Species Action Plan for the Critically Endangered Polynesian Ground-dove *Alopecoenas erythropterus*

2016-2021

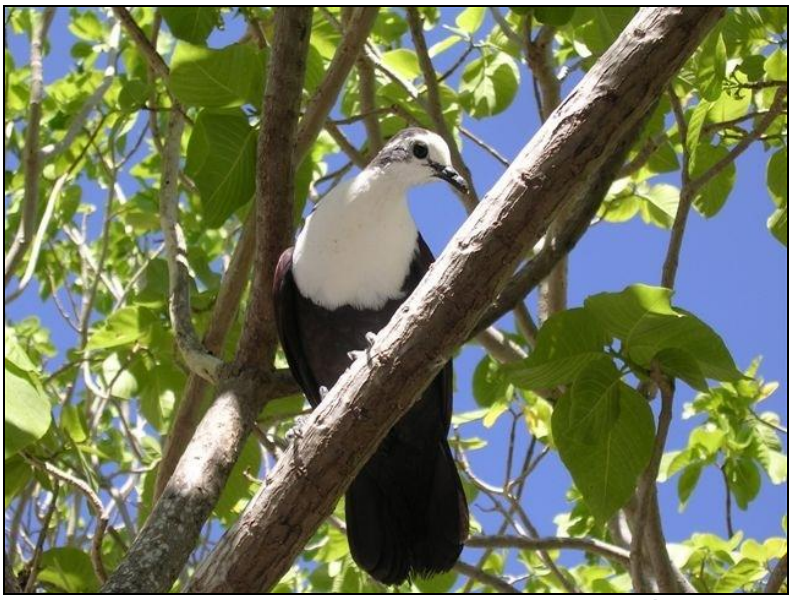

Photo Blanc L.

By R. Pierce, C. Blanvillain and T. Ghestemme

January 2016

Société d'Ornithologie de Polynésie "MANU" – B.P. 7023 - 98719 Taravao, Tahiti, French Polynesia
Phone number : (+689) 521100 - Email : sop@manu.pf - Website : www.manu.pf

BACKGROUND

1- Species description, importance for people and status

a- Species description

The Tutururu or Polynesian ground-dove is a medium-sized dove (100-150 g, 25 cm-long) with a strong sexual dimorphism (Figures 1 and 2). The male has white forehead, throat and chest, with variable extent of grey on crown and nape; the rest of the body is dark grey, the upper part of the back and the wings being variable olive grey fading to brown-red. The female has a more uniform plumage, dark brown except for the head, throat and chest which are light brown. For both sexes, bill and legs are dark grey; legs are robust, as this bird spends most of its time on the ground (hence its English name).

Morphological differences have been noted between the populations of Eastern Tuamotu and Rangiroa (see 2.2 Present Distribution), despite being of the same subspecies. The males of Rangiroa usually have a lighter head, and the females of Rangiroa have a lighter chest than the eastern Tuamotu birds (Blanvillain *et al*. 2002b, Gouni *et al*. 2004; Gouni *et al*. 2005). Males of the extinct sub-population of central Tuamotu were reported to have no grey extent on crown and nape.

Fig. 1: Male (left) and female (right) of *Alopecoenas erythropterus* on Rangiroa
Credits: Left: Ghestemme T../SOP Manu - 2008 / Right: Gouni A./SOP Manu - 2004

Fig. 2 : Male (left) and female (right) of *Alopecoenas erythropterus* on Tenararo
Credits: Butaud J.-F. - 2002

b- Importance for people

Beck (MS) reports that Polynesians formerly hunted Tutururu for food. More generally, Steadman (1989) stated that "Among landbirds, rails, pigeons and parrots were the main food items in Eastern Polynesia". No other cultural or social importance can be attributed to the Tutururu. Indeed, the remaining birds are today found on isolated islets or islands with no permanent inhabitants.

c- Status

The IUCN status of *Alopecoenas erythropterus* is currently CR C2a(i) (BirdLife International 2015), meaning :

CR: Critically Endangered

C: Population size estimated to number fewer than 250 mature individuals

2: A continuing decline, observed, projected, or inferred, in numbers of mature individuals

a(i): no subpopulation estimated to contain more than 50 mature individuals

The above assessment was conducted in 2009. While there has been no significant change in the Tutururu range recorded since then, there has been a change in population estimate. In 2015 the population in Tenarao was estimated to be c.200, comprising mostly adults, thus exceeding the criterion a(i) above of “no subpopulation estimated to contain more than 50 mature individuals”. However, the decline of other subpopulations at Rangiroa and apparently Morane (see below) means that the Tenararo subpopulation currently contains about 90% of mature individuals (criterion C2a(ii)). Thus a revaluation of Tutururu status could consider changing C2a(i) to C2a(ii). If recent rat and cat eradication programmes on nearby islands are successful, however, the population threshold of 250 may well soon be exceeded (see later).

2- Past and present distribution - population trends

a- Past distribution

Two subspecies of *Alopecoenas erythropterus* are known to have existed in French Polynesia. They were distributed as follows (Holyoak & Thibault 1984):

- *Alopecoenas erythropterus pectoralis*, of which presence is documented (or suspected) in some of the North and Central Tuamotu Islands: Tikehau, Fakarava, Katiu, Tuanake, Hiti, Tahanea, Makemo, Hao, Aratika, Manihi;
- *Alopecoenas erythropterus erythropterus*, known to have occurred in some of the Society Islands (Tahiti, Moorea, Huahine) and some of the South Tuamotu Islands (Vanavana, Tenararo, Tenarunga, Maturei-Vavao, Marutea, Maria).

Archaeological records also show the past occurrence of *Alopecoenas erythropterus* on Mangaia and Atiu, Cook Islands (Steadman 1989) and on the Gambier Islands, French Polynesia (Steadman & Justice 1998) but the subspecies was not known or given by the authors.

Table 1: available data on the range of *Alopecoenas erythropterus* (adapted from Blanvillain 2002)

Taxa	Extinct	present in 1922-1923, uncontrolled since	present those last 30 years (numbers)
G.e.erythropterus	Moorea, Tahiti, Marutea Sud Huahine, Mangaia, Atiu	Vanavana, Tenararo, Tenarunga, Maria	Maturei Vavao (few)
G.e.pectoralis	Aratika, Hao, Manihi?, Tikehau?, Tahanea?, Makemo?	Tuanake, Hiti	
G.e.erythropterus ?			Rangiroa (12-20 birds; extinct?)

b- Present distribution

Following the 1921-1930 Whitney South Sea Expedition, other surveys took place in the Tuamotu to look for the birds during the 20th century. Until the 1990s, no Tutururu were found, even on the islands which were formerly part of the specie's range, except on Maturei-Vavao in 1968 (Holyoak & Thibault 1984; Lacan & Mougin 1974; Petitot & Petitot 1975; Poulsen *et al.* 1985; Seitre & Seitre 1992). Thus, on all of the other surveyed islands, Tutururu populations have been considered extinct.

Fortunately, new surveys between 1990 and 2015 were more successful and documenting remnant populations of tutururu in five islands, Tenararo, Vahanga, Tenarunga (Tenania), Rangiroa and Morane (Monnet *et al.* 1993, Blanvillain et al 2002a & b; Blanvillain et al, 2003, Pierce *et al.* 2003, Pierce *et al* 2015).

G. e. pectoralis

Surveys did not find any population of this subspecies and it is thus considered extinct today (Blanvillain et al, 2002b; Faulquier 2015; M-H Burle (pers. comm.).

Fortunately, new surveys between 1990 and 2015 were more successful and documenting four remnant populations of Tutururu (Monnet *et al.* 1993); Blanvillain *et al* 2002b, Pierce *et al.* 2003, Pierce *et al* 2015).

G. e. erythropterus

In 1990-2003, surveys found only four populations of the species, of which three were previously unknown:

- **Rangiroa ;** Monnet *et al.* (1993) discovered a new population of 12-20 birds in 1990-1991. This population still exists today but males only have been observed since 2011 (Blanvillain *et al,* 2014) and has the particularity to present a coloration closer to *G. e. erythropterus* than to *G. e. pectoralis* (Blanvillain *et al*. 2002a), despite its geographical

location, *G. e. erythropterus* was thought to occur in the Society and South Tuamotu Islands (Holyoak & Thibault, 1984).

- **Tenararo;** in 1999 two expeditions were conducted in several islands of the Tuamotu, most of them (Tuanake, Hiti, Tepoto, Motutunga, Tenarunga, Vahanga & Tenararo) being part of the historical range of the species (Blanvillain *et al*, 2002a). Tutururu were found on Tenararo only, where it had already been documented (Murphy 1924). This population was still present in in 2015 when it was estimated to be c.180 individuals (Blanvillain *et al*. 2015).

- **Vahanga;** in 2000, a small new subpopulation was discovered in 2001 (Blanvillain *et al*. 2002a, 2003). This subpopulation was still present in 2007 (3-4 birds), none seen in 2012, and in 2015 (6-7 birds) (Ghestemme *et al*., 2012, Pierce *et al*. 2015).

- **Tenarunga;** in 2001 and 2012 singles were reported by local people and two were present there in 2015 (Blanvillain 2001; A. Gouni, *pers. comm*., Pierce *et al*. 2015).

- **Morane;** in 2003 a new population of 10-30 individuals was discovered (Pierce *et al.* 2003). However, another brief visit and a separate biota survey in 2012 found only 3 and 2 birds respectively (G Wragg, Ghestemme *et al.* 2012).

The above islands are indicated on Figure 3.

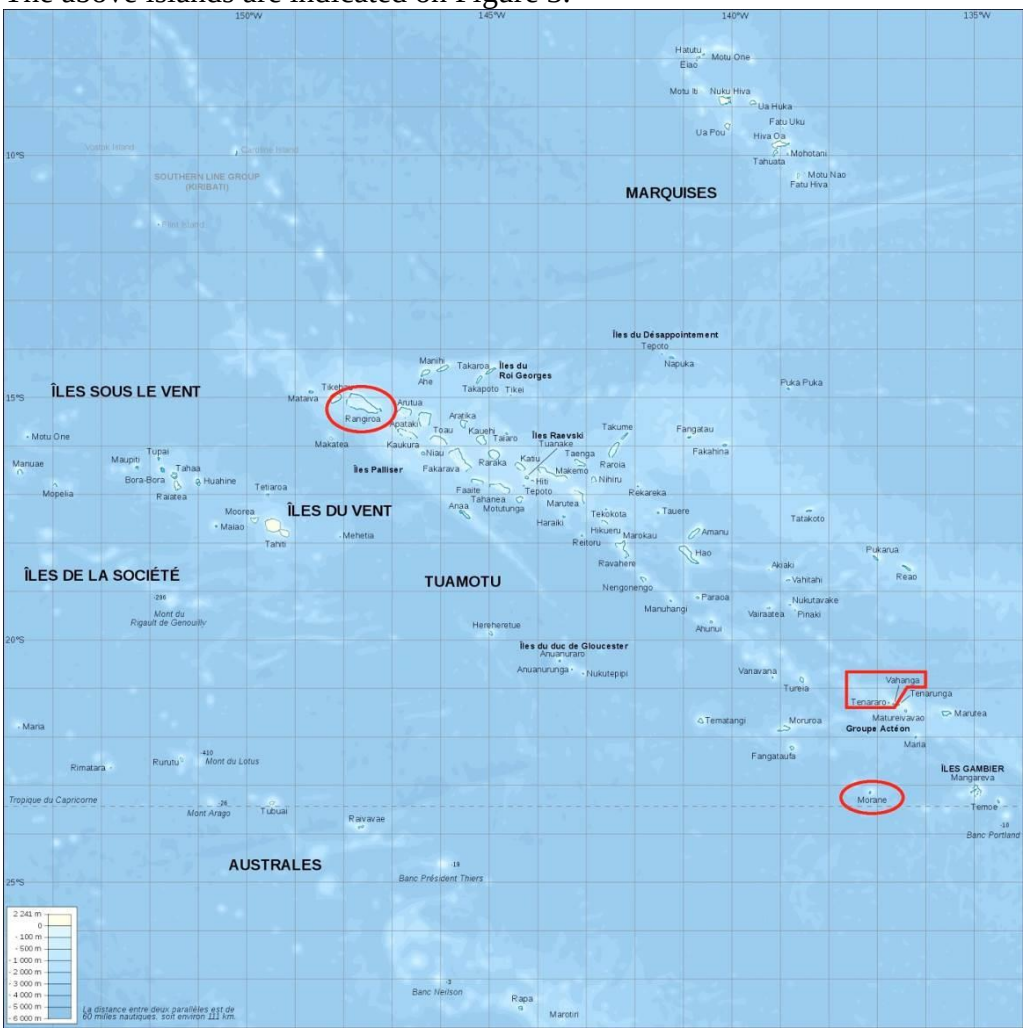

Fig. 3: Map of French Polynesia showing the current known range of the Polynesian Ground-dove. Credits: Modified from Wikimedia Commons.

It should also be noted that Tutururu were observed until 1985 on Maturei-Vavao ((Holyoak & Thibault, 1984; Lacan & Mougin 1974; Petitot & Petitot 1975; Poulsen *et al.* 1985; Seitre

& Seitre 1992), but surveys in 1999 and 2002 didn't find them on this island (Blanvillain 1999; Blanvillain *et al.* 2002a). Additional surveys are needed of Tutururu and black rats here but Polynesian rats were present (Blanvillain *et al.* 2002a).

Tenararo (2015) and Morane (2012) were still rat-free during the last field trips to these islands, as are the motu of Rangiroa where *G. erythropterus* occurs (Gouni *et al.* 2008). Nevertheless, Vahanga has been long inhabited by Pacific rats *Rattus exulans* (Blanvillain et al 2002b, Griffiths *et al.* 2008). Tenania has both *Rattus rattus* and *Rattus exulans* present and also wild cats and pigs (Blanvillain *et al*. 1999). Thus it appears that Vahanga and Tenania subpopulations persist because of regular arrival of new birds from Tenararo, located at only 7 & 15 km respectively.

c- Population Trends

Over the long-term, the Tutururu population has dramatically declined, given the high number of islands it has disappeared from, including during the 20th century (Blanvillain 2002b, Holyoak & Thibault 1984; Steadman 1989). This is why the IUCN is currently classifying the Tutururu population trend as decreasing (BirdLife International 2009, IUCN 2015). The process of the decline of this species had begun when the first Polynesians arrived (Steadman 1989).

It is difficult to know the exact trend of the Tutururu populations over the last 20 years. The only well-documented population is the easiest to access, i.e. that on **Rangiroa**. When Monnet *et al.* (1993) discovered this population, they saw 12 birds (and possibly more were present); but since then, counts have fluctuated but never exceeded 11 birds. During more recent assessments (Albar *et al.* 2010, Ghestemme *et al*. 2012) between 11 and 7 birds were seen. Unfortunately females have always have been very scarce and none have been observed since May 2013 when an avian pox lesion was observed on 3 birds. This situation of only male birds being found has occurred for six expeditions now (Blanvillain *et al*. 2015).

The other remnant populations, all of them in the South Tuamotu Islands, have been visited very few times. Indeed, their access is difficult and expensive: whereas there are several flights a day between Tahiti and the island of Rangiroa (350 km), there are 2 flights a week between Tahiti and Mangareva (1650 km), from which it is necessary to rent a boat to go to the Actéon group (200 km from Mangareva) where nobody lives permanently. The islands from this group have thus been visited between one and five times since 1999:

- on **Tenararo** in 1999, Blanvillain (1999) estimated the population to be at most 30 individuals. In 2002, after another visit on the island, the same author estimated the population to be of 50 (36-70) birds (Blanvillain *et al.* 2002a), but a longer visit by CB and RP in 2015, produced a much larger estimate of c.180 birds (including c.20% subadult males), and occupying all motu of the atoll (Blanvillain *et al*. 2015).
- on **Vahanga**, 0 birds were found in 1999 during a one day trip, 3 birds were seen in 2000 and 7 birds in 2001 when several trips were performed for a first rat eradication attempt (Blanvillain 2002). No birds were seen in 2002 during a one day trip (Blanvillain *et al.* 2002 [a]). In 2007, there were 3-4 birds (Griffiths *et al.* 2008). No birds were seen at Vahanga in 2012 (Ghestemme *et al*. 2012) but during a much longer visit in 2015, 6-7 birds were located including males, females and a subadult male (Pierce *et al.* 2015).
- on **Tenarunga** a single bird was noticed by the local population in 2001 (Blanvillain, 2002a), a single bird was located on the only area of good indigenous forest in 2012

(Ghestemme *et al.* 2012), and a male and female was frequently seen during a longer visit in 2015 (Zito 2015, in Pierce *et al* 2015).

- on **Morane** in 2003, 10 individuals were seen during a comprehensive survey of the atoll with an estimated total of 10-30 birds (Pierce *et al.* 2003). Two visits in 2012 produced 3 birds in part of one day and 2 birds in three days respectively (G Wragg pers. comm., T Ghestemme *pers. comm*.). These lower counts in 2012 suggested that numbers present were lower than in 2003.

3- Causes of decline and current threats

Rats and cats

Although members of the genus *Alopecoenas* have provided food for local people for centuries, it is the depredations of cats and rats that are the key reasons for the decline of *A. erythropterus* (Holyoak and Thibault 1984, Steadman 2007, Blanvillain *et al*. 2002) and for many other groups of birds (Atkinson 1985). On several islands, cats have been reported to be at least partly responsible for the extinction of local Tutururu populations (e.g. Tahanea or Makemo (Beck MS), but the presence of Pacific rat (*Rattus exulans)* alone in many Tuamotu Islands is enough to coincide with its disappearance (Blanvillain et al, 2002b). The two strongholds for this species, Tenararo and Morane, are currently free of rats and cats, and birds from the former population disperse to neighboring Vahanga (which has *R exulans* to at least 2015) and rarely Tenarunga (which has *R exulans, R rattus* and cats and pigs to 2015 at least). If cats or rats arrived at Tenararo or Morane it would spell the end of those populations, and potentially the species. However, the likelihood of predator introduction is reduced to some extent due to the extreme isolation of these islands and the decision by the Catholic Church to preserve Morane and delay indefinitely the harvesting of coconuts on Vahanga and Tenararo (P. Raust *in litt.* 2012). Rodents are present on several islets or motu within the Rangiroa atoll and eco-tours reach the atolls several times a year, thus posing a potential risk of introducing predators and other invasive species.

Invasive ants

Several invasive ant species are present in French Polynesia, including *Anoplolepis gracilipes* and *Wasmannia auropunctata.* These species can impact on birds and most other fauna species, sometimes to the point of ecosystem collapse (Global Invasive Species Database 2015). *Anoplolepis* species are present on mainly populated islands in the Tuamotu and Gambier Islands, including Tureia and Mangareva. If they invaded Tutururu islands it would be catastrophic as, unlike rats, there are currently no effective eradication methods for ants. The risks of invasions occurring are increasing as *Anoplolepis* has recently invaded and is establishing on Tureia (along with another invasive ant *Tetramorium bicarinatum* which was found at Turea Airport in June 2015) which is a departure island for visiting the Acteon Group (Pierce *et al.* 2015). *Anoplolepis gracilipes* also occur on other populated islands e.g. Mangareva and Reao, which are also departure islands for visits to the Acteon and Morane. *Anoplolepis gracilipes* have already accessed at least one uninhabited island in the form of Manui apparently via fishing parties swimming ashore with equipment in drums (G Wragg *pers. comm*. in Pierce *et al.* 2015). The risks to other islands in the Tuamotu-Gambier (including actual or potential Tutururu islands) are very serious.

Diseases

Avian malaria is a significant threat for Tutururu and as it can be transported via domestic chickens and possibly sea birds as noddies and terns have been reported to be victims of this disease. It may already have caused the deaths of some Tutururu at Rangiroa and the crash of the local population (Blanvillain *et al*. 2014). It is a key concern for the Acteon population if chickens are present as Tutururu currently disperse amongst 3-4 of these islands and this is likely to increase if the 2015 rat and cat eradications succeed.

It is difficult to regulate migratory and sea birds movments between Pacific Islands, but this aspect along with the potential increase in cyclones in the future, is an important consideration in the geographical approach to the species recovery.

Habitat degradation and loss

Tutururu are dependent on mature indigenous forest for their feeding and breeding requirements as described above. All islands in the Acteon Group (and many other Tuamotu Islands) have been planted with coconuts (Monnet *et al.* 1993) and these have matured and are in various stages of forming an understory of juvenile coconuts which are shading out indigenous plant species. This has resulted both from coconut regeneration below parent trees and also from seeds being translocated by water during tidal or storm surges (Pierce *et al.* 2015). This is well advanced on Vahanga, which was planted before Tenararo, and the habitat quality of both of these islands is under threat from coconut regeneration. There are also local weed infestations, that of lantana on Vahanga being serious despite it sometimes being used for food by Tutururu. An eradication attempt of lantana in Vahanga has been undertaken in 2015. On Tenaraunga, the situation is somewhat different as vehicles are used for accessing different parts of the island resulting in direct damage and "weeding" of unwanted vegetation, and hence the maintenance of a more open understory.

While the advance of coconuts is outward on the atolls, storms and tidal surges are providing an additional inward directed force. Thus the beaches and hoa are under erosion pressure in parts of the Acteon Group – this was most noticeable on Vahanga where between 2001 and 2015 there has been significant erosion particularly of the southern and western shores of the outer beach and also the eastern and northern shores of the lagoon, but this was also happening at Tenararo (R Pierce *pers. obs*.). As a consequence, the preferred feeding sites for Tutururu along the lagoon and hoa shorelines are becoming narrower and constrained by opposing advances of coconuts and ocean surges.

4- Ecology and biology

a- Habitat and food

The Tutururu spends most of its time on the ground in lightly to highly vegetated areas, either in the centre or in the border of islands/islets (Ghestemme *et al.* 2012, Monnet *et al.* 1993).

Observations on Tenararo (and Vahanga) in 1999 and 2015 showed that Tutururu favoured indigenous forest habitats particularly along the vegetated lagoon edges together with the hoa (channels) and especially throughout the forest of the many small motu. This pattern of distribution coincided with the presence of mainly sandy open areas populated with scattered shrubs of *Achyranthes aspersa,* plus combinations of *Boerhavia tetrandra, Cassytha*

filiformis, Guettarda speciosa, Pandanus tectorius, Portulaca lutea, Scaevola taccada and *Heliotropum foertherianum*. Key correlates were the proximity of *Achyranthes aspersa*, the presence of soil or sand (less frequent in coral rubble substrates), and the absence or scarcity of coconut regeneration. A fairly open canopy (<40% cover) of mature coconut trees was tolerated, but more closed canopies of coconuts inhibited the growth and reproduction of essential understory plants (C. Blanvillain *in litt.* 1999, Blanvillain *et al.* 2002, Pierce *et al.* 2015).

The species has a varied diet, including caterpillars and other insects, seeds, green leaves, buds and fruit (C. Blanvillain *in litt.* 1999, Blanvillain *et al.* 2002, Pierce *et al.* 2015). On Tenararo and Vahanga in June 2015 key foods were seeds of *Achyranthes* and podsibly *Heliotropium*, flowers and growing shoots of *Boerhavia*, *Cassytha* and *Portulaca*, fruit of *Guettarda*, seeds of grasses (*Digitaria stenotaphrodes*), and insects and snails gleaned from *Achyranthes, Heliotropium* and *Digitaria* and from beneath leaves and from on the ground.

b- Breeding

Little is known of breeding. The only nest observed was in a *Pandanus* tree (Ghestemme *et al.* 2012, Grassi 2013). No nests or chicks were observed on Tenararo in June 2015 and juveniles were mostly independent of parents at the time, suggesting that breeding was seasonally focused. The egg is pale blue, speckled with light brown (Peva Levy *pers. comm.*).

5- Past conservation efforts

5.1 Actéon group

Rat and cat eradication

An attempt to eradicate rats on Vahanga was undertaken in 2000 and 2001, by hand-spreading of rodenticide in bait stations spaced regularly throughout the island three times. Unfortunately, financial restrictions and other issues resulted in the eradication failing (Blanvillain *et al.* 2002, Pierce *et al*. 2006). Other issues included:

- uncertain bait specifications as it was not possible to test the toxin provided by a poison bait manufacturer on Tahiti – originally intended to be brodifacoum, but believed to include chlorophacinone and bromadialone (Gouni *et al.* 2004)
- bait used for the last attempt contained coconut flesh which contains Vit K1, the antidote of the toxin
- insufficient bait quantity for the size of the atoll (the actual bait provided was significantly less than ordered and funds were running out (Blanvillain *et al.* 2002c),
- too few workers and insufficient time for set-up, poisoning and follow-up,
- gaps in coverage due to lack of poison at the end of the third campaign
- rapid loss of baits to crabs from some lower stations, but most stations were placed at one meter elevation over the island
- Some rats may not have been prepared to climb to some higher bait stations on young palm fronds, etc.

A second operation took place at Vahanga in June 2015 (Ghestemme and Cranwell 2015) and included Tenarunga rats (two species) and cats, and invasive species on several islands in the

Gambier Archipelago. This operation involved the helicopter-application of rodenticide baits across Vahanga and Tenarunga in June 2015 and cat trapping on Tenarunga (Ghestemme and Cranwell 2015). The success of the operations will be known in 2016 or 2017. The Vahanga operation also included beginning the eradication process for of lantana in and around the site of the old village.

During the June 2015 pest operation field research was undertaken in the Acteon Islands primarily to assist with the recovery effort of Tutururu (and Tuamotu Sandpiper or Titi). This work included mitigation to minimize potential mortality during rat eradications on the Acteon Islands of Vahanga and Tenarunga, plus population surveys and ecological research on nearby rat-free Tenararo. The former involve the capture and translocation of two Tutururu from Vahanga to Tenararo and the monitoring of others *in situ* that were not captured on Vahanga. The Tenararo research was aimed at collecting population data and ecological observations to assist with more effective recovery planning in the form of a revised Tutururu Action Plan and the development of a Recovery Plans. The population of Tutururu on Tenararo was larger and more productive than previously documented (Pierce *et al* 2015, Blanvillain *et al.* 2015).

Captive breeding

.

In 2000, it was decided to capture some Tutururu on Tenararo to set up a secondary captive population on Tahiti (Blanvillain 2002). Below are the justifications for this action, given by Blanvillain et al (2002b):

- preventing the species' extinction in case of the collapse of the Tenararo population, due to a predator introduction or a natural disaster;
- multiplying wild populations if necessary and if any contact between captive populations and pathogens is avoided;
- getting the species known by the public and more generally increasing Polynesian public's awareness about their avifauna heritage;
- easily disposing of birds for future reintroduction actions, following the setting-up of natural reserves on inhabited islands.

Peva Levy, one of SOP Manu's charter members and already a bird breeder, proposed to host this captive population. In June 2001, he spent a week in Bristol Zoo (England) to be trained on Tutururu captive breeding.

Finally, in October 2002, two couples of Tutururu were captured on Tenararo and transferred to Peva Levy's aviaries on Tahiti (one couple per aviary) (Blanvillain 2002).

In November 2003 a female died without any sign of disease or injury. An egg retention may have been the cause of the death or male aggression as the cages were far too small in consideration with what was recommended by Bristol zoo. Her male was transferred into the other aviary, i.e. with the other couple. No conflict between the two males was seen (Ghestemme *et al.* 2008; Gouni *et al.* 2004).

In February 2004 one of the males died, without any apparent reason either. His body was given to the Musée de Tahiti et ses Îles, which preserved it (Gouni *et al.* 2004).

The second male died in June 2005. No reason was found to explain his death. However, it had been noticed that he had some articulation problems with his legs when he was released in the aviary in 2002, but this cannot entirely explain the sudden death of the animal (Ghestemme *et al.* 2008; Gouni *et al.* 2005).

The last female finally died in 2011 (P. Levy com. pers.).

A. Gouni (pers. comm.) though that one reason of the failed breeding of the Polynesian Ground-dove came from the fact that the pairs are separated in two separated cages, but this

species is a gregarious species. C. Blanvillain is sure that it is the size of the aviary being too small: 2x3 m^2 instead of 50 m^2 as minimal recommendation. In Bristol, Ground dove were held in pairs separately. Furthermore, during the catching of the birds in 2002, one male and two females were caught at the same time and the manager of the mission decided to keep the heaviest female and release the lightest. Perhaps the best option was to keep all three birds. No further captive work is planned except briefly in support of translocations (see later).

b- In Rangiroa

When the Tutururu population on this island was discovered, authors expressed concerns about its long-term viability (Monnet *et al.* 1993). In 1999, this population was thought to be dispersed or even extinct due to a powerful swell which destroyed the two close islets on which Tutururu were known to occur (Blanvillain 1999). Fortunately, in 2001, four Tutururu (all male) were found again on Big Omai, Small Omai and Ahua (Blanvillain 2001). Until 2004, the population on this atoll was considered as a near extinct population and after a mission in 2004, Gouni *et al.* decided to set up a conservation programme on Rangiroa.

The study zone of SOP Manu on Rangiroa, where *G. erythropterus* occurs, is shown in Figure 4.

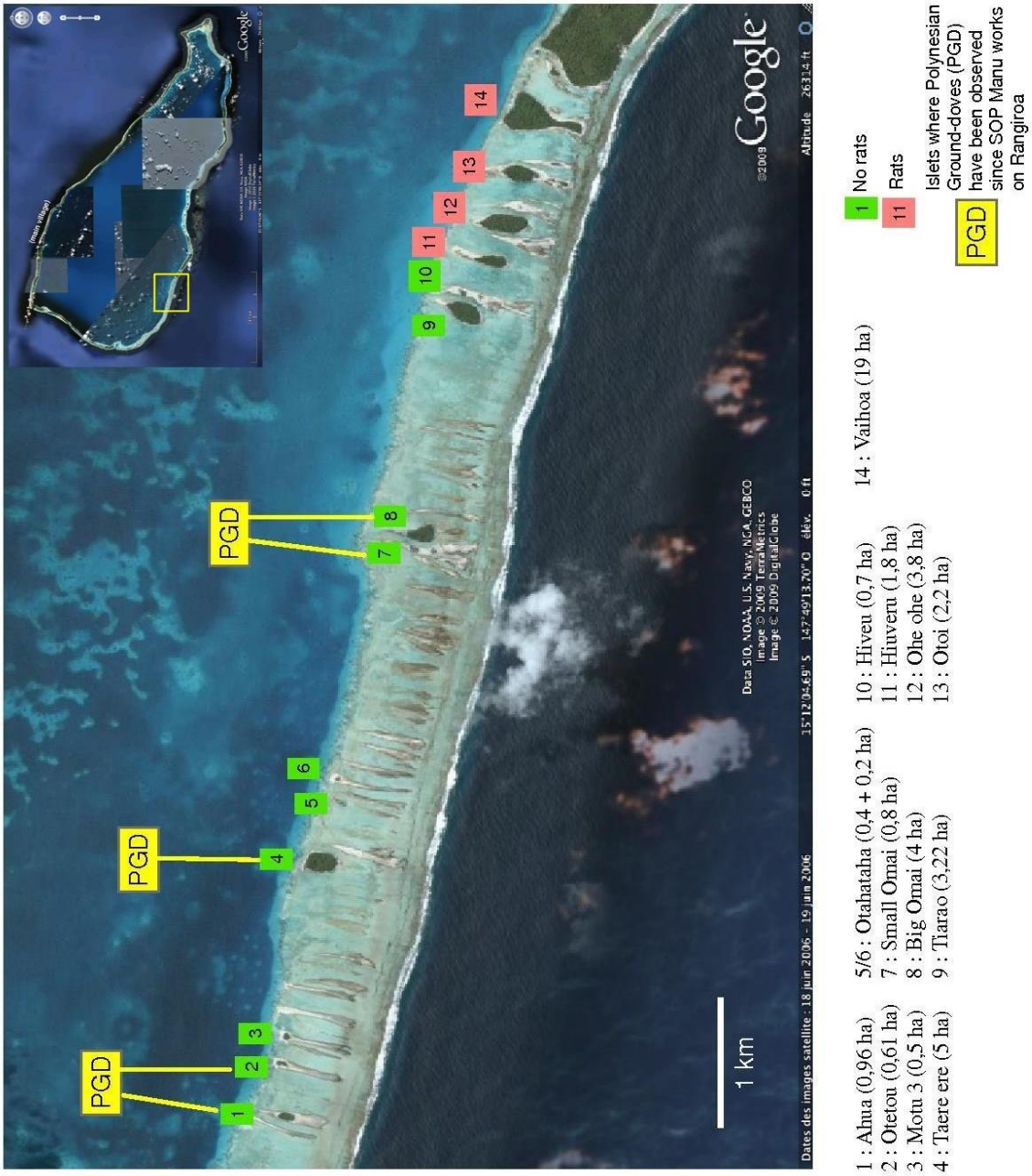

Fig. 4: Study zone of SOP Manu on Rangiroa
Credits: Modified from Google Earth™

Table 2: Observations of Tutururu on Rangiroa 2008-11

Bague n°	Date de bagage	Age ois bagué	Patte Gauche	Patte Droite	Sexe selon phénotype	Sexage génétique	Juin 2009	Nov 2009	Fév 2010	Nov 2010	Fév 2011	Nov 2011	juillet 2012
GH123501	18/12/2008	+2A		Orange	M	M	non	ok	ok	-	ok	+/-	
GH123502	18/12/2008	+2A		Bleu	M	M	ok	ok	ok	-	ok	ok	ok
GH123504	18/12/2008	+2A	Orange		F	F	ok	ok	ok	-	ok		ok
GH123505	18/12/2008	+2A		Jaune	M	M	ok	ok	ok	-	ok	ok	ok
GH123506	19/12/2008	+1A?	Orange		M	M	ok	ok	ok	-	ok	+/-	ok
GH123507	19/12/2008	+1A?	Bleu		F	M	ok	non	non	-	non	-*	
GH123508	19/12/2008	2A?	Jaune		F	M	ok	non	non	Ok	non	-*	
GH123509	19/12/2008	+2A		Jaune	F	F	non	non	ok	-	ok	-*	ok
GH123510	19/12/2008	+2A	Bleu		M	M	ok?	non	ok?	-	non	non	
GH123511	31/01/2011	+2A	Rouge		M	-	-	-	-	-	ok	ok	ok
GH123512	01/02/2011	+2A		Rouge	F	-	-	-	-	-	ok	-*	-
GH123513	02/02/2011	+2A		Noir	M	-	-	-	-	-	ok	ok	ok
I non bagués vus	-						2 M		2 juv 2 M				

i- Rat eradications

The two motu Omai were separated from Ahua by motu Taere ere, which was invaded by rats. It was thus proposed to eradicate rats from motu Taere ere, which would avoid an invasion of the Tutururu islets and would offer to the birds a group of several rat-free motu (Gouni *et al.* 2004). An eradication was carried out in 2005 and was successful: none of the checks conducted by SOP Manu during field trips in 2007, 2008, 2009 and 2010 caught rats on this islet (Gouni *et al.* 2005; Gouni *et al.* 2007; Ghestemme *et al.* 2008; Albar *et al.* 2009; Albar *et al.* 2010), Albar et al (2011) and (T. Ghestemme 2012 *pers comm*.).

A first positive result of the rat eradication on Taere ere was observed in 2007, when a Tutururu was seen on this motu (Gouni *et al.* 2007). It was the first time this bird was recorded there.

Following the success of the 2005 eradication, another one was attempted in 2007 on the Tiarao and Hiveu islets, which are the first islets to the east of motu Omai (Gouni *et al.* 2007). Unfortunately, this eradication failed as rats were trapped on Tiarao in 2008 (Ghestemme *et al.* 2008). A last eradication was conducted in late 2008 and targeted motu Tiarao, Hiveu and the following one, Hiuveru (pictures of the operation are shown in Figure 5 (Ghestemme *et al.* 2009). A field trip in 2009 checked this eradication: no rats were trapped on Tiarao or Hiveu, but one rat (unknown species) was trapped on Hiuveru, showing the failure of the rat eradication on the latter (Albar *et al.* 2009). The last field trip to date on the island was conducted in 2010 and confirmed those results, with a Black rat trapped on Hiuveru (Albar *et al.* 2010).

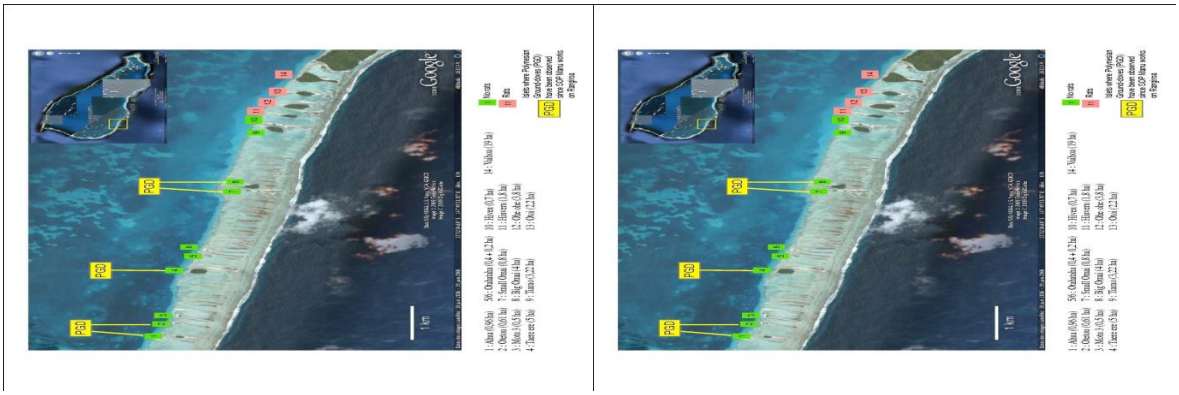

Fig. 5: Rat eradication of Tiarao, Hiveu and Hiuveru in December 2008
Credits: Faulquier L/SOP Manu - 2008

It is not clear whether those failures are due to a problem with the eradication methodologies themselves or if the motu were reinvaded by rats from adjacent motu (Ghestemme *et al.* 2008; Albar *et al.* 2009). However, the second option is correct for the Black rat at least, which was present on Tiarao in 2008 but had not been recorded on this motu before the 2007 eradication (Ghestemme *et al.* 2008). The situation is not as clear for the Polynesian rat, which was present before and after the first eradication on Tiarao (Gouni *et al.* 2007; Ghestemme *et al.* 2008).

Following those failures, both Ghestemme *et al.* (2008) and Albar *et al.* (2009) suggested to change SOP Manu's eradication strategy on Rangiroa. Instead of eradicating rats progressively (2 or 3 motu after each other's), they proposed to eradicate at the same time whole groups of connected motu, to avoid reinvasions.

ii- Follow-up of the Tutururu population

From 2004, Tutururu counts were conducted on the study zone during every field trip of SOP Manu on Rangiroa, to know the population trend. Below are presented the results of these counts (Table 1).

Table 1: Counts of Polynesian Ground-dove on Rangiroa

year	Count	Bibliography references
2001	4	Blanvillain 2001
2004	10	Gouni *et al.* 2004
2005	11	Gouni *et al.* 2005
2007	11	Gouni *et al.* 2007
2008	5	Ghestemme *et al.* 2008
2009	10	Ghestemme *et al.* 2009
2009	5	Albar *et al.* 2009
2010	11	Albar *et al.* 2010
2011	9	Albar et al 2011
2012	7	T Ghestemme pers. comm.
2013	6	T Ghestemme pers. comm.
2014	4-5	Blanvillain *et al.* 2014
2015	2	Blanvillain *et al.* 2015

Table 2a: Observations of Tutururu on Rangiroa 2013-14

Bague n°	Date de bagage	Age ois bagué	Patte Gauche	Patte Droite	Sexe selon phénotype	Sexage génétique	Mai 2013	Nov 2013	Avril 2014	Mai 2014	Oct 2014	Nov 2014
Mâles												
GH123501	18/12/2008	+2A		Orange	M	M						
GH123502	18/12/2008	+2A		Bleu	M	M	**ok**					
GH123505	18/12/2008	+2A		Jaune	M	M		**ok**	ok		Ok	ok
GH123510	19/12/2008	+2A	Bleu		M	M						
GH123511	31/01/2011	+2A	Rouge		M	-	**ok**	ok	Ok		Ok	
GH123513	02/02/2011	+2A		Noir	M	-	**ok**	**ok**	Ok	ok	Ok	
Femelles												
GH123509	19/12/2008	+2A		Jaune	F	F	**ok-lésion**					
GH123504	18/12/2008	+2A	Orange		F	F	ok					
GH123512	01/02/2011	+2A		Rouge	F	-			Ok			
Mâles ou femelles bagués juvéniles												
GH123508	19/12/2008	2A?	Jaune		F	M						
GH123506	19/12/2008	+1A?	Orange		M	M	**ok-lésion**	**ok**	Ok	ok	ok boite	ok boite -
GH123507	19/12/2008	+1A?	Bleu		F	M						
GH123514	13/11/2013	+1A		Violet	M	-	-	**ok**				
Total	13						6/8	5/6	4/5	2/4	4/4	2/4

The fluctuations are probably due to an external factor which affected the results of the counts but the population decrease was confirmed in 2015 where only 3 males were observed. This decrease start on May 2013, the period where avian pox was first observed in several birds.

iii- Colour-banding

In order to individually follow some Tutururu across several years, 9 birds were colour-banded on a second trip in 2008, all of them on Small Omai or Big Omai (see Figure 6) (Ghestemme *et al.* 2009). Then, during every Tutururu count on Rangiroa, observers noted the sex and ring colour (if any) of the Tutururu they see.

Fig. 6: Colour-banding of a Tutururu in December 2008
Credits: Chong F./SOP Manu - 2008

In 2009, all of the 5 observed Tutururu were colour-banded (Albar *et al.* 2009).

In 2010, out of the 10 Tutururu that were observed on both Small Omai and Big Omai, 7 were colour-banded. The three others were one adult and 2 subadults. Among the 7 colour-banded birds, 5 were those already seen in 2009.

In 2011 6 of the 9 birds seen were already banded and the new birds were subsequently banded (Albar *et al* 2010).

In 2012 all 7 of the birds seen had been banded in previous years (T Ghestemme pers. comm.).

In 2013-15 fewer birds were seen and comprised solely males in 2015.

iv- Awareness-rising towards, and support from, Rangiroa's local population

SOP Manu's Tutururu conservation programme on Rangiroa is approved by the mayor of the island, who lends (when possible) a municipal boat so Manu can travel on the island.
Moreover, Manu has been helped for several years by some of the owners of the motu of the study zone. Not only do they give authorization to work on their motu, but they also help SOP Manu for fieldwork and logistical organization.

In parallel Manu raises community awareness, and especially children's' awareness, about the importance of Rangiroa's avifauna and in particular Tutururu. For example, in 2009 and 2014, Manu participated in the Fête de la Science, an event which takes place every year in France and its overseas territories. It aims to convey scientific knowledge to the public and in particular children, with the organization of free educational events in various domains of science (biology, geology, astronomy etc). Manu made a presentation about the birds of French Polynesia and Rangiroa, and the threats that hang over them, in several classes of Rangiroa's Junior High School (Figure 7).

Fig. 7: Manu's presentation in Rangiroa
Credits: Besançon P.

SOP Manu is involved in several types of events, including the days of the environment or birds festival (between the 14th and the 18th September 2010). During these events, conferences are given about the Polynesian Ground-Dove. In addition, a kakemono has been

created on this bird and the conservation programme on this species. This kakemono is used for several public meeting.

A Site Support Group was established in Rangiroa, and is composed of:
- a City councilman, who is also the owner of some of the motu where *G. erythropterus* occurs and who helps Manu during field trips
- a member of Manu's Board, who lives on Rangiroa
- Manu's landbird programmes manager.

Further work is needed on the persistence of avian pox at Rangiroa to see if it is still active in the local seabird population or in the soil environement (Blanvillain *et al*. 2014). This will have a bearing on future plans for the species reintroduction within its former range (refer actions).

v- Awareness-rising towards Acteon invasive species eradications

SOP Manu has undertaken extensive consultations with the commununity, Catholic Church and other stakeholders leading up to the eradication activities at Acteon in 2000-01 and 2015-16 (Ghestemme and Cranwell 2015).

RECOVERY GOAL & OPTIONS

Long-term recovery goal

The long-term goal is to improve the status of *Alopecoenas erythropterus*, ie to uplist the species in the IUCN Red list of threatened species so it is no longer at risk of extinction.

Recovery objectives and actions for the 2016-2021 period

Conservation objectives and actions over the period 2016-21 will focus on excluding invasive species and diseases from key sites and establishing additional island populations in strategic locations. These actions and stakeholders are detailed below, with recommended lead agencies denoted **in bold**.

Objective 1 – Provide a Revised Tutururu Species Action Plan and develop a Steering Committee to oversee implementation

Background.

An action plan for Tutururu was developed in 2012 and is updated here following intensive work in the Acteon in 2015.

Note that the Tutururu and Titi (Tuamotu sandpiper) share similar environments, threats and opportunities for their recovery in and beyond the Tuamotu. It would be a good strategic move to develop a combined recovery plan and steering committee for these species and potentially other Tuamotu species) which would assist in coordinating the recovery effort and assist with funding bids and awareness raising for this suite of threatened birds (Pierce and Blanvillain 2004).

Action 1 – Provide a revised Tutururu Action Plan in 2016.

Action 2 - Meet with stakeholders, potentially during biosecurity meeting (Objective 2), to discuss merits of progressing a steering committee and recovery plan in 2016.

Appropriate expertise needed for a Steering Group include:

- botanist;
- conservation biologist;
- Staff members from SOP Manu: Programme Manager and Executive and Programme Director;
- Programme Manager rom BirdLife;
- Expert of *Alopecoenas* genus or pigeons;
- Community and council members from Tuamotu.

Stakeholders include Catholic Church, Councils, **SOP MANU**, **R Pierce** (revise action plan), DIREN, BirdLife, technical experts.

Objective 2 – Monitor Tutururu populations

Background.

Populations of Tutururu appear to be dynamic, e.g. there has been a decline on Rangiroa and an apparent decline on Morane since 2003 despite no changes in pest status at the latter, but recent increases in Tutururu at Tenararo and Vahanga. Also if the rat and cat eradications on Vahanga and Tenarunga are successful, these could lead to natural improvements in Tutururu status on these atolls. All Tutururu atolls need to be monitored to measure positive and negative trends and the causes of these.

Action 1 – Monitor Morane population every c.3-5 years. Repeat 2-x 1 day surveys of past science expeditions in 2003 and 2012 and study birds to better understand the biology of this population. During counts keep record of females, adult male and subadult male; photograph each bird to help distinguish individuals between counts. Note also feeding stations and any food items observed.

Action 2 – Monitor Tenararo population every c.3-5 years. Follow methods of Pierce *et a*l 2015, i.e. ideally two people undertake 1 + 1 replicate photographic surveys of the 9 small motu (in their entirety) plus SE motu lagoon-edge and hoa at both ends of that motu; each survey taking one day, total of 2 days. Keep record of females, adult male and subadult male; photograph each bird to help distinguish individuals between counts. Note also feeding stations and any food items observed. If time does not allow for the replicated count, then complete a single one day survey of the above same sites, giving total count plus males, subadult males and females.

Action 3 – Monitor Vahanga population every 3-5 years. Follow methods of Pierce *et al* 2015, i.e. ideally walk the outer perimeter of village motu and titi hoa area and outer perimeter of all of the small motu, returning to Village by the lagoon edge perimeter of the same motu. Ideally replicated once and all birds photographed, feeding stations, etc. recorded. If more time is available, complete survey of the main motu including areas of shrubland within mid part of the large motu and towards the south end of the large motu.

Action 4 – Monitor Tenarunga population every 3-5 years. Complete an outer perimeter survey, ideally replicated once and all birds photographed. Encourage copra workers to keep inventory of birds seen – date, location (marked on map), numbers, sex, feeding stations, etc., observer.

Action 5 – Monitor Maturevaovao every c.10 years as per Vahanga above to determine if Tutururu are present and better understand ecoogy and pest status.

Action 6 – Monitor Rangiroa population every 2 years and extend research to assess potentially suitable motu all around this very large atoll.

Action 7 – Priorotise a list of other potential Tutururu islands from which there are recent reports or where it is suspected Tutururu could still be present, and complete surveys on these islands. Complete these opportunistically as logistics allow.

Action 8 – Maintain central database of monitoring and survey data.

For all actions use trained observers and utilise opportunities to train new observers including

locals. Photograph all individual birds encountered to enable short-term recognition during each survey and its replicate. Supplement this on Rangiroa and potentially also on Tenararo and Vahanga by mark-recapture techniques, i.e. colour-banding in order to determine accuracy of counts and gather biological information (Objective 6). Use transport opportunities where appropriate, e.g. copra vessels to Tenarunga, research vessels to Morane, but ensure government and/or SOP Manu observers are present to validate biosecurity and monitoring.

Stakeholders for Actions 1-8 – Catholic Church, **SOP MANU,** BirdLife

Objective 3 – Determine that IAS are absent from Tutururu islands

Background.

All Tutururu islands are vulnerable to invasion by rodents and invasive ants as well as weed species. Close surveillance is needed to ensure that the islands remain free of IAS.

Action 1 – check status of rats and cats on Vahanga and Tenarunga (and Temoe) where they were targeted for eradication in June 2015. Follow methodology of rat operational plan (Ghestemme and Cranwell 2015).

Action 2 - During each field trip on the islands/islets where Tutururu occur (Tenararo, Vahanga, Tenarunga, Morane, Rangiroa), rat surveys should be carried out comprising night-time spotlighting (LED headlamps ideal), chew sticks and trapping throughout the stay. Traps should be non-lethal traps or nailing lethal traps to trunks, to avoid killing Tutururu. An invasion of rodents should lead to immediate action implementation of a rapid response plan (confirm identity of rodent and extent of invasion and complete eradication plan of rats and/or translocation of birds urgently) to ensure that the Tutururu population of the affected island/islet is saved.

Also during the same field trips carry out survey for other IAS particularly invasive ants by using standard methods – sugar and protein lures located at landing and camping sites and samples of all ants collected for identification in the laboratory. Invasive ants will need a rapid response plan as eradication will become virtually impossible after they are firmly established. Note any other predators (cat, pig, dog, etc.) so that they may be eradicated in the future (see Objective 3 Action 1).

Stakeholders for Actions 1-8 – Catholic Church, **SOP MANU,** BirdLife

Objective 4 – Improve biosecurity in the Tuamotu-Gambier to ensure that IAS do not invade Tutururu islands and potential Tutururu islands

Background.

Tutururu depend on islands being free of cats, rats, invasive ants and other predators. The Acteon Group is currently the key area for the conservation of Tutururu as it currently holds

the largest population on a rat-free island, has the most suitable habitat and IAS are being eradicated on two islands there in 2015. There are other important islands in the Tuamotu, e.g. Morane (IAS free), Rangiroa (some motu free of rats and cats) and others that could potentially receive Tutururu, e.g. Temoe. However, there are serious risks of IAS (rodents, ants, weeds, disease, etc.) establishing due to unauthorized landings at uninhabited islands and poor biosecurity on vessels, aircraft and at all of these islands.
Action 1 – Meet with stakeholders to agree on and scope a Biosecurity Committee and its roles plus a Biosecurity Action Plan for urgent implementation. Meet in 2016. Stakeholders include Catholic Church, Councils, **SOP MANU**, Nuku Hau, Air Tahiti, **Agriculture,** DIREN, School teachers, BirdLife, biosecurity specialists. Action 2 - Complete a Biosecurity Action Plan urgently for Tutururu islands and the Tuamotu-Gambier generally, spanning vessels, aircraft, awareness raising, scientific parties. The plan will firstly need to address IAS pathway analyses and threats before implementing effective biosecurity measures. To be drafted early 2016; completed and implemented ASAP. Stakeholders – as above. **SOP MANU** could take lead on this, potentially with BirdLife, PII and other specialist support. Action 3 – Use the Biosecurity Action Plan to improve the biosecurity on Nuku Hau and other interisland vessels and aircraft, and international and local yachts, etc., to ensure invasive insects and rodents are never transported. Meet in 2016 and gradually improve preventative processes in 2017. Stakeholders – Nuku Hau, Air Tahiti, SOP Manu, Agriculture, Councils. **Lead agency** should be identified at 2016 meeting. Action 4 - Exclusion of landings on Tenararo and Vahanga by birding parties and any other non-scientific parties. Effective immediately. Confine birding opportunities to Rangiroa in the interim, but develop a plan for managing these international birders' needs. Stakeholders – **Catholic Church;** SOP MANU could vet scientific parties to Tenararo and Vahanga to ensure biosecurity implementation is stringent and direct birding opportunities at Rangiroa. Action 5- Survey IAS on key staging/departure sites e.g. Reao, Tureia, Mangareva, and develop management/eradication plans at those sites. Timetable as agreed at 2016 meetings. Stakeholders – Catholic Church, Councils, Schools, **lead agency** as identified at 2016 meetings. Action 6 – Raise awareness of biosecurity needs and techniques amongst agencies and community. Timetable as agreed in 2016 meeting. Stakeholders – As for Action 5.

Objective 5 – Evaluate potential islands for translocation

Background.

Tenararo appears to offer the best habitat for Tutururu at present. There, preferred habitat comprises coastal forest dominated by *Boerhavia tetrandra, Cassytha filiformis, Guettarda speciosa, Pandanus tectorius, Portulaca lutea, Scaevola taccada* and *Heliotropum foertherianum,* while *Achyranthes aspersa* and *Digitaria* are key sources of food. Low densities of coconut canopy and undergrowth are tolerated, but not dense coconut canopy or undergrowth. Substrates of sand and particularly soil are also favoured. Potential translocation islands should exhibit the bulk of these features as well as being free of IAS and with favorable biosecurity. Island physiography is also important, i.e. islands should be large, not be vulnerable to ocean swells swamping the island and habitats, and take account of specific reconemendations in the IUCN Guidelines for Re-introductions (IUCN 1998). A suite of potemtial islands should include some which are a long distance from Acteon to minimise the chances of disease being spread between populations.

Action 1 – Evaluate the motivation and conditions from the Catholic Church to allow some Tutururu to be caught from Tenararo in order to create new, secure populations (and its timetable if the answer is positive) and an alternative population for bird-watching. Meet with Church and other stakeholders in order to confirm if this strategy is feasible and identify their preferred options.

Action 2 – Evaluate suitability of Temoe for Tutururu if it is confirmed free of rats in 2016-17. A comprehensive vegetation assessment has been completed (Butaud 2011, 2014).

Action 3 – Evaluate suitability of those Pitcairn Islands currently rat-free, i.e. Oeno (69 ha) and Ducie (390 ha). These islands have similar vegetation (including *Achyranthes aspersa*) to the Acteon islands, but are relatively small and may potentially be prone to damaging ocean swells.

Action 4 –Work with Rangiroa community to evaluate suitability of Rangiroa motu for supplementing the existing (male) population, addressing risks of rats, disease, visitations, etc.

Action 5 – If one or more of these islands above are suitable for Tutururu, develop a translocation plan that takes into account source populations and timing of translocations, capture and transfer methods, captive husbandry, monitoring, etc. (IUCN 1998).

Stakeholders for Actions 1-5 – Catholic Church, **SOP MANU,** BirdLife, potentially UK government and RSPB. Timing - evaluations and translocation planning best completed after eradication status of Vahanga, Tenarunga and Temoe are known in 2016-17.

Objective 6 - Evaluate other more distant islands for potential translocation if they become pest-free in future

Background.

Other more distant islands that could be considered include islands in the southern Cook Island group where the species once occurred and at Henderson Island in the Pitcairn Islands where a separate species once occurred (Steadman 2007). Distant sites provide better protection from stochastic events, e.g. diseases, cyclones, tsunami. Preferred scenarios are as for the previous Objective 5.

Action 1 – Evaluate suitability of Henderson Island if it becomes rat-free (this island is a very large (3700+ ha) raised atoll and has over 51 plants including *Achyranthes aspersa*) and few coconuts (BirdLife 2012.)

Action 2 – Evaluate suitability of islands in the southern Cook Islands if they become rat and cat free, e.g. Atiu, Mangaia and Takutea.

Action 3 – Work with possible destination communities and agencies as for Action 4 in previous Objective 5.

Stakeholders for Actions 1-3 – Catholic Church, **SOP MANU,** BirdLife, potentially UK government and RSPB for Action 1 and Cook Islands and Te Ipukarea Society for Actions 2-3. Timing - evaluations and translocation planning best completed after eradication status of Vahanga, Tenarunga and Temoe are known in 2016-17.

Objective 7 – Manage habitat quality of key islands in the Acteon Group

Background.

This particularly applies to the Acteon Group and Rangiroa. In the former, coconuts planted in the 1970s and 1980s are altering the habitat of both Tenararo and Vahanga. Juvenile coconuts are beginning to form a dense shrub layer on the edges of the motu and in the understory, thereby displacing the important food plants used by Tutururu. Eventually the *Achyranthes* shrubs and other key feeding sites will be lost from these islands.

It would be feasible to select key feeding areas of Tutururu and keep these free of juvenile coconuts. These key areas on Tenararo are the lagoon edge of the SE motu and all small motu plus the hoa separating all of these motu. The key areas on Vahanga are the edges of the hoa of all motu and outer parts of the small motu. Other issues relate to weed species e.g. lantana, which is currently being managed on Vahanga.

Action 1 – Meet with Catholic Church to discuss and agree on and scope a habitat management plan that is mutually acceptable. 2016.

Action 2 – Implement management as identified in a plan from Action 1 above and monitor outcomes on regular basis, potentially working in with Tutururu monitoring visits.

Stakeholders for Actions 1-2 – **Catholic Church, SOP MANU**

Objective 8: Gather more information on Tutururu biology and threats

Background.
A better knowledge of the species' biology, including seasonal habitat preferences and disease threats, will help to guide future conservation actions mre effectively.

Action 1 – Continue the follow-up of the colour-banded individuals on Rangiroa and colour-band all new individuals.

Note that re-sightings of colour-banded birds will enable knowledge their survival over the years, along with their movements between the motu of Rangiroa. For the same reason, it is important to band all new individuals; this also helps determine survey efficiency and allows a more precise count of the population, because a same individual cannot be counted twice if it is identified with its band. This action will allow a better understand the biology of the species: average lifetime, renewal rate of the population, movements between the islets and population size.

Action 2 – Collect data on biology of the birds of Acteon and Morane subpopulations

During monitoring of Acteon and Morane birds, make standard observations of seasonal habitat use, feeding sites, food, breeding behaviour, etc. This will add to the growing information base on the species which is critical to its survival.

Action 3 – Carry out targeted research on avian influenza to assess the threats from different sources (e.g. chickens, wild birds, soil spores, etc.) to allow informed management of Tsutururu islands and potential islands for this species and the Titi.

Stakeholders for Actions 1-3 – Catholic Church, ornithologists, **SOP MANU**

Objective 9 – Tutururu Awareness Raising

Background.

The communities of Tuamotu, Gambier and Society Islands are key to the successful recovery of Tutururu. By raising the awareness of the predicament that Tutururu is in, along with the threatening processes, school children and the community generally will become better aware and more effective advocates for the species. Key threats (rats and invasive ants) also have a negative impact on agriculture and tourism economies and so are a common enemy of all projects. It is essential to include local populations in the Tutururu conservation programme. Getting their approval and their help to conduct field trips on their islands is a key factor of the programme. Additionally, this will give a greater ownership of the programme to people and they will thus act as a relay when Manu is not present on the islands (i.e. the great majority of the year).
We believe children are very receptive to new information, especially in schools of the Tuamotu which receive few visits of scientists. As some of those children will be the future users and/or owners of land where Tutururu occur, it is important to raise their awareness about the species and inform them about the good practices to set up to preserve it. Additionally, children are known to be very good information vectors towards their parents, so we also aim to indirectly raise their parents' awareness about the species.

There are opportunities for working synergistically with similar awareness raising for the Tuamotu Sandpiper (Titi) which faces similar threats to that of Tutururu.
Action 1 – Work with schools, councils, Catholic Church, etc. to have Tutururu and general conservation projects included in schools, meeting agendas, etc. Include photos, videos and other awareness material from overseas on invasive ants, rats etc. With schools there are opportunities for developing surveillances projects for detecting or delineating IAS, e.g. yellow crazy ant on Tureia. Explore options for setting up and running Site Support Groups as on Rangiroa. Action 2 – Make material available on professional websites, e.g. birding sites, yacht web sites declaring exclusion zones without being specific to sensitive islands. - Stakeholders for Actions 1-2 – Catholic Church, **SOP MANU,** Education, teachers, Agriculture, mayors, BirdLife, also information sources in NZ, UK and Australia. Key decision-makers identified include: - the representative of the different local community (Church, school teacher, environment NGO) of the Island where the Polynesian Ground-dove are or could be after an introduction or a restoration of the Island; - the mayor of the district where the Polynesian Ground-dove are or could be after an introduction or a restoration of the Island; - the different persons on charge of the administration of the archipelagos for the local government or French government; - the administrative person on charge of the terrestrial biodiversity in the Direction of Environment of French Polynesia; - the ministry of the environment of the local government; - the representative of the French government in French Polynesia.

9. Conclusion

This action plan builds on the current action plan and existing initiatives by SOP MANU and its supporters to restore islands in the Acteon and Gambier groups to provide habitat for the Critically Endangered Tutururu and other threatened biota. Many of the initiatives identified here are needed by both the Tutururu and Titi. It is hoped that this Action Plan will assist in coordinating ongoing conservation activities and succeed in obtaining funding for further work to this end.

BIBLIOGRAPHY

Albar G., Champeau J., Autai T., Gouni A., Gfeller H., Gfeller K., Gfeller M., Gfeller K. Jr (2009). Programme de conservation de la Gallicolombe érythroptère *Alopecoenas erythropterus* en 2009. Unpublished report. Société d'Ornithologie de Polynésie, Taravao, Tahiti, French Polynesia, 13 p.

Albar G., Champeau J., Yan L., Gouni A., Gfeller H., Carles B., Quemin M., Gfeller N., Taaroa N. (2010). Programme de conservation de la Gallicolombe érythroptère Alopecoenas erythropterus en 2010. Société d'Ornithologie de Polynésie Manu, Taravao, French Polynesia, 19 p.

Albar G., Ghestemme T., Thierry A., Gfeller H., Gueffier, F., Gfeller N. (2011). Recherche des Gallicolombes erythropteres. SOP report, 3 pp.

Atkinson I. A. E. (1985). The spread of commensal species of *Rattus* to oceanic islands and their effects on island avifaunas. *International Council for Bird Preservation Technical Publication* **3**, 35-81.

Beck R. H. (MS). Typed copy of the Whitney South Sea Expedition journal, 1920-1924. Filed in the American Museum of Natural History, New York, USA.

BirdLife International (2009). *Alopecoenas erythropterus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.2. <www.iucnredlist.org>. Downloaded on 20 July 2010.

BirdLife International (2015) Species factsheet: *Alopecoenas erythropterus*. Downloaded from http://www.birdlife.org on 03/07/2015. Recommended citation for factsheets for more than one species: BirdLife International (2015) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 03/07/2015.

Blanvillain C. (1999). Projet Tutururu. Projet 1, phase 1 : Conservation de la Gallicolombe érythroptère, établissement de la situation de l'espèce. Confidential report. Société d'Ornithologie de Polynésie, Taravao, Tahiti, French Polynesia, 15 p.

Blanvillain C. (2001). Post-doctorat sur l'étude et la sauvegarde des oiseaux endémiques de Polynésie française. Rapport final d'activité 2000-2001. Confidential report. Société d'Ornithologie de Polynésie, Papeete, Tahiti, French Polynesia & Université de la Polynésie française, Laboratoire de Biologie, Faa'a, Tahiti, French Polynesia, 13 p.

Blanvillain C. Pierce R., Saulnier D., Itihura R., Craig E., Tehano T., Kapihura, J., Ahmi B., Mahiti J., Teano E., Teahuotoga N., Moearo T., Temano M. (2003). Project Tutururu : Follow-up final report. Confidential report. Université de Polynésie française, Laboratoire de Biologie, Faa'a, Tahiti, French Polynesia & Société d'Ornithologie de Polynésie Française, Taravao, Tahiti, French Polynesia, 11 pp.

Blanvillain C., Serra C., Butaud J.-F., Levy P. (2002a). Rapport de mission sur le programme de sauvegarde de la Gallicolombe de la Société (*Alopecoenas* erythropterus). Rapport confidentiel. Société d'Ornithologie de Polynésie, Taravao, Tahiti, French Polynesia, 10 p.

Blanvillain C., Florent C., Thenot V. (2002b). Land birds of Tuamotu Archipelago, Polynesia : relative abundance and changes during the 20th century with particular reference to the critically endangered Polynesian ground-dove (*Alopecoenas erythropterus*). *Biological Conservation* **103**, pp 139-149.

Blanvillain C., Chaussard E., Gfeller H., Gfeller He, Blanc L., Teriitaohia T., Fontaine P.E., Scanga V. et Ghestemme T. (2014). Conservation de la Gallicolombe érythroptère (Alopecoenas erythroptera Gmelin, 1789), oiseau endémique des Tuamotu en danger critique d'extinction à Rangiroa. SOP MANU, Papeete.

Butaud, J-F. (2011). Plants and Birds of Temoe Island (Tuamotu, Eastern Polynesia).

Butaud, J-F. (2014). Tuamotu de l'est. Guide Floristique. Direction de l'environnement.

Faulquier L. (2014). Inventaire ornithologique de l'atoll de Raraka SOP MANU, Papeete.Ghestemme, T. and Cranwell S. 2015. Operational Plan to Eradicate Rats, Cats, Rabbits, Goats, and Control Lantana on three Islands and three Atolls in French Polynesia. SOP MANU, Papeete.

Ghestemme T., Gouni A., Portier E., Gfeller H., Levy P. (2008). Programme de conservation de la Gallicolombe érythroptère, *Alopecoenas erythropterus*. Unpublished report. Société d'Ornithologie de Polynésie, Taravao, Polynésie française, 16 p.

Ghestemme T., Faulquier L., Durieux J., Portier E., Kape J., Gfeller H., Gouni A. (2009). Programme de conservation de la Gallicolombe érythroptère *Alopecoenas erythropterus*, ou *Tutururu*. Mission d'éradication des rats et de baguage des Tutururu du 12 au 22 décembre 2008. Rapport non publié. Société d'Ornithologie de Polynésie, Taravao, Polynésie française, 26 p.

Ghestemme T., Blanvillain C., Albar G., Gouni A., Gfeller H. , Blanc L. , Chaussard E., Say Salllaz E. et Taaroa N., 2012. Amélioration des connaissances sur la Gallicolombe érythroptère (Gallicolomba erythroptera Gmelin, 1789), oiseau endémique des Tuamotu en danger critique d'extinction. SOP MANU, Papeete

Ghestemme T., Cranwell S. 2015. Operational Plan to Eradicate Rats, Cats, Rabbits, Goats, and Control Lantana on three Islands and three Atolls in French Polynesia.

Global Invasive Species Database. 2015. *Anoplolepis gracilipes.* ISSG.

Gouni A., Blanc L., Barrau-Juin C., Gfeller H., Levy P. (2004). Programme de conservation de la Gallicolombe de la Société, *Alopecoenas erythropterus*. Unpublished report. Société d'Ornithologie de Polynésie, Taravao, Tahiti, French Polynesia, 46 p.

Gouni A., Blanc L., Gaugne S., Gfeller H., Levy P., Lau N. (2005). Programme de conservation de la Gallicolombe de la Société, *Alopecoenas erythropterus*. Unpublished report. Société d'Ornithologie de Polynésie, Taravao, French Polynesia, 29 p.

Gouni A., Zysman T. (2007). Oiseaux du Fenua – Tahiti et ses îles. Téthys Editions, Taravao, Tahiti, French Polynesia, 239 p.

Grassi 2013 – see p9 Breeding

Griffiths R., Climo G., Gouni A. (2008). Ecological restoration of Vahanga Atoll, Acteon Group, Tuamotu Archipelago. Department of Conservation, Wellington, New-Zealand, Société d'Ornithologie de Polynésie, Taravao, French Polynesia, 16 p.

Holyoak D.T., Thibault J.-C. (1984). Contribution à l'étude des oiseaux de Polynésie orientale. Mémoires du Muséum National d'Histoire Naturelle, Série A, Zoologie, Tome 127. Editions du Muséum, Paris, France.

IUCN (1998). *Guidelines for Re-introductions.* Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. 10 pp.

IUCN 2015. The IUCN Red List of Threatened Species. Version 2015-4. <www.iucnredlist.org>. Downloaded on 26 December 2015

Lacan F., Mougin J. L. (1974). Les oiseaux des îles Gambier et de quelques atolls orientaux de l'Archipel des Tuamotu (Océan Pacifique). *L'Oiseau et la Revue Française d'Ornithologie* **44**, pp. 193-280.

Monnet C., Sanford L., Siu P., Thibault J.-C., Varney A. (1993). Polynesian Ground-Dove (*Alopecoenas erythropterus*) discovered at Rangiroa Atoll, Tuamotu Islands (Polynesia). *Notornis* **40**, pp 128-130.

Murphy R. C. (1924). Birds collected during the Whitney South Sea Expedition. I. *American Museum Novitates* **115**, pp 8-10.

Petitot C., Petitot F. (1975). Observations ornithologiques dans l'atoll de Manihi (Tuamotu) et dans l'île de Tubuai (Australes). *L'Oiseau et la Revue Française d'Ornithologie* **45**, pp 83-88.

Pierce R.J., Blanvillain C. 2004. Current status of the endangered Tuamotu sandpiper or Titi *Prosobonia cancellata* and recommended actions for its recovery. *Wader Study Group Bulletin 105*: 93-100.

Pierce R., Raust P., Wragg G. (2003). Report on an avifauna survey of atolls in the Tuamotu and Austral archipelagos, French Polynesia. Wildland Consultants, Rotorua, New Zealand, 20 p.

Pierce R., S. Boudjelas, K. Broome, A. Cox, C. Denny, A. Gouni & P. Raust 2006. Ecological restoration of Vahanga Atoll, Acteon Group, Tuamotu Archipelago Operational Plan draft. EcoOceania Ltd draft report.

Pierce R.J., Blanvillain C., Burle M-H. 2015. Bird research and monitoring associated with SOP Manu pest eradications in Acteon-Gambier Archipelagos, June 2015. Eco Oceania Pty Ltd draft report for BirdLife and SOP Manu.

Poulsen M. K., Intes A., Monnet C. (1985). Observations sur l'avifaune en 1984. In: ORSTOM (Ed.), *Contributions à l'étude de l'atoll de Tikehau' notes et documents océanographiques* **24**, Papeete, pp 114-124.

Seitre R., Seitre J. (1992). Causes of land-bird extinctions in French Polynesia. *Oryx* **26** (4), pp 215-222.

Steadman D. W. (1989). Extinction of Birds in Eastern Polynesia: A Review of the Record, and Comparisons with Other Pacific Island Groups. *Journal of Archaeological Science* **16**, pp 177-205.

Steadman D. W., Justice L. J. (1998). Prehistoric exploitation of birds on Mangareva, Gambier Islands, French Polynesia. *Man and Culture in Oceania* **14**, pp 81-98.

Thibault J-C. (1988). Menaces et conservation des oiseaux de Polynésie française. *In* : Thibault J-C., Guyot I. (Eds.). *Livre rouge des oiseaux menacés des régions françaises d'Outre-Mer*. Monographie n°5, Conseil International pour la Protection des Oiseaux, CIPO, France, pp 87-124.

Zito J. 2015. Tenarunga incidental sightings and bird list. Island Conservation unpublished report.