick had been mutilated and the decision was made for it to be euthanized. This was an extremely unfortunate incident though it could not have been predicted or prevented. Close monitoring of nests during hatch day will be carried out next season. It is suspected that the ants were attracted by the membrane on the newly hatched chick. An ant infestation was seen on nest ZC08IAA44, when accessed it was observed that the ants were attempting to remove a damaged egg which was leaking into the nest. On removal of the egg the ants ceased and the remaining egg successfully hatched at a later date. As a preventative, Carbaryl will be applied to all nests on the predicted day of hatch to prevent further ant infestations.

All the nesting attempts for this pair were located in the same area though in the same case as GA78243 and GA78249 there were no signs to indicate the reason for the sight.

This pair is no longer seen together as the male GA78254 is now thought to be paired with GA78240. This is the first case seen where a male has left a female for another following a successful breeding season. GA78240 became available following the disappearance of her male GA78238. If she had not become available it is possible that the re-pairing may not have occurred. Close monitoring of pair formation will be carried out next season to help understand their movements and pair formation.

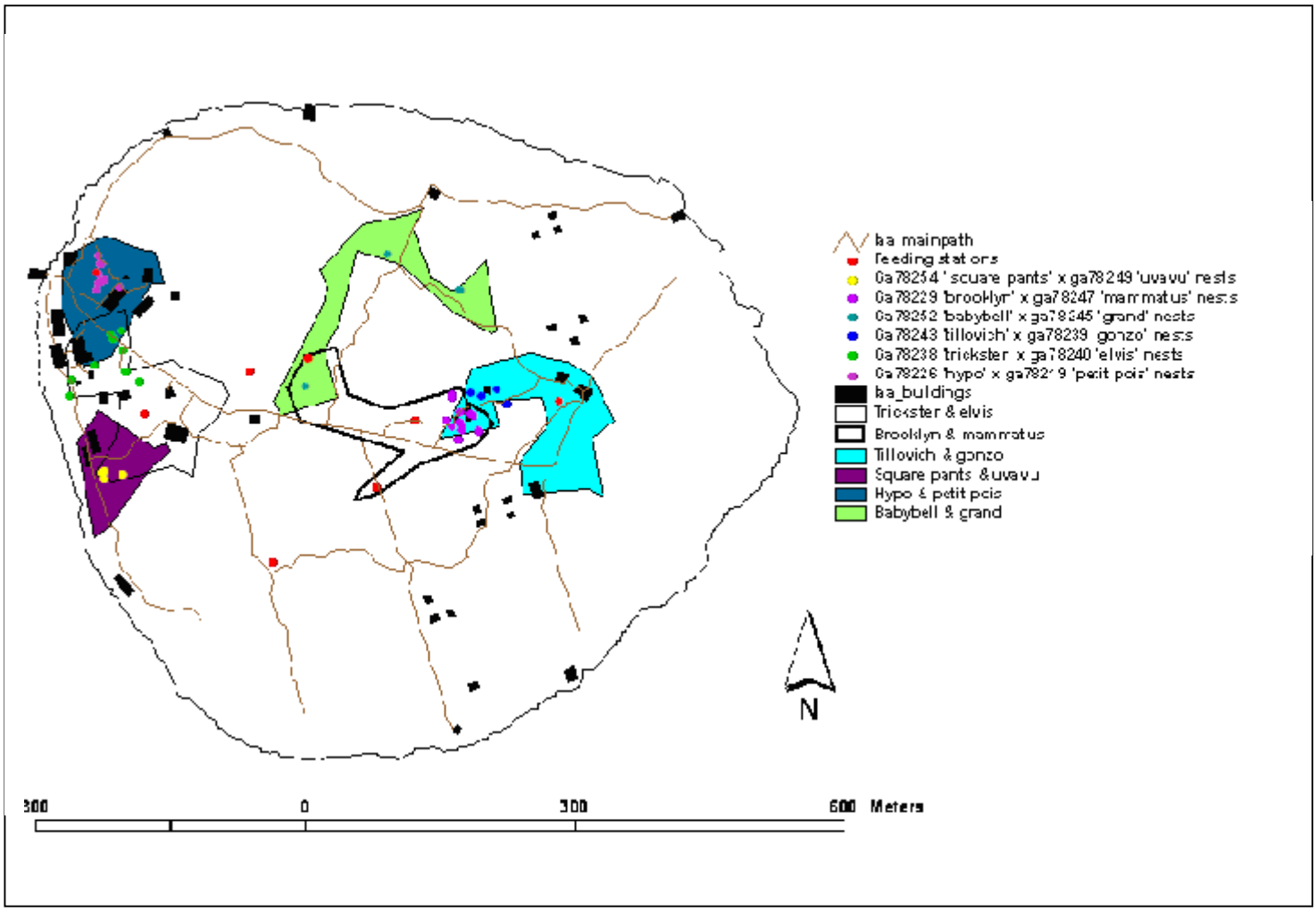


Figure 4.2 Olive white-eye territories monitored on Ile aux Aigrette during the 2008/09 season. Colour blocks show mapped territories, with points indicating nests sights, feeding stations, structures (IAA base map, tracks and building GPS points provided by the Durrell Initiative Reptile Translocation Team, DIRTT)

Suspected Pairs - Pairs that have not yet laid eggs, but defend a territory, may have attempted nest building and are otherwise exclusively seen together.

All of the suspected pairings described below involve both released birds from 2007/08 season and fledglings from this season (2008/09). Three of the pairings were prior to the 2008/09 breeding season and the remaining formed after involving juvenile birds which is why no eggs have been laid. Most newly formed pairs have remained constant since they were formed. Close monitoring of these birds is essential in order to gain information on territory formation, plasticity and first-year breeding. Preliminary observations show that these suspected pairs set up territories that centre or involve a supplementary feeding station. In two cases a feeding station is not situated in their territory though this may be due to dominant pairs defending them, they are however situated bordering the territories of those which do. Suspected pairs from the 2008/09 season are summarised below:

GA78254 'Square Pants' & GA78245 'Grand'

This juvenile pair was seen together from the 02/04/08. They were seen mainly on the North East side of the islet around AT26 and AR30. They haven't been seen to defend a territory and no nesting attempts were seen from this pair. They were no longer seen together following their disappearance at the end of April 2008.

GA78244 'Yawa' & GA78249 'Uvavu'

This juvenile pair was seen together following their release in January 2007. They were observed around feeding station five, the Nursery, the Skink Pit and on the West coast of the islet. This pair was not seen exhibiting any nesting behaviour and were no longer seen together following the disappearance of GA78244 in August 2008.

GA78248 'Nimbus' & GA78237 'Pepito'

This pair formed in February 2008. They held a territory on the Southern side of the islet between BQ29 and BQ23. They were also seen regularly using feeding station four on line 20. They were seen nest prospecting on one occasion but no nesting attempts were found. The pair was no longer seen together following the disappearance of GA78248 in October 2008.

GA78236 'Zissou' & GA78245 'Grand'

Following the fledgling of GA78236 in November 2008 the suspected male was seen exclusively with GA78245 mutually preening around feeding station three. GA78245 an adult female was observed nest prospecting on one occasion though no nesting attempts were found. The pair was no longer seen together from the end of December 2008. There were no signs to indicate why but it is thought that the male had unsettled behaviour due to his juvenility.

GA78236 'Zissou' & GA78267 'Bang Bang'

These juvenile birds have both fledged on Ile aux Aigrettes this season and have been seen together since February 2008. They paired following the fledgling of GA78267 from its parents in January 2008. They have been seen defending a territory around feeding station seven and the neighbouring main path. No nesting behaviour has been seen from this juvenile pair.

GA78233 'Whoopi' & GA78240 'Elvis'

This pair have not been seen exclusively together or seen defending a territory but on 09/02/08 GA78233 was seen copulating with GA78240. No nesting attempt was found and no nesting behaviour was observed. The juvenile male GA78233 would be incapable of reproducing at only two months old. No further observations were made between this pair following the incident.

GA78254 'Square Pants' & GA78240 'Elvis'

GA78254 a mature breeding male was previously paired with GA78249. He has been seen mutually preening and defending a territory with GA78240 since February 2008. The pair is seen actively chasing GA78249 out of the area and are now exclusively seen together. There were no observations made to indicate why GA78254 would leave his female and it is the first account of this behaviour seen in the Olive White-Eye. The previous pair was successful in their breeding attempts and held a strong territory.

Following the disappearance of GA78240's male she was seen socialising with the fledglings and harassing males from other pairs but was not seen pairing with any until GA78254. GA78254 leaving his female could disprove the theory that the Olive White-Eye pairs are loyal and could show that they change pairs following the breeding season. Close monitoring on Ile aux Aigrettes throughout the year will enable us to monitor pairings and determine whether this is the case.

GA78233 'Whoopi' & GA78237 'Pepito'

This pair was seen exclusively together from late February 2008. They were observed at feeding stations three, four and six and also at the top of line 30 around BH30. This pair was seen together until the death of GA78237 in March 2008. No breeding behaviour was observed.

GA78268 'Monster' & GA78235 'Shamrock'

These juvenile birds are both Ile aux Aigrettes fledglings and have been seen together since March 2008. The female GA78235 has been single since fledgling in December 2008 but was not seen to pair even when males were single e.g. GA78233 'Whoopi'. The suspected female paired with the suspected male GA78268 once he had become dependant from his parents and they have been seen together exclusively ever since. It could be thought that a male and female would pair if available but this could show that they can be picky in their choices or competition between same sex single birds is present when pairings take place. Until now no signs of pair formation disputes have been seen but close monitoring will be carried out to understand the social behaviours involved in pair formation of both adult and juvenile birds.

They have been observed on the West coast around the Visitors Centre Kiosk and also at feeding station one. No breeding behaviour has been observed from this juvenile pair.

GA78233 'Whoopi' & GA78245 'Grand'

This pair has been seen together since the death of GA78237 in March 2008. They are seen exclusively together and have been observed defending the area around feeding station three. No nesting behaviour has been seen from this pair.

Evolution of the supplementary feeding method

The supplementary feeding routine for the Olive white-eyes on Ile aux Aigrettes was originally designed using the knowledge learned from keeping captive Olive white-eyes at GDEWS plus the current method used in supplementary food provision of Mauritius Fody on Ile aux Aigrettes (see Cole *et al.*, 2007). The supplementary food for Olive white-eyes comprised of nectar, fresh fruit and insectivorous mix.

Nectar solution is prepared from the powdered formula Avesnectar®. This is given to birds in a dripper-style nectar feeder. The birds are given soft, sweet, juicy fruits such as papaya, melon, and mango. Grapes are always provided, as the birds show preference for grapes. All fruit is cut into 3cm cubes, grapes are halved in order to make the juice and soft parts accessible to the birds. Insectivorous soft-bill (Witte Molen® Universal Food) mix is combined with finely chopped apple, grated carrot and grated hard-boiled egg. This mixture is prepared daily and provided in porcelain dishes. All of the supplementary food is provided from a metal mesh stand which is submerged in a water dish to eliminate ants from swarming the food and nectar nozzle.

Temperatures in summer on Ile aux Aigrettes frequently exceed 40°C. In these conditions fruit goes gooey and black or dries up, in both cases the food becomes unpalatable and harmful bacteria can grow rapidly. Sugary nectar will ferment or evaporate. In order to prevent this, all supplementary food is replaced twice daily - early morning between 06:00 and 07:00 (depending on sunrise) and early afternoon between 13:00 and 14:00. All food is replaced and clean disinfected equipment is used at each change. Nectar feeders, dishes and other equipment is disinfected by soaking in Virkon® solution for at least 20 minutes. The metal parts of the feeders are sterilised by boiling in water as the metal parts tarnish in the Virkon® solution and nectar can accumulate in the nozzles and on the grater and potentially absorb the Virkon becoming extremely dangerous to the birds. All food preparation equipment is kept clean and separate from other kitchen equipment and all bird food is kept in a designated refrigerator.

Prior to May 2007, supplementary food was given from inside the release aviaries at BB27 (see description in Cole *et al.*, 2007). Providing food from a single location created a number of problems. Firstly, a young pair of birds (GA78221 x GA78225) had established a territory which centred on the aviaries and were often seen to aggressively defend this area at times and persistently chase away other Olive white-eyes, thus deterring other birds from visiting the aviaries. Secondly, if any other birds were able to enter the aviaries to feed, the dominant pair would chase them within the aviary, often to the ground and prevent them from exiting the aviary. If unable to escape, the targeted bird would become obviously distressed. The discovery of the carcass of GA78230 on the floor of the aviary may suggest that this has lead to fatalities. This method of supplementary feeding did not supply the whole released population with an additional food source and may have had a negative effect on survival. A new method was needed.

An alternative supplementary feeding method was devised in May 2007. This involved providing food at multiple sites over the island, thus catering for all birds. Each site is called a feeding station. Feeding station design was based around our existing knowledge and procedures and was aimed at providing an easily accessible food source for Olive White-Eyes. The design was aimed at excluding other birds, Telfair skinks *Leiolopisma telfairii* and Indian Musk Shrews *Suncus murinus*. The feeding stations consisted of small (60 x 40 x 40cm) wood framed, roofed cages with 1inch² mesh on the outer sides and 1cm² on the base. The outer mesh was designed to exclude other species and the base mesh to prevent

food from falling to the ground and attracting skinks and shrews. Inside the station a mesh partition was erected to attach the nectar so that it is out of reach of birds trying to feed through the mesh. The fruit was spiked on sparse foliage within the feeding station and the insectivorous mix within a dish of water to prevent ants from accessing and swarming the food. Some perching was also attached to the outside as the Olive white-eyes seemed to prefer to perch before going through the mesh. The stations were suspended between trees using wire in order to prevent skinks from accessing them and were hung in shaded forest to allow for some cover from direct sunlight and winds. In some cases, ants invaded a feeding station and covered the fruit and nectar feeder, often blocking the nozzle. Greasing the supporting wires was ineffective. To combat this wire stands were placed in the water trays. Paint was applied to protect the stand from rust and enable regular effective cleaning. The food dish is used to weight it down. The fruit and nectar feeder were fixed to this stand and therefore all of the food was protected by the water tray (Figure 4.3). All new feeding station sights were chosen depending on where the Olive White-Eye cohorts were released during the 2007/08 season (excluding the first three positioned in the 2006/07 season).

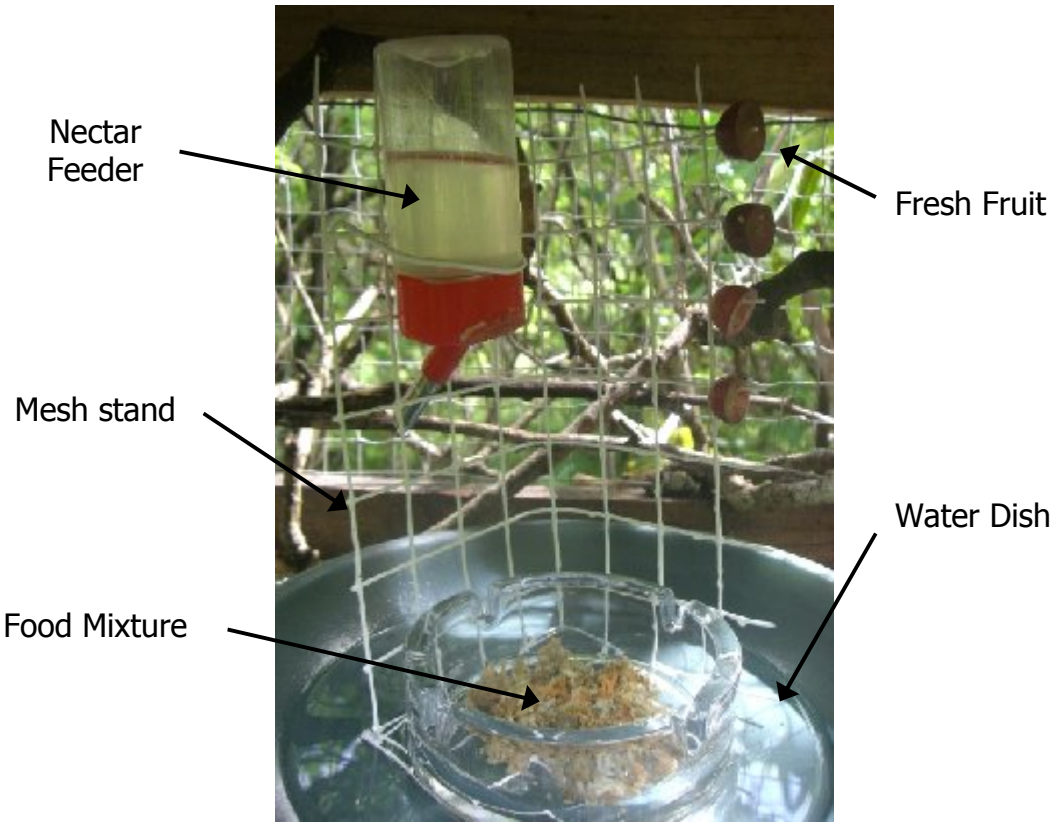


Figure 4.3 Feeding stand within the feeding station, modified to prevent ant infestation (Photo: Gwen Maggs)

During the early months of this season (2008/09) further problems started to arise with the feeding station design. Juvenile Mauritius Fody's began to enter the feeding stations through the 1inch² mesh. Initially they caused no harm and they were not considered as a problem as following maturity they would no longer fit. Unfortunately following this small female Mauritius Fody's also started to enter the feeding stations. Once the female Mauritius Fody's started to enter the stations problems were observed. Mauritius Fody faeces were found within the feeding stations which is a potential disease risk. This season the Mauritius

Fody Project has experienced around six deaths due to unknown causes, it is suspected that they may have died of an unidentified digestive disease. If this is the case the probability of them passing diseases onto the Olive White-Eyes is high. No signs of disease have been seen in the Olive White-Eye (apart from a few cases of Avian Pox) though all potential risks need to be prevented. Additional to the disease risks Mauritius Fody pairs began to defend the feeding stations from all other birds including the Olive White-Eyes preventing them from accessing the supplementary feed. Due to these problems and the complete consumption of the supplementary food in general a new design was devised. The frame design of the stations remained the same with new smaller mesh attached to the outside. A smaller ¾ inch² mesh was fitted to feeding station 1 as a trial in December 2008. The new feeding station was erected in the same sight with excessive perching placed around the outside to allow perching before entry. We timed the change just before the 1-2pm feed so that the birds would be keener to enter. It was clear within the first hour of observations that the mesh was too small. The 1inch² mesh feeding station was re-erected and modifications made to the new design. The ¾ inch² mesh holes where widened and rounded on each side (excluding the side with the entrance hatch) (see Figure 4.4). On the second attempt one of the Olive White-Eyes known to use the feeding station was seen to enter and exit through the widened holes with little resistance. No permanent change was made until all Olive White-Eyes known to use the feeding station had been seen to enter and exit with ease. It is imperative that the feeding stations are well perched in and outside the mesh (Figure 4.4) and that the stations are not left in place until all known Olive White-Eye visitors are seen using it. In the following 3 months all the feeding stations were changed over with few problems. One female Olive White-Eye, GA78239, was seen entering the feeding station but was repeatedly found inside. On approach to release her she would fly out of the mesh showing that she was able to do so. This feeding station is still under close observation until GA78239 is seen using it confidently. During the feeding station modifications some of the new stations were fitted with ¾ inch² mesh on the base instead of the 1cm² mesh. This still creates a barrier to the Mauritius Fody's though allows more food to fall through potentially attracting Indian Musk Shrews and Telfair Skinks.

Figure 4.4 Modified Feeding Station designed to exclude the Mauritius Fody (Photo: Gwen Maggs)

Following the evacuation of the Mauritius Fody, in February 2008 Mauche Jaune's began to feed on the fruit placed within the feeding stations. An effective technique was devised using a candle flame to burn the wasps in the event that they didn't leave following disturbance. Although this method may seem extreme if not removed they would return and it was predicted that numbers could potentially increase. This problem is in correlation with the Mauche Jaune season and will hopefully cease once they have commenced hibernation around May time. The Mauche Jeune's haven't shown to directly effect the Olive White-Eyes.

During March 2009 one Olive White-Eye, GA78237, was found dead within feeding station four situated at BF19. The body was found during the morning feeds on the bottom on the feeder. Its head was positioned through the ¾ inch² mesh with the body still in the station. From previous observations it is suspected that the bird may have been attacked by the pair which has a territory around the area (GA78229 and GA78247). Although GA78239 was seen using the feeding station on many occasions if it had been attacked by two other birds it may not have been able to escape and become distressed. It was noted in 2006/07 that an Olive White-Eye was found dead on the floor of the release aviary at BB27 following observations of aggressive behaviour between the birds, feeding stations were implemented due to this incident. Alternative causes of death could include disease, though no signs of this were seen prior to the death and nothing was found in the post mortem. If anything the bird was very healthy with large muscle and fat stores. Stress could also be a possibility due to becoming stuck within the feeding station although as previously mentioned GA78239 was perfectly capable of exiting the feeding station. As a result all the feeding stations will be fitted with 1cm² mesh on the base so that birds are unable to get stuck or think that they can escape through the base if they become distressed. Due to the nature of this species it will be difficult to prevent pairs from interacting and defending food sources. It would not be possible to provide feeding stations for all pairs on the island as there are single and juvenile birds which will fly between them and pairs regularly use stations which are not in their territories. One option would be to cease supplementary feeding to reduce pair interaction but without clear knowledge of the Olive White-Eyes dependence on the food it could cause more fatalities in the long run. Close observations will be carried out on the feeding station sights and behaviours exhibited between the birds so further alterations can be made if problems persist.

New birds are trained to pass through the mesh and use the feeding stations whilst in initial captivity on the island, prior to release (see release methodology). The feeding stations have proven effective and there are currently eight in use over the island. All birds regularly use the stations and they therefore provide a means of gaining daily sightings of birds and maintaining an accurate measure of survival. The locations of the eight feeding stations and the dates each was implemented and changed for modified versions are as follows:

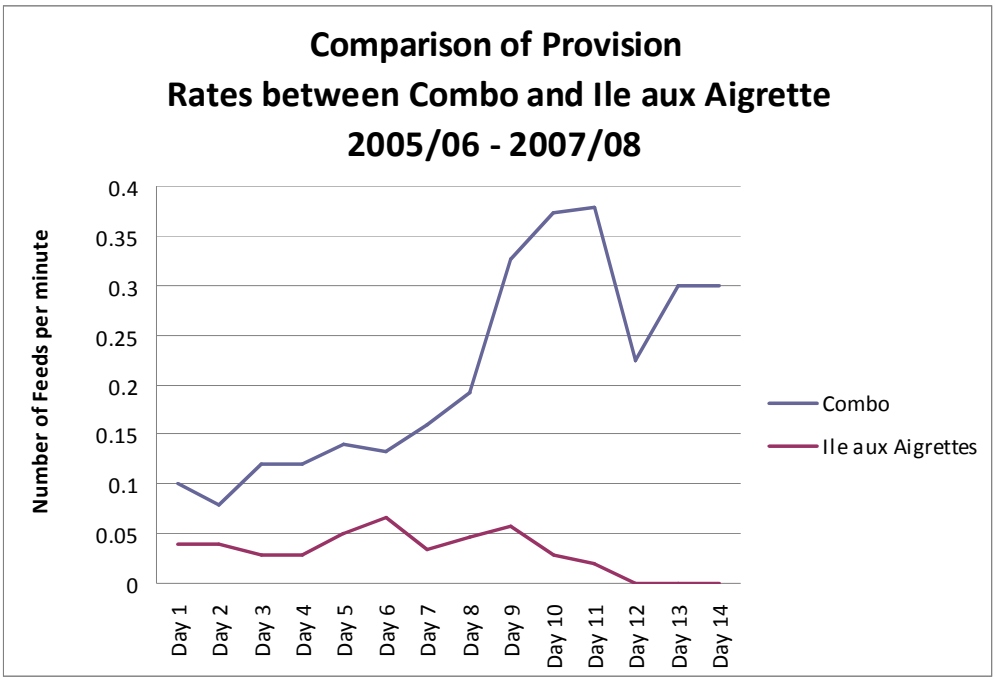
Feeding Station 1: implemented 29/05/07 at AL06, modified Nov 2008
Feeding Station 2: implemented 29/05/07 at BC27, modified Feb 2009
Feeding Station 3: implemented 29/05/07, relocated 13/12/07, modified Nov 2008
Feeding Station 4: implemented 04/12/07 at BF19, modified Feb 2009
Feeding Station 5: implemented 04/12/07 at AV06, modified Nov 2008
Feeding Station 6: implemented 22/12/07 at BD33, modification currently in process
Feeding Station 7: implemented 12/01/08 at AV14, modified Dec 2008
Feeding Station 8: implemented 26/02/09 at BH11, modified March 2009

The supplementary feeding techniques in use have been refined over the past two seasons. The stations used at present are still under trial and any modifications required will be carried out in the coming season to increase the safety and efficiency.

Parental Provisioning Rates

During the 2007/08 season the breeding attempts of two Olive White-Eye pairs were monitored on Ile aux Aigrette. This was the first breeding season for these pairs and both were seen to have numerous attempts. Unfortunately none of the nesting attempts resulted in any offspring fledging. Out of the 20 nesting attempts found during the 2007/08 season only three reached chick and out of these only two reached ringing age (~10 days). The first chick to reach ringing age, chick GA78231, was of a healthy weight and size but died before fledging. The reason for this was unknown although it was suspected that blood parasites were the cause due to the healthy appearance and sudden unexpected death. The second chick ringed, GA78232, was seen to be under weight and looked underdeveloped (*pers. comm*. Amanda Ladkoo, Hand rearing coordinator) and later failed to fledge, the reason unknown. Due to the underweight appearance and low fitness of the two chicks it was suggested that there may be a low abundance of food on the island for the pairs to sufficiently feed their young (*pers. comm*. Dr. Carl Jones).

To assess whether a low insect diversity is affecting the food availability for the Mauritius Olive White-Eye the provisioning rates from all the nests found between 2005/06 and 2007/08 seasons from both the wild population and released population, which reached this stage, were compared (Graph 4.1).



Graph 4.1 Provisioning rates from the wild population at Combo compared with the released population on Ile aux Aigrettes between 2005/06 and 2007/08 season.

After comparing the feeding rates it is clear that there is a distinctive difference between the two populations, and this could be caused by a number of reasons. The pair in question (GA78221 and GA78225) was released onto Ile aux Aigrette during the 2006/07 season and so the 2007/08 season was their first at breeding age. As a result their first nesting attempts were regularly abandoned before completion and when they reached incubation or brood they were predated although there was a clear improvement in their ability with every attempt. The fact that they almost fledged a chick at the end of the season may indicate that their first season is a learning curve. A major factor could also be food availability as suggested, as it would seem they aren't providing the same amount of food as the pairs are at combo. Again this could be due to the inexperience of the pair or the lack of resources.

Any possible hindrance in the breeding success of the Olive White-Eye must be addressed so this season techniques were used to increase invert availability to brooding pairs. The Mauritius Olive White-Eye unlike some Passerines does not have a crop and therefore have to feed their chicks fresh food. Behavioural observations of wild birds in past seasons have shown that brooding pairs fly catch to feed their chicks. Fruit Fly cultures were decided as an appropriate food source to provide brooding pairs. Various techniques were trialed in order to identify the most productive and effective methods. Fruit Flies are already present on the island and the aim was to increase their densities in areas were the brooding adults would be present. Four techniques were devised.

The first attempt used one litre pots. Holes were made in the base to allow any fluids to drain, in the sides to allow the entrance and exit of Fruit Flies and a lid was placed on top to prevent rain and birds form entering. The pots were hung at all the feeding stations from branches using wire. The wires were coated in grease to prevent ants from accessing the pot. A mixture of papaya, banana and oats was placed within each pot and they were left to be colonized (Figure 4.5). Within twenty-four hours the pots were swarmed with fruit flies. The pots were maintained weekly when half the contents would be emptied and replaced with fresh mixture. Removing all the contents would remove all the fruit fly eggs present and be counteractive. Leaving half allowed them to hatch and colonize the new half.

Figure 4.5 One litre Fruit Fly Culture hung from branches within the middle canopy at all feeding station sites (Photo by: Gwen Maggs)

Although the pots were successful in attracting and producing fruit flies the inverts would remain inside the pots and only disperse when knocked. It is unlikely that the Olive White-Eyes would use the inverts unless they are available within the environment so it was decided to increase the size of the cultures to increase the numbers outside of the pots. Two more cultures were designed aimed to create 'clouds' of fruit flies within the territories of the brooding pairs. The first were twenty litre cultures. These were of the same design as the

one litre cultures just on a bigger scale and hung within the nesting areas of the territories instead of at feeding stations. By hanging the cultures within the territories the fruit flies would be more abundant within the birds foraging area. The second design was using a one hundred and ten litre bin. The bin was designed to be portable in order to increase the invert densities in specific areas of the forest. The design was based on the original one litre culture with holes around the side on the bin and a firm lid placed on top. This large culture was not hung from trees due to its size but remained on the ground. To prevent the culture being infested with ants the bin was placed in a water dish. Standing water is avoided on Ile aux Aigrettes as birds can drown in it and it can also spread various avian diseases. As a preventative wire mesh was placed over the water to stop anything accessing it. Due to the bin being submerged in water holes were not made in the base instead the fruit mix was placed in two mesh baskets which could be removed and rotated weekly when new mix is added (Figure 4.6).

Figure 4.6 One hundred and ten litre Fruit Fly Culture designed for large production and portability (Photo by: Sarah Lovibond)

Unlike the one litre culture, which colonised over night, the two larger designs took longer to establish. The mixture inside was renewed weekly as with the smaller cultures but the larger cultures did not colonise as thought. It was predicted that by increasing the size of the cultures the fruit fly populations would also increase but this was not the case. It appeared that the cultures were far more efficient at a smaller size and as the culture increased the population would reach its carrying capacity and remain constant.

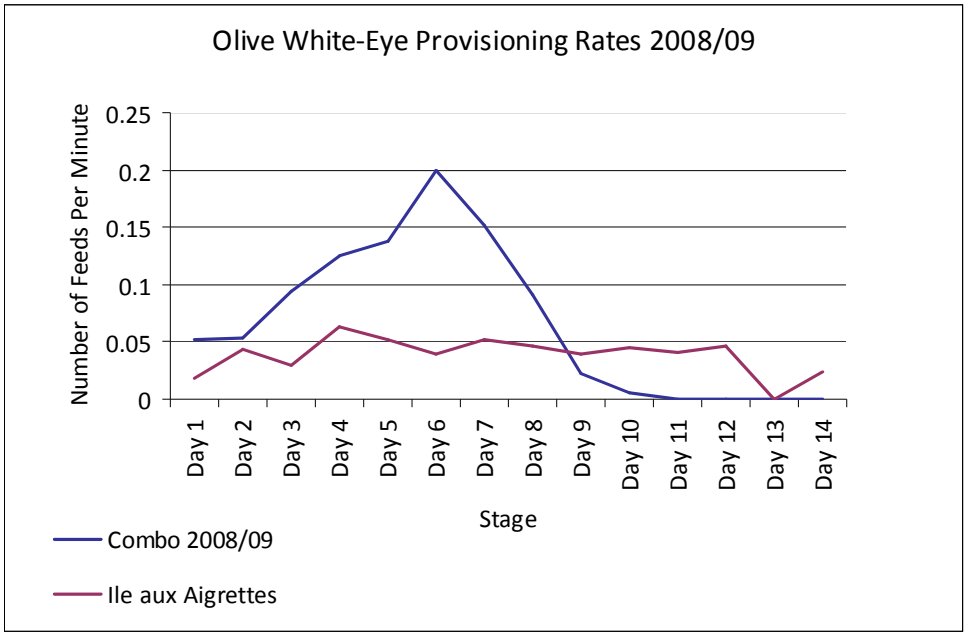
Following the low productivity of the larger cultures a smaller design was created. This was devised to bring the fruit flies into direct contact with the Olive White-Eye. The easiest way of achieving this was by placing cultures inside the feeding stations were they are known to visit regularly. Fruit Flies are already found within the feeding stations on the fresh fruit provided but in small numbers. To encourage the presence of the Fruit Flies small mesh baskets were placed on the wire mesh stand alongside the supplementary feed (Figure 4.7). These were filled with papaya, banana and grapes. No oats were added as the baskets were small and the sticky mixture would create hygiene risks within the stations. The fruit

was replaced on a more regular basis as its exposure caused it to become dried and less attractive to the flies. It was not designed to create breeding cultures but to merely attract large numbers and allow the Olive White-Eyes to peck or glean the inverts from the fruit and surrounding environment to feed the chicks.

Figure 4.7 Basket Fruit Fly culture placed within all feeding stations in order to increase invert availability (Photo by: Gwen Maggs)

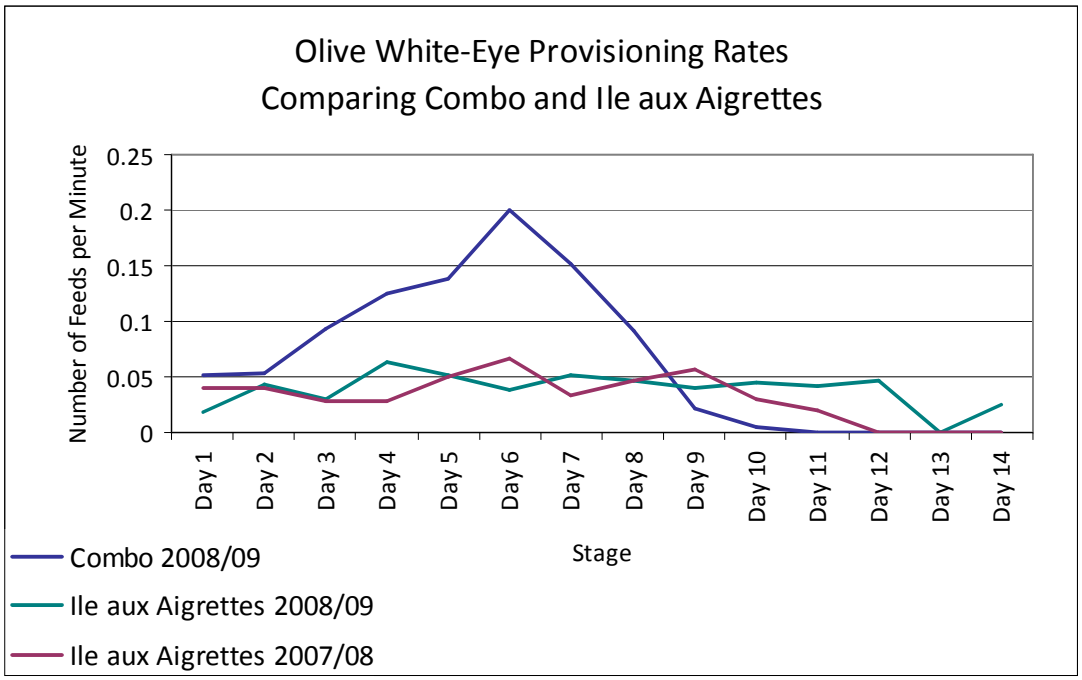
Of all the Fruit Fly cultures the smaller designs were the most effective. The larger designs although contained a lot more surface area could not produce the numbers desired and required a lot more work when preparing the mix and distributing it throughout the cultures. The smaller cultures were far more productive and were easily maintained.

The breeding attempts of this season were far more successful than the previous season with three pairs producing five fledglings. All the chicks were weighed on day four in order to compare their weights with those that have been hand reared in past seasons. All the chicks were the average weight and some were even above average. None of the brooding adults were seen to use the fruit fly cultures though this was only based on field records so they could have been used without observation. All the nests which reached brood this season were monitored and provisioning rates were recorded and compared with both the wild population (Graph 4.2) and those taken from Ile aux Aigrettes last season (Graph 4.3).



Graph 4.2 A comparison of the provisioning rates from the wild population at Combo and the released population on Ile aux Aigrettes in the 2008/09 season

During this season focus was put in to collecting the provisioning rates of broods from both Olive White-Eye populations. In total eight nests were monitored on Ile aux Aigrettes and six nests at Combo. When plotting the data the results are similar to those in Graph 4.1. The feeding rates at Combo appear greater than those on the Ile aux Aigrettes although the island rates are far more constant. In order to see the effect of the Fruit Fly cultures the feeding rates on Ile aux Aigrettes collected in the 2007/08 season were also plotted (Graph 4.3).



Graph 4.3 Comparing the provisioning rates from Ile aux Aigrettes in both breeding seasons (2007/08 and 2008/09) and Combo (2008/09)

With the increase in invert abundance and availability on Ile aux Aigrettes it could be predicted that the feeding rates would have increased though when looking at the results (Graph 4.3) this is not the case. The provisioning rates on Ile aux Aigrettes in both seasons appear to follow a similar rate and Combo remains higher. There are various factors which could have affected both the breeding success of the previous season (2007/08) on Ile aux Aigrettes and the increased provisioning rates in the wild population.

Provisioning rates obtained for all the nests are done so through daily observations. The average heights of the nests at Combo this season were 7.5m were as those on Ile aux Aigrettes averaged at 3m. This difference even with the use of binoculars means that a lot of observations have to be made through behaviours observed. It could be possible that the observations made at Combo exaggerated the number of feeds actually given to the chicks and therefore the feeding rates could be far lower than indicated.

In 2007/08 the provisioning rates on Ile aux Aigrettes were based upon just one nest from GA78226 and GA78219. This was the first breeding season for this pair. The one chick which reached ringing age was recorded as healthy with no signs of an underweight or underdeveloped appearance though was unsuccessful in fledging. Another chick from the pair was rescued during incubation for hand rearing but also died during brood. The fact that the chick, even when hand reared, failed to fledge could indicate that it is not the parent provisioning rates which is the problem. Following observations this season the pair have shown a similar pattern. Out of three clutches which reached brood one failed on day two (following suspected predation) and two reached ringing age. When weighted on day four the chicks were average weight for their age. When ringed it was noticed that the estimated age day was not accurate according to their development. GA78234 was healthy for the day which it appeared to be though it was noted that it was a day younger than estimated (estimations are accurate following weighing on day four). Following this the bird was seen on the nest until day fourteen but failed to fledge. When accessed the nest was empty. The other chick ringed GA78263 died two days after ringing, a post mortem revealed no obvious cause though it was noted that the chick did not look bigger than when it was ringed. The provisioning rates for this pair when compared to the successful nests from this season are at a similar frequency yet the chicks were still unable to survive. It is suspected that the problem is not with the pair's behaviour but with the chicks themselves. This season during hand rearing at the Gerald Durrell Endemic Wildlife Sanctuary (GDEWS) problems were encountered with the rearing of chicks from a specific wild pair (see Part Three). All the chicks which were reared at the sanctuary from this pair began healthy though after time their growth and development ceased and none successfully fledged. This is similar to what is being seen with GA78226 and GA78219 on Ile aux Aigrettes.

It is very difficult to gain accurate results from such small sample sizes but they can provide a guideline for management. Following the successful fledgling of chicks on Ile aux Aigrettes this season it would show that the provisioning rates on Ile aux Aigrettes are more accurate than those from Combo. This could be due to additional invert availability or that the initial comparison was unreliable following further observations this season.

Close monitoring of both the wild and released populations will continue in the coming season to create more reliable comparisons in order to design more accurate management techniques. The most effective method of contact between the fruit flies the Olive White-eye was through the small baskets within the feeding stations. These were highly successful in

attracting fruit flies. The other one litre cultures which were positioned within two metres of the feeding stations would have helped increase the number of flies available for the baskets though not as effective at enabling contact. In the coming season small baskets will be applied to the feeding stations during the breeding period and if the numbers of fruit flies are low one litre pots will be applied to increase the invert densities.

Evolution of Release method

The semi-soft release techniques used for the trial release of Mauritius Olive White-eyes to Ile aux Aigrettes in 2006/07 were adapted in 2007/08 in response to territorial behaviour and the change in the supplementary feeding procedure and establishment of feeding stations. The techniques used this season (2008/09) were the same used in 2007/08 though modified to deal with the low number of hand-reared birds. The transfer, captivity and release of birds are described as follows:

Transferring to Ile aux Aigrettes as Fledglings

This season the number of Olive White-Eyes hand-reared was extremely low. Due to this modifications were made to the transfer techniques to account for the imprinted behaviour of GA78270. This behaviour is thought to have been caused by the lack of socialisation between GA78270 and other Olive White-Eyes during the critical developing stages when fledgling. It was decided to transfer GA78270 to Ile aux Aigrette during the weaning stage to try and get the fledgling accustomed to Ile aux Aigrette and other Olive White-Eyes. GA78270 was transferred on 07/01/09 15 days after fledgling. As previously seen in Combo and at GDEWS, Olive White-Eyes take between 2-3 weeks to become weaned and 3-4 weeks before becoming completely independent. GA78270 was transferred to Ile aux Aigrettes by 4WD in a small wooden travelling box, which was perched and loosely foliated. The bird was fed nectar on several occasions during the hour-long journey to remain hydrated. A boat to transfer the birds to the island was pre-arranged and the cage was kept covered throughout the journey in order to keep stress to a minimum. GA78270 was seen to be active and often very vocal throughout transfer and no problems were encountered. All birds are transferred during the morning in order to allow them to settle into the new surroundings during the afternoon.

Captive Care and Training

The purpose built Olive White-eye aviaries are located at grid peg reference BB27. They have two bays thus allowing for two groups of birds to be captive simultaneously. Both aviary bays are accessed via a double-door entrance to aviary one in order to prevent any captive birds from escaping. Both aviaries have a rear storm shelter, which includes a $1m^3$ (approx) cage that is used for catching birds. An aluminium barrier is fitted to the outside perimeter of the aviaries in order to exclude shrews and Telfair Skinks from the aviary. The aviaries are foliated with common native plants found on Ile aux Aigrettes in order to allow the birds to adapt to the change in vegetation and create shelter and shade.

Due to the age of GA78270 when transferred to Ile aux Aigrette, release into the aviary was postponed until the following day and the fledgling was kept in its original fledgling cage to allow for habituation to the new environment. On the following day GA78270 was released into one side of the heavily foliated aviary prepared with nectar solution, a dish of food and plenty of fruit spiked throughout. The food provided to the

fledgling differed from that given within feeding stations. A mixture of scrambled egg and insectivorous mix was given and mixed with nectar when feed to create a soft mix. Due to the dependence of the fledgling field staff continued the feeding routine for the bird until it was naturally weaned. Feeding times were kept the same as those at GDEWS (Table 4.3)

Table 4.4 Feeding times for transferred captive reared Mauritius Olive white-eye fledgling

Age (days)	**15-22**	**23-31**
Time of first feed	7:00	7:00
Time of last feed	19:00	19:00
Interval between feeds	2hrs	3hr
Feeds per day	7	5

On 14/01/09 the second aviary was vegetated in preparation to capture GA78237, another Olive White-Eye hand-reared individually and semi-tame. GA78237 was seen on occasion around the release aviary and attempts were made to capture the Olive White-Eye in the aviary using the release hatches. Food was placed inside and a rope attached to the hatch. In the event of GA78237 visiting the aviary the hatch would be opened and closed if the Olive White-Eye entered. The aim was to introduce GA78237 to GA78270 within the aviary to socialise the fledgling with another Olive White-Eye prior to release. Due to the compromised behaviour of GA78237 it was perceived that the older Olive White-Eye would not react in an aggressive manor towards the fledgling. During the attempts GA78237 was unable to be captured so the decision was made to release GA78270 into the whole aviary to allow more area for flight and foraging. All behaviours of GA78270 and any signs of aggression or interaction with other birds outside the aviary were noted.

Prior to release GA78270 was trained to feed from a feeding station setup within the aviary. This was to both familiarise the bird with the feeding station design so the bird would recognise them as a food source and also train it to pass through the small mesh holes. Training commenced once the fledgling was feeding independently. Initially the food was placed in the feeding station with the hatch open to allow GA78270 to become accustomed to entering. Following this watches were carried out when the food was placed near the edge of the mesh within the station and the hatch closed. The nectar was within reach through the mesh to get the bird accustomed to moving through the wire. Slowly the food was moved further away. At this point the bird showed little interest in going into the station. It was noticed that the bird didn't feed on regular occasions and during an hour watch would only feed one to two times. To combat this, a more brutal approach was taken. The food was made out of reach from the beginning, this made the bird more determined to enter. Initial training was carried out with a 1inch² mesh feeding station with the aim to introduce a ¾ inch² station once the initial technique was picked up. GA78270 entered the 1inch² with ease though the newer design appeared more challenging. Due to time restraints the decision was made to release GA78270 with 1inch² and introduce a ¾ inch² mesh station at a later date.

The release cage, set-up and site choice

For the release a fledgling cage was used as the release cage design used in the previous season (2007/08) was thought too big for a temporary structure. The cage was situated centrally in good canopy forest and outside of any known or suspected Olive White-eye territories. A feeding station was hung at the release site, facing the exit door of the cage. Perching and foliage was fixed inside the cage and fresh nectar, fruit and a dish of food put inside prior to introducing the bird to the cage. The feeding station was also set up with food prior to release.

The release site was chosen taking into account various issues. It was requested that a feeding station be placed in an area on Ile aux Aigrette where a new school tour path will be passing in order to increase the chances of seeing an Olive White-Eye. Fortunately the sight which they proposed was not situated within existing Olive White-Eye territories which is the biggest issue as aggressive interactions can severely stress young birds. The release sight was therefore chosen at BH11.

Transferring birds to release cage and release

Suitable weather conditions on the day of release are essential. Birds are not released in persistently windy or wet weather or if a cyclone was forecast to influence the region immediately after release. On the morning of release the bird is fed from within a cage situated at the rear of the aviary – no food is given any where else in the aviary in order to attract the bird into this cage. The cage is set up with a pull-cord so that the bird can be trapped in the cage and hand caught. Once trapped and caught, the bird is put into a cotton bird bag and taken to the release site. The bird is then released from the bag into the prepared release cage. The cage is observed immediately after introducing the bird to it to ensure that they settle and find food. GA78270 was transferred to the release cage on 26/02/09 at 9.50am (the release was postponed due to a cyclone during the beginning weeks of February). The bird was observed feeding as soon as it was released into the cage and swiftly adapted to the change in environment. Observations of alarm calling from the back of the cage were seen though the reason for this is unknown and it didn't appear to affect its general behaviour. After one hour the bird was released. After the release door was opened the bird flew out without hesitation.

GA78270 was followed immediately after release and detailed behavioural observations recorded where possible. Prior to transfer the bird was ringed with a metal identity ring plus a unique combination of plastic colour rings, so that it can be identified.

Part Five

Mauritius Olive white-eye Recovery Project

2009 – 2010

Collecting DNA sample from Olive White-Eye Chick 'Whoopi' GA78233
(Photo by: Kimberley Dawson)

Carl Jones, Vikash Tatayah,
Gwen Maggs and Amanda Ladkoo

The Olive White-eye Recovery Program will continue work into the 2009/10 season with the main focus on intensive management of the upland (Combo) and island (Ile aux Aigrettes) populations of Olive white-eyes with the aim of establishing a breeding population on Ile aux Aigrettes.

Monitoring upland populations of native passerines with intensive management of Mauritius Olive white-eye

Sites: Combo, Black River Gorges National Park (BRGNP)

Monitor the breeding activity of Olive white-eyes at Combo and harvest Olive white-eye nests for incubation and hand rearing. Based on the survival of released birds on Ile aux Aigrettes, rescues/harvests of nests will be selective, with view to maintaining a maximum level of genetic diversity in the Ile aux Aigrettes population. Efforts will therefore be focused on pairs that are underrepresented or not represented in birds on Ile aux Aigrettes. Monitoring will be focused on pairs which have not been rescued previously. Following the movement of pairs of Olive White-Eye on Ile aux Aigrettes it is suspected that pairs could change between seasons. To prevent rescuing from the same pairs without knowledge focus will be made on pairs which are the furthest from the main population. These include Bat Roost, Sugar Cane Pair, Tea Pair and those which have been sighted at Pigeon Wood. By focusing our work on specific pairs and harvesting nests which are accessible we can concentrate the hand rearing period over 2-3 months instead of the whole season. New suspected pairs found in the 2008/09 season will be further investigated in 2009/10 and new areas searched in order to identify new wild pairs for future genetic harvesting. Predator control will be applied to all Olive White-eye nests that reach incubation. Nests will be rescued/harvested at egg stage in order to minimise exposure risk to predation and nest failure, with the aim of rescuing/harvesting approximately six clutches.

Poison grids will be trialled in high risk predation areas to establish the possibility of applying them to all known breeding pair territories.

An extendable telescopic mirror will be used on Olive White-Eye nests in order to identify accurate dates for the start of incubation and brood and also identify when nests have failed in order to reduce the amount of watches needed to positively identify failed nests.

Begin collecting data on habitat use of Olive white-eyes at Combo and expand knowledge on feeding ecology.

Staff:

- Two, consisting of one experienced member of staff and a volunteer between early July and February, with peak workload between September and November.

Monitoring and Intensive Management of lowland populations Mauritius Olive white-eye

Site: Ile aux Aigrettes

Continued year-round population monitoring of the Mauritius Olive white-eye population on Ile aux Aigrettes is required to learn more about this species. Territory formation and breeding success will be monitored very closely next season. All pairs will be closely monitored and all nesting attempts followed in order to develop understanding of the species breeding biology.

Work will continue into maintaining genetic records. All chicks will be ringed and entered into the studbook. When ringed blood samples and blood smears will be taken from the chicks. Blood samples will continue to be collected for DNA records. Blood smears will also be taken from the chicks if possible to enable any identification of blood parasites and level of immunity following the unexpected deaths of chicks during both the 2007/08 and 2008/09 seasons in order to rule out all possibilities.

Releases will be carried out in order to increase genetic diversity in the founding population. Approximately six clutches will be hand-reared with the aim of yielding around 10 birds for release.

Supplementary food provision will be maintained throughout the year in order to aid survival, productivity and ultimately establishment. Any modifications will be made to feeding protocol and feeding stations if required.

Fruit Fly baskets will be applied to all feeding stations during the breeding season in order to increase the availability of inverts to brooding pairs.

Due to the return of birds following prolonged periods, mainland observations will be carried out to identify any unidentified sub populations.

Possible causes of nest failure will be investigated. Mynah bird control will be established this coming season. Nest boxes will be set up in order to capture both adult birds and chicks and any potential nesting sights will be removed to reduce breeding capacity.

Staff:

- 2 staff (one senior) from August to February
- 1 staff from April to July for out of season monitoring and supplementary food provision.

Artificially rear Mauritius Olive white-eyes to independence and transfer to Ile aux Aigrettes for release.

Site: Gerald Durrell Endemic Wildlife Sanctuary (GDEWS), Black River

The Hand Rearing team will be rearing both Mauritius Olive white-eyes in the 2009/10 season. The aim will be to artificially incubate, hatch and rear Olive white-eyes for transfer to Ile aux Aigrettes and release. An estimate of 6-8 nests will be rescued/harvested from Combo aiming to yield 10-12 birds for release.

This season all hand rearing is going to be concentrated between September and November.

Staff:

- Coordinator to manage team between September and November. Two staff are required during this time to assist with the intensive rearing of Olive white-eyes.
- Two staff from Chester or Jersey zoos, to complete the team during the three months.

Releases of hand-reared juvenile Mauritius Olive white-eyes to the lowland population

Site: Ile Aux Aigrettes

Following the successful releases between 2006/07 and 2008/09, we plan to continue releasing Olive white-eye on Ile aux Aigrettes with the aim of establishing an independent breeding population. We hope to release approximately ten juveniles which will have been rescued from wild nests and hand reared at GDEWS. The birds will be provided with supplementary food throughout the year in order to maximise survival and productivity.

Olive White-eye Field Team 2008/09 Staff Details:

Project Coordinator (Gwen Maggs)

- To focus on Olive white-eye management at Combo and Ile aux Aigrettes, closely monitor activity of both populations, rescue/harvest nests from Combo and conduct releases of birds to Ile aux Aigrettes.
- Recruit and train new staff, daily management of the field team, data collection and application of management techniques.
- Produce monthly and annual progress reports, funding appeals and other reports as required, maintain studbook and ringing records.
- Organise purchases and maintenance of field equipment, prepare an annual budget.
- Fully supported with return flight and 12 month living costs provided by MWF
- Present in Mauritius between July and April and based in UK from May to June.

Volunteer Field Staff (Edward Whitfield and Tara Proud)

- Self-supported staff to make up field teams at Combo and on Ile aux Aigrettes for at least six months from August

Out of season staff x 1

- One member of staff required to maintain supplementary food provision and basic population monitoring of Ile aux Aigrettes birds between April and July.
- Staff could be sourced from the above field team, either as long-term volunteers or supported staff. Otherwise the required staff needs to be recruited by February/March to allow an adequate training period and overlap with exiting team.

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Appendices

Appendix 1a: Nest data tables for all Olive white-eye nests found at Combo 2008/09 Location, Outcome and Management:

Nest Reference	GPS Location		Pair Reference	Date Found	Stage	Access?	Management	Outcome	Outcome Date
	S	E							
ZC08COM01	20°27.845'	057°31.159'	LAS VEGAS	12/8/2008	ENB	No	P/C	AAC	23/08/08
ZC08COM02	20°27.822'	057°30.899'	LASAGNE	16/08/08	ENB	Yes	P/C	FDB	11/9/2008
ZC08COM03	20°27.786	057°30.827	BRIDGE	21/08/08	LNB	No	P/C	FDI	3/10/2008
ZC08COM04	20°27.816'	057°31.203'	POOKY	22/08/08	ENB	No	P/C	FDB	24/09/08
ZC08COM05	20°27.842'	057°31.225'	ORCHID-MARSH	28/08/08	LAY	Yes	P/C	F	30/09/08
ZC08COM06	20°28.044'	057°30.868'	BAMBOUS	6/11/2008	LNB	Yes	None	ABC	11/9/2008
ZC08COM07	20°27.453'	057°31.316'	MEADOW	18/09/08	ENB	No	None	ABC	6/10/2008
ZC08COM08	20°27.787'	057°30.826'	BAT ROOST	24/09/08	LNB	No	None	ABC	10/10/2008
ZC08COM09	20°27.803'	057°31.184'	PATRICKS	28/10/08	ENB	No	P/C	F	28&29/11/08
ZC08COM10	20°27.470'	057°31.352'	MEADOW	29/10/08	LNB	Yes	P/C, RQ/HD	RQ/HD	6/11/2008
ZC08COM11	20°28.050'	057°30.898'	BAMBOUS	4/1/2009	BROOD	Yes	None	F	7/11/2008
ZC08COM12	20°27.467'	057°31.364'	MEADOW	21/11/08	ENB	Yes	P/C, RQ/HD	RQ/HD	3/12/2008
ZC08COM13	20°27.803'	057°30.839'	BRIDGE	25/11/08	LNB	Yes	P/C, RQ/HD	RQ/HD	2/12/2008
ZC08COM14	20°27.831'	057°30.912'	LASAGNE	18/12/08	ENB	Yes	None	ABC	2/1/2008
ZC08COM15	20°28.065'	057°30.887	BAMBOUS	19/12/08	LNB	Yes	P/C	FDI	4/1/2009
ZC08COM16	20°27.787'	057°30.835'	BRIDGE	19/12/08	LNB	Yes	P/C	FDI	6/1/2009
ZC09COM01	20°28.071'	057°30.898'	BAMBOUS	5/1/2009	LAY/INC	Yes	None	FDI	16/01/09
ZC09COM02	20°27.820'	057°31.163'	POOKY	12/2/2009	ENB	No	None	ABC	7/1/2009
ZC09COM03	20°27.820'	057°31.163	PATRICKS	21/01/09	ENB	No	None	ABC	4/2/2009
ZC09COM04	20°28.075'	057°30.896'	BAMBOUS	26/01/09		Yes	P/C	FDI	27/02/09
ZC09COM05	20°27.800'	057°30.796'	BRIDGE	12/2/2009	BROOD	No	None	FDB	20/02/09
ZC09COM06	20°27.826'	057°31.165'	PATRICKS	13/02/09	BROOD	No	None	FDB	27/02/09

Appendix 1b: Nest data tables for all Olive white-eye nests found at Combo 2008/09 Productivity data of all nests proceeding to clutch stage

Nest Reference	Clutch size	Incubation start	Hatch Date	Blood Size	Date Fledged	Fledglings	Wild/GDEWS
ZC08COM02	unknown	24&25/08/08	07&08/10/08	-	-	-	-
ZC08COM03	unknown	26/08/08	08&09/10/08	-	-	-	-
ZC08COM04	unknown	26/08/08	10/9/2008	-	-	-	-
ZC08COM05	unknown	30/08/08	11/9/2008	-	30/09/08	1	Wild
ZC08COM09	unknown	3/11/2008	17/11/08	-	28&29/11/08	2	Wild
ZC08COM10	2	02&03/11/08	13/11/08	2		0	GDEWS
ZC08COM11	unknown	12/10/2008	24/10/08	2	11/07/08	2	Wild
ZC08COM12	2	27/11/08	11/12/2008	2		0	GDEWS

ZC08COM13	2	27/11/08	8/12/2008	1	23/12/08	1	GDEWS
ZC08COM15	unknown	19-23/12/08	-	-	-	-	-
ZC08COM16	unknown	22/12/08	-	-	-	-	-
ZC09COM01	unknown	4/1/2009	-	-	-	-	-
ZC09COM04	unknown	29/01/09	-	-	-	-	-
ZC09COM05	unknown	-	-	-	-	-	-
ZC09COM06	unknown	-	-	-	-	-	-

Appendix 1c: Nest data tables for all Olive white-eye nests found at Combo 2008/09
Nest tree and habitat details

Nest Reference	Tree Species	Tree, Nest Height (m)	Proximity to trunk (m)	Position in Canopy	Density of foliage	Habitat type	+	Dominant Understorey Species, Height (m), density
ZC08COM01	Michelia champaka	9, 7	3	Upper	Medium	SYZJAM THK	Syzygium jambos, 10, sparse	nia hirta, 1, medium
ZC08COM02	Litsea monopetala	12, 8	2	Middle	Medium	SYZJAM THK	Syzygium jambos, 10, dense	Ossaea marginata/Psidium cattleianum, 0.75, sparse
ZC08COM03	Syzygium jambos	12, 11	0.5	Upper	Dense	SYZJAM THK	Syzygium jambos, 12, dense	Psidium cattleianum, 1, sparse
ZC08COM04	Litsea monopetala	11.5, 8	4	Upper	Sparse	SYZJAM THK	Syzygium jambos, 10, medium	Ardisia crenata, 1, sparse
ZC08COM05	Litsea monopetala	5, 5.5	0.1	Upper	Medium	MIX EX	Syzygium jambos, 12, medium	Rubus alceifolius, 1.5, dense
ZC08COM06	Warneckea trinervis	4, 2.5	1	Middle	Dense	MIX EX	Psidium cattleianum/Ligustrum robustum, 5, dense	Psidium cattleianum, 2, dense
ZC08COM07	Syzygium jambos	7, 6	3	Upper	Sparse	SYZJAM THK	Syzygium jambos, 10, dense	Psidium cattleianum, 0.5, sparse
ZC08COM08	Syzygium jambos	12.5, 12	1	Upper	Dense	SYZJAM THK	Syzygium jambos, 12.5, dense	Psidium cattleianum, 1.5, sparse
ZC08COM09	Syzygium jambos	6.5, 7	0.5	Upper	Medium	SYZJAM THK	Syzygium jambos, 7, dense	Mixed exotics, 1, spare
ZC08COM10	Litsea monopetala	9, 8	4	Upper	Dense	MEADOW	Litsea monopetala, 10, sparse	?, 2, medium
ZC08COM11	Psidium cattleianum	4.5, 4	0.5	Upper	Medium	PSICAT THK	Psidium cattleianum, 4, dense	Psidium cattleianum, 1, sparse
ZC08COM12	Litsea monopetala	12, 7	3	Middle	Medium	MEADOW	Litsea monopetala, 12, sparse	?, 1.5, dense
ZC08COM13	Syzygium jambos	9, 4	4	Upper	Medium	SYZJAM THK	Syzygium jambos, 9, dense	Psidium cattleianum, 1, sparse
ZC08COM14	Syzygium jambos	3.5, 2.5	0.5	Lower	Medium	SYZJAM THK	Syzygium jambos, 3, dense	Psidium cattleianum, 1, medium
ZC08COM15	Psidium cattleianum	5, 4	0.25	Middle	Medium	MIX EX	Psidium cattleianum, 6, sparse	Clidemia hirta, 2, dense
ZC08COM16	Syzygium jambos	7.5, 6	3.5	Upper	Dense	SYZJAM THK	Syzygium jambos, 8, dense	Psidium cattleianum, 1, sparse
ZC09COM01	Ligustrum robustum	3.5, 3	1	Middle	Medium	MIX EX	Syzygium jambos, 10, sparse	Psidium cattleianum/Rubus

								alceifolius, 2, dense
ZC09COM02	Syzygium jambos	10, 3.5	2	Lower	Medium	SYZJAM THK	Syzygium jambos, 10, medium	Psidium cattleianum, 0.5, sparse
ZC09COM03	Cinnamomum camphora	18, 17	10	Upper	Dense	MIX EX	Syzygium jambos, 12, medium	Psidium cattleianum, 1.5, sparse
ZC09COM04	Psidium cattleianum	10, 8	0.5	Middle	Sparse	SYZJAM THK	Syzygium jambos, 10, dense	Psidium cattleianum, 2, sparse
ZC09COM05	Litsea glutinosa	11, 10.5	0	Middle	Sparse	MIX EX	Syzygium jambos, 15, medium	Psidium cattleianum, 1.5, sparse
ZC09COM06	Cinnamomum camphora	18, 16	9	Upper	Dense	MIX EX	Syzygium jambos, 7, medium	Psidium cattleianum, 2, medium

Appendix 1, KEY:

ENB: Early nest building
LNB: Late nest building
LAY: Laying
INC: Incubation
ABC: Abandoned before completion
AAC: Abandoned after completion
FDI: Failed during incubation
FDB: Failed during Brood
F: Fledged
RQ/HD: Rescued/ Hand Reared
P/C: Predator control
SYZJAM TKT: *Syzygium jambos* thicket
MIX EX: Mixed Exotics