

SEABIRDS OF THE GAMBIER ARCHIPELAGO, FRENCH POLYNESIA, IN 2010

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SUMMARY

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We visited the Gambier Archipelago in April 2010, and noted the presence of 15 species of seabirds. An additional species was noted in 2008 and 2011 during a visit by members of our team. The species and breeding populations are significant for the French Polynesian region, including nesting Polynesian Storm-Petrel *Nesofregatta fuliginosa*, listed as Endangered by the International Union for the Conservation of Nature (IUCN). We noted nesting by 11 species, including confirmation of the presence of breeding Red-footed Booby *Sula sula*, previously noted in 2008. The islands in the south of the archipelago were the main focus for our study, as they had been proposed as sites for island restoration through removal of introduced mammal species. These were Manui, Kamaka, Makarua and the tiny islet of Motu Teiku. These sites held the richest and most numerous populations of seabirds in the archipelago, and, as they are very near to one another and relatively inaccessible due to difficult landing conditions, they presented the best opportunities to safeguard the important large seabird populations of the south of the French Polynesian Region.

Key words: seabird, Gambier Islands, French Polynesia, population surveys

INTRODUCTION

Despite a major extinction of terrestrial birds in the Gambier Archipelago (Conte *et al.* 2004, Lacan & Mougin 1974, Steadman & Justice 1998), this island group still holds important seabird populations that have remained relatively stable during the 20th century (Thibault & Bretagnolle 1999). The scientific community has recognised these islands as important for seabird conservation regionally and globally because of high species diversity (11 nesting species), including three endangered species. These are the IUCN red-listed Polynesian Storm-Petrel *Nesofregatta fuliginosa* (Endangered) the Tahiti Petrel *Pseudobulweria rostrata* (Near threatened) and the Murphy's Petrel *Pterodroma ultima* (Near threatened) (IUCN 2011).

Previous surveys at the Gambier Archipelago found 14 breeding seabird species and three non-breeding species, summarised by Thibault & Bretagnolle (1999) (Table 1). The earliest scientific study was the Whitney South Seas Expedition in May 1922 (R.H. Beck, unpublished journal), which recorded 11 species. Emory (1939) noted only two species, but his study was focused on archaeology. Subsequently, multi-year surveys were carried out in 1965–1968 (Lacan & Mougin 1974) and in 1971 by Thibault (1973), who also visited the archipelago in 1995/96 (Thibault & Bretagnolle 1999). These visits added several new species to those known at the Gambier Islands, in particular Murphy's Petrel and Polynesian Storm-Petrel (Lacan & Mougin 1974) as well as Tahiti Petrel (Thibault & Bretagnolle 1999). The number of breeding individuals noted for any species has been consistently small (Thibault & Bretagnolle 1999), probably due to the presence of numerous alien species, such as rats *Rattus* spp., cats *Felis catus* and pigs *Sus scrofa*, which are all known to have direct impacts on native species (Anderson 2009, Atkinson 1985, Jones *et al.* 2008).

There is significant interest from the scientific community in engaging in restoration projects to conserve sites and their seabird populations in the Gambier Islands (Butaud 2008, Thibault & Bretagnolle 1999, Wragg & Raust 2004). Local community members have also been actively involved. For example, the owner of Kamaka Island has been proactive in seeking methods and expert assistance to eradicate rats from that island (J. Reasin, pers. comm.). Some islands are uninhabited and isolated by several kilometres of water from the main inhabited sites and also have simple communities of introduced species (e.g. only one or two species of introduced mammals), so are good targets for restoration through eradication of non-native predators.

The primary reason for our visit was to assess the feasibility of rat eradications at several sites, and this study focussed on assessing seabird breeding populations as part of that wider study. We surveyed seabird populations around the Gambier archipelago. In particular, we targeted four rocky islets in the south of the group, where the feasibility of rat eradication seemed most promising based on expert opinion. These four islets were recognised as a BirdLife Important Bird Area (IBA) by Raust & Sanford (2007). They are part of the protected area (*zone de site protégé – réserve d'oiseaux*) in the Plan d'Aménagement Général (PGA) of the Gambier Islands.

STUDY AREA AND METHODS

The Gambier Archipelago (23°03'S, 135°W) is located in the subtropical Pacific Ocean, south of the Tuamotu Archipelago and approximately 1 800 km southeast of Tahiti (Fig.1). Twenty-one islands and islets make up this archipelago, which is among the remotest of all island groups in French Polynesia. They are spread

over a marine area of 2 550 ha (Andréfouët *et al.* 2005). A barrier reef with several coral islets encloses the north and east of the lagoon, but the lagoon is open to the ocean in the south.

We visited the Gambier Archipelago from 30 March to 6 April 2010. Visits by members of our team from 16–30 April 2008

(L. Faulquier, pers. obs.) and in January 2011 (J. Champeau, pers. obs.) yielded important observations at Mangareva. In our 2010 visit, we conducted thorough searches over six days for seabirds and introduced mammals. We visited 10 islands for periods of a few hours to 48 h to provide a survey of the diversity of seabird species nesting throughout the archipelago. Our focus was on the following

TABLE 1
Summary results of previous surveys at the Gambier Islands

Species	IUCN ranking ^a	Survey (date)					
		R. Beck Unpublished notes from Whitney South Seas Expedition (27 Apr–11 May 1922)	Emory 1939 Mangarevian expedition (1934)	Lacan & Mougin 1974, Lacan & Mougin unpublished data (Nov 1965, May 1966, Apr 1967, Apr 1968, Apr 1969)	Thibault 1973 (28 Jul–10 Aug 1971)	Thibault & Bretagnolle 1999 data for breeding birds from Table 1 (13–Dec 1995 and from 25 Jul–11 Aug 1996)	Butaud 2008 (Sept 2008)
<i>Anous minutus</i>	LC	Several pairs		Several tens of pairs	Several tens of pairs	< 50 pairs	Few nests
<i>Anous stolidus</i>	LC	Several pairs and nests		Several hundred pairs		150–242 pairs	
<i>Fregata ariel</i>	LC	No data	No data	Not data	No data	No data	No data
<i>Fregata minor</i>	LC	Not breeding		Not breeding	Not breeding	Not breeding	
<i>Gygis alba</i>	LC	Breeders	Present but number unknown	Several thousand pairs	Breeders	< 600 pairs	Few nests
<i>Nesofregatta fuliginosa</i>	EN			> 10 pairs		200–500 pairs	1 corpse
<i>Phaeton lepturus</i>	LC	5 specimens collected, breeders	1 specimen collected	Present but number unknown, breeders		15–22 pairs	
<i>Phaethon rubricauda</i>	LC			1 pair		1–2 pairs	
<i>Procelsterna cerulea</i>	LC	6 specimens collected		1000 individuals, breeders	1 nests	60–123 pairs	
<i>Pseudobulweria rostrata</i>	NT					12–26 pairs	1 nests
<i>Pterodroma heraldica</i>	LC			Present but number unknown	50 individuals	77–118 pairs	
<i>Pterodroma ultima</i>	NT			Present but number unknown	Present but number unknown	5–10 pairs	2 nests
<i>Puffinus lherminieri</i>	LC	25 specimens collected		> 100 pairs		660–1085 pairs	Several individuals
<i>Puffinus nativitatis</i>	LC					450–850 pairs	
<i>Puffinus pacificus</i>	LC	4 juveniles collected		Present but number unknown		60–85 pairs	
<i>Sula leucogaster</i>	LC			< 10 pairs		3–5 pairs	15 nests
<i>Sula sula</i>	LC			Not breeding		100 individuals	10 nests
<i>Sterna bergii</i>	LC	Not breeding		Not breeding	Not breeding	Not breeding	

^a LC = least concern; EN = endangered; NT = near threatened

sites: Makaroa, Kamaka, Manui and Motu Teiku (Fig. 1). These steep, rocky, volcanic islands are in the south of the archipelago and therefore exposed to strong swells from the open ocean; hence, they are chiefly uninhabited (although Kamaka is inhabited periodically during the year by one family; J. Reasin pers. comm.). They differ markedly from the low-lying coral atolls that characterise most of the rest of the group, which are inhabited (some only seasonally) or visited regularly by residents of Mangareva.

For the four southern sites, we deployed the following survey effort: Manui – one camping night and daytime walk-through surveys, 2 trap nights; Makaroa – one camping night, and daytime walk-through surveys, no trapping; Kamaka – one camping night, daytime walk-through surveys, no trapping; and Motu Teiku – 2 trap nights and walk-through surveys in the daytime. At Kamaka and Makaroa, confirmed observations of rodents from the island owners or previous surveys negated the need to trap (Wragg & Raust 2004, Faulquier pers. comm., J. Reasin pers. comm.). At each site we used 20–50 snap-traps, set each night and baited with peanut butter. We walked across the majority of the island in each case and ensured that all slopes or cliffs that could safely be seen were observed.

At Kouaku and Gaioio, walk-through surveys of 2–4 h were conducted to search for seabird nests during daytime. We spent two evenings at Mount Duff (Mangareva) to assess the presence of Tahiti Petrel reported by Thibault & Bretagnolle (1999), augmented by two separate evening visits in late April 2008 and January 2011.

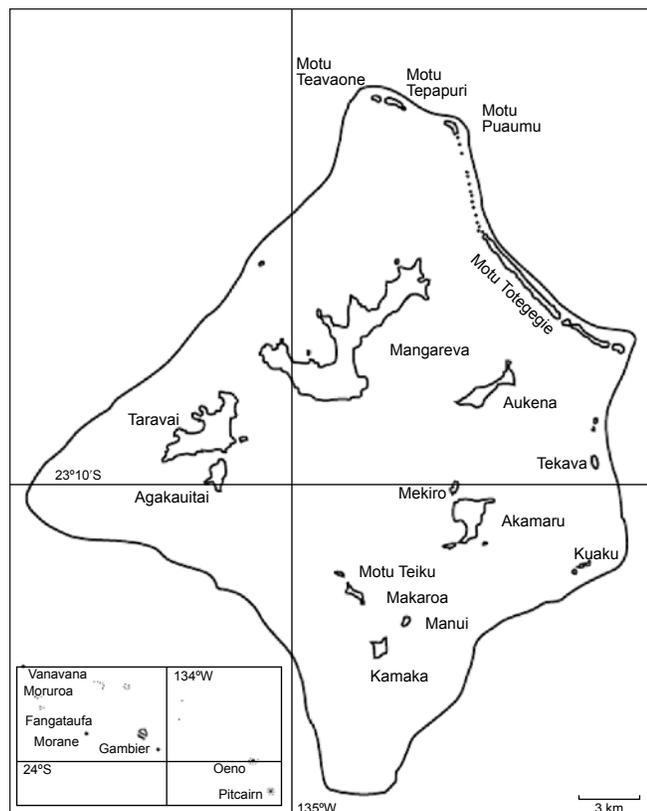


Fig. 1. Gambier Archipelago, south of the Tuamotu Archipelago in French Polynesia, showing the locations of the various small islands visited (after Faulquier 2008, unpublished report “Feasibility study for the eradication of rats from islands of the Gambier Archipelago (French Polynesia)”).

At Teavaone, Tepapuri and Puaumu, which form a continuous chain of atolls, being part of the outer reef of the northern Gambier Islands, we spent two nights and two days surveying for introduced species and seabirds, and we trapped for two nights. We trapped for rats at Mekiro during one night and conducted walk-through surveys in daytime.

At Teavaone, Tepapuri and Mekiro (in addition to two other islets that we did not visit), previous rat eradications had been undertaken (Wragg & Raust 2004); therefore, we were interested in surveying for the presence of rats at these sites.

The timing of our visit to the region was determined by logistical constraints, not by the timing of the breeding of petrels. Therefore, we did not expect to find all petrels previously noted breeding at the sites we visited.

Walk-through surveys were conducted with a minimum of two observers, independently recording seabirds observed in flight and nesting. For this methodology, we visited all accessible areas of the site at a walking pace and noted species seen and heard. These were not transect-surveys, as we maintained neither a fixed distance of monitoring nor a fixed transect-length. Results were compared, and a range recorded where the numbers observed differed between observers.

RESULTS

We observed 16 species of seabird, of which 12 were noted to be breeding (Table 2), including confirmation of breeding by Red-footed Boobies, first reported by Butaud (2008), who observed about 10 Red-footed Boobies’ nests on Manui.

Information on introduced predators from our survey and previous studies are given in Table 3. Our direct observations of introduced mammals included Pacific rats *Rattus exulans* on Teavaone and Tepapuri, where we also found pigs. The latter were also present at Puaumu. At Mekiro, we trapped Ship rats *Rattus rattus* only; at Manui, we observed rabbits *Oryctolagus cuniculus* but no rats. No introduced mammals were found at Motu Teiku. We searched for but found no sign of rats at Kouaku, although we did not trap at this site. At Makaroa, we observed a small herd of goats *Capra hircus*. Sixteen individuals were counted, but goats observed in previous years numbered as many as 50 (J. Reasin, pers. comm.).

DISCUSSION

The primary finding of the study was that the islands of Makaroa, Manui, Kamaka and Motu Teiku, in the south of the Gambier Archipelago, hold significant populations of seabirds for the region. These include the globally threatened Polynesian Storm-Petrel, listed as Endangered (IUCN 2011), found at Motu Teiku and Manui. Although the numbers of birds for any of the populations observed were not high, the high diversity of seabird species at the sites is an important factor in determining priorities for conservation action, and in particular for site restoration. These four southern islands had populations of three species of shearwater: Christmas, Wedge-tailed and Audubon’s shearwaters, *Puffinus nativitatis*, *P. pacificus* and *P. lherminieri*, respectively, all found in small numbers.

One new non-breeding species was observed, the Lesser Frigatebird *Fregata ariel*, noted at Makaroa. In addition, a relatively large number of Black Noddies *Anous minutus* (250 nests) was found

to be breeding at Kouaku, where they had been recorded breeding in 1968 (Lacan & Mougin in Thibault & Bretagnolle 1999) but had been subsequently reported as probably extinct (Thibault & Bretagnolle 2007). We searched extensively for signs of rats at this site, but none was found.

We confirmed the reports of nesting Red-footed Boobies at Manui, previously noted by J.-F. Butaud in 2008. This species was noted in the 1970s and 1990s as non-breeding only (Lacan & Mougin 1974, Thibault & Bretagnolle 1999).

A site that is particularly important but also highly vulnerable in the southern Gambier Islands is Motu Teiku. This site of less than 1 ha had no introduced predators and supported seven species, including Polynesian Storm-Petrel and Audubon's and Christmas Shearwaters. This is the most diverse of Gambier sites. However, a stretch of only 300 m of water separates it from Makaroa, where we found Polynesian rats and none of these seven bird species. The absence of a coral reef in this area leads to strong swells; a rat dispersion from Makaroa is therefore unlikely since Pacific rats are poor swimmers and are not known to disperse naturally

TABLE 2
Seabirds in Gambier archipelago in April 2010

Species (alphabetical order)	IUCN ranking ^a	Mount Duff (Mang- areva)	Teavaone- Tepapuri	Puaumu	Mekiro	Kouaku	Manui	Kamaka	Makaroa	Motu Teiku
<i>Anous minutus</i>	LC					250 nests		< 50 nests	5–10 individuals	
<i>Anous stolidus</i>	LC		< 50 individuals	< 50 individuals		< 50 individuals	< 50 individuals	< 50 nests	5–10 individuals	<50 pairs
<i>Fregata ariel</i>	LC								1 individuals	
<i>Fregata minor</i>	LC						2 nests	x	2 individuals	
<i>Gygis alba</i>	LC		100–250 individuals	250 individuals		3 nests	10–20 pairs	10–20 pairs	5–20 nests	50–250 individuals
<i>Nesofregata fuliginosa</i>	EN						<1000 pairs			< 50 pairs
<i>Phaethon lepturus</i>	LC	x						< 50 individuals		
<i>Procelsterna cerulea</i>	LC						< 50 individuals	10–20 pairs	< 10 individuals	3–4 individuals
<i>Pterodroma heraldica</i>	LC	3 individuals ^b								
<i>Pseudobulweria rostrata</i>	NT	2–30 individuals								
<i>Puffinus lherminieri</i>	LC	6–12 individuals					500–2 500 pairs	5–20 pairs	< 50 individuals	250 pairs
<i>Puffinus nativitatis</i>	LC									< 50 pairs
<i>Puffinus pacificus</i>	LC	< 50 individuals					Present but number unknown	10–50 pairs		
<i>Sula leucogaster</i>	LC						< 50 pairs	2–10 nests		
<i>Sula sula</i>	LC						20 pairs			
<i>Sterna bergii</i>	LC		5 individuals							

^a LC = least concern; EN = endangered; NT = near threatened

^b L. Faulquier, pers. obs. Reported in Faulquier & Ghestemme. Also reported in January 2011 by J. Champeau (pers obs.).

further than 100 m across water. However, this risk of dispersion, even if small, must be considered seriously, as it could lead to considerable seabird population reduction, and worse, eliminate the last mammal-free nesting site for shearwaters and storm-petrels in the Gambier archipelago.

At Makaroa, despite extensive searching and an overnight visit, we did not detect any sign of shearwater nesting (no burrows were found), although several Audubon's Shearwaters were seen by lamplight at night. We believe that the presence of rats at this site and the considerable habitat degradation due to overgrazing by goats probably had eliminated the shearwater populations. In 1995/96, it was estimated that 250 pairs of Christmas Shearwaters, 50 pairs of Audubon's Shearwaters and unknown numbers of Wedge-tailed Shearwaters nested at the site (Thibault & Bretagnolle 1999). It appears that shearwaters can survive in the presence of Pacific rats alone but not in the presence of both rats and goats.

We did not find Murphy's Petrel during our surveys, but these had been noted in June–August 1996 by Thibault & Bretagnolle (1999). Budaud (2008) found two nests on Manui in September 2008. The lack of observations during our visit may be due to the difference in timings.

We did not observe Herald Petrels, but they were observed at Mangareva (Mount Mokoto) in late April 2008 (L. Faulquier, pers. obs.) and in January 2011 (J. Champeau, pers. obs), after our study. The species was not observed at this site during January 2007 by Thibault & Bretagnolle (2007).

The Red-tailed Tropicbird appears to have disappeared from the area since the 1995 survey, when only one pair was present (Thibault & Bretagnolle 1999). Previously, it was noted at Kamaka and Aukena (Steadman & Justice 1998). It appears that the species is very sensitive to human disturbance, as it is rarely found at inhabited or

TABLE 3
Introduced species in Gambier Islands

Island	Visited in 2008 ^a and/or in 2010	Introduced species ^b									
		Pacific rat <i>Rattus exulans</i>	Ship rat <i>Rattus rattus</i>	House mouse <i>Mus musculus</i>	Cat <i>Felis catus</i>	Dog <i>Canis lupus familiaris</i>	Rabbit <i>Oryctolagus cuniculus</i>	Goat <i>Capra hircus</i>	Sheep <i>Ovis aries</i>	Pig <i>Sus scrofa</i>	Cane toad <i>Rhinella marina</i>
Agakauitai	yes	?	X	?	X	0	0	X	0	0	0
Akamaru	yes	X	X	?	X	X	0	X	0	0	0
Aukena	no	?	?	?	?	?	?	?	?	?	0
Gaioio	yes	X	?	?	?	?	?	?	?	?	0
Kamaka	yes	X	0	0	0	X	0	0	0	0	X
Kouaku	yes	0	0	0	0	0	0	0	0	0	0
Makapu	yes	?	?	?	0	0	0	?	0	0	0
Makaroa	yes	X	0	?	0	0	0	X	0	0	0
Mangareva	yes	X	X	?	X	X	0	X	X	X	0
Manui	yes	0	0	0	0	0	X	0	0	0	0
Mekiro	yes	X	X	?	?	0	0	X	0	0	0
Motu Teiku	yes	0	0	0	0	0	0	0	0	0	0
Pohue	no	?	?	?	?	?	?	?	?	?	0
Puaumu	yes	0	0	0	0	0	0	0	0	X	0
Tarauru Roa	no	?	?	?	?	?	?	?	?	?	0
Taravai	yes	X	?	?	X	X	0	X	0	0	0
Tauna	yes	?	?	?	0	0	0	0	0	0	0
Teavaone	yes	X	0	0	0	0	0	0	0	X	0
Tekava	no	?	?	?	?	?	?	?	?	?	0
Tenoko	no	?	?	?	?	?	?	?	?	?	0
Tepapuri	yes	X	0	0	0	0	0	0	0	X	0
Totegegie	yes	X	X	?	?	X	0	0	0	0	0
Vaiatekeue	no	?	?	?	?	?	?	?	?	?	0

^a L. Faulquier, pers. obs. Reported in Faulquier & Ghestemme. Also reported in January 2011 by J. Champeau (pers obs.).

^b X = presence; 0 = absence; ? = occurrence unknown

frequently visited sites. The presence of pigs and dogs on atoll islets could also have led to the extirpation of this species.

Our study allowed the state of seabird populations at the Gambier Archipelago to be brought up to date. It has identified the continuing presence of important, although vulnerable, populations of shearwaters, storm-petrels and other birds, especially in the south of the island group. This, along with the synthesis of information on introduced predators, provides a strong basis for prioritising site restoration work. The highest priorities for site restoration are those with the highest seabird diversity; namely, Kamaka, Manui, Makaroa and Motu Teiku.

The Société d'Ornithologie de Polynésie (MANU) is preparing to eradicate introduced mammals from each of these four sites. This program, if successful, is likely to allow for consolidation of seabird populations in the archipelago. Because of the close proximity of the various islands, bird species will probably colonise neighbouring predator-free sites in the future, creating more secure populations of seabirds, especially of the endangered Polynesian Storm-Petrel.

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