A Conservation Action Plan for Two Endangered Seabirds - Phoenix Petrel (*Pterodroma alba*) and Polynesian Storm-petrel (*Nesofregetta fuliginosa*), 2020-2025

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September 2020

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Document history: Framework developed among RP, KT and EVW April-May 2019.
First draft RP 25 January 2020,
Revised with input from EV 29 February 2020
Revised with input from SC, TG, TW and Graeme Taylor 27 March 2020 and nomenclature change 31 March 2020
Finalised following comment from multiple sources September 2020

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Acronyms and Abbreviations

BL	BirdLife International, Pacific Regional Office
CEPF	Critical Ecosystem Partnership Fund
DIREN	Direction de l'Environnment
DOC	New Zealand Department of Conservation
EDA	US Environmental Defense Agency
IAS or IS	Invasive (alien) species
Islet	Small island, in this document referring to a high island, c.f. motu
IUCN	International Union for the Conservation of Nature
LFA	Little Fire Ant *Wasmannia auropunctata*
MELAD	Kiribati Ministry of Environment, Lands and Agriculture Development
Motu	Low-lying islet, typically within lagoons or making up fringing reefs
MPA	Marine Protected Area
OSNZ	Ornithological Society of New Zealand
PHPE	Phoenix Petrel
PIO	PIPA Implementation Office
PSP	Polynesian Storm-petrel
PIPA	Phoenix Islands Protected Area
RSPB	Royal Society for the Protection of Birds
SOP-MANU	Société d'Ornithologie de Polynésie "MANU"
TNC	The Nature Conservancy
WCU	Wildlife Conservation Unit, MELAD, Kiritimati
YCA	Yellow Crazy Ant *Anoplolepis gracilipes*

A. BACKGROUND

1. Purpose of Action Plan

This Action Plan provides guidance for the recovery of two seabird species considered Endangered by the IUCN (Birdlife International 2018), the Phoenix Petrel (PHPE, *Pterodroma alba*) and Polynesian Storm-petrel (PSP, *Nesofregetta fuliginosa*), sometimes also known as the White-throated Storm-Petrel. These two species are grouped into the one action plan because they share many breeding islands in common within countries of the central Pacific Ocean, face many of the same threats, and would benefit from many of the same integrated management and monitoring actions identified in this Action Plan. There are also significant data deficiencies for both species which we need to address to help in the recovery process.

2. Species Descriptions

At 35 cm long and c. 270 g in body weight, the PHPE is a moderate-sized *Pterodroma* species in the Procellariidae. The PHPE is sexually monomorphic and superficially resembles the slightly larger Tahiti Petrel (*Pseudobulweria rostrata*), but *P. alba* is paler dorsally than the latter species, has a variable pale patch on the throat, a white leading edge to the underwing, and a smaller bill (Fig. 2.1).

At 24-26 cm in length the PSP is marginally the longest of the storm-petrel family (Hydrobatidae). The PSP is polymorphic – the dominant morph being black and white (Fig 2.2), a rarer morph in the Samoan region being completely ash-grey, with intermediate forms. Sexes of the dominant morph are similar. The PSP has broad wings (for a storm-petrel) and long legs that it often patters on the water.

Fig 2.1 – PHPE showing diagnostic pale leading edge to the underwing (L) and pale patch on throat (both photos). Photos by Eric VanderWerf.

Figure 2.2. Polynesian Storm-Petrel in flight and outside nest showing the white throat for which the species is named. Left photo also shows the broad wings and long legs. Photos by Eric VanderWerf and Ray Pierce

Table 2.1 – Alternative common names for PHPE and PSP

English	Kiribati	French Polynesia	Chile
Phoenix Petrel	Te Ruru	Petrel a poitrine blanche; Taiko	Petrel de las Phoenix
Polynesian (White-throated) Storm-petrel	Te Bwebwe ni Marawa	Oceanite a gorge blanche; Kotai (Gambier)	Paino Gorgiblanco

3. Distribution and abundance

Historical distribution

Historically, the ranges of the PHPE and PSP were centred on the central Pacific, with breeding colonies located in the Phoenix Islands (Kiribati), Line Islands (Kiribati and USA), and east and south to the Marquesas and Tuamotu-Gambier (French Polynesia), and the Pitcairn Group (UK). The PSP apparently also extended further east, south and west than PHPE, including breeding in Chilean Polynesian islands, Austral Islands, and west to Vanuatu, New Caledonia, Fiji, Samoa and possibly the Solomon Islands, and there is a subfossil record from Hawaii (H. James*, pers. comm*.).

Current distribution and abundance

Today, breeding populations of both species are largely confined to Kiribati, French Polynesia, and the Pitcairn Group, with PSP also recorded farther east at Sala y Gomez Islands of Chile in the 1990s (Vilina and Gazitua 1999; Fig 3.1). The breeding stronghold for both species is, however, at Kiritimati (Christmas Island) in Kiribati where there were an estimated 10,000 pairs of PHPE and a few hundred pairs of PSP in 2010-2018 (Pierce et al. 2006, 2013). Smaller numbers of both species also occur elsewhere in Kiribati at the Phoenix Islands and in French Polynesia, where several islands in the Marquesas support PHPE and perhaps one island supports the PSP. The PSP also breeds on 1-2 islands in each of Tuamotu-Gambier and Austral Islands (French Polynesia), and Sala y Gomez Islands (to Chile). PHPE also breed on one island (Oeno) in the Pitcairn Group (UK). Details of these breeding islands confirmed since 1990 are listed in Table 3.1 along with estimated populations if known. This list of breeding islands is provisional because of lack of up to date information, but it does indicate a severe contraction in the number and extent of breeding islands since humans colonised the Pacific. At sea and during the non-breeding season, PSP and PHPE disperse over much of the tropical Pacific as far north as the northern Line Islands and as far south as the Kermadec Islands (BirdLife 2017). Highest densities at sea are recorded near the breeding grounds, e.g. around the Phoenix Islands and Kiritimati (Pierce *et al.* 2020).

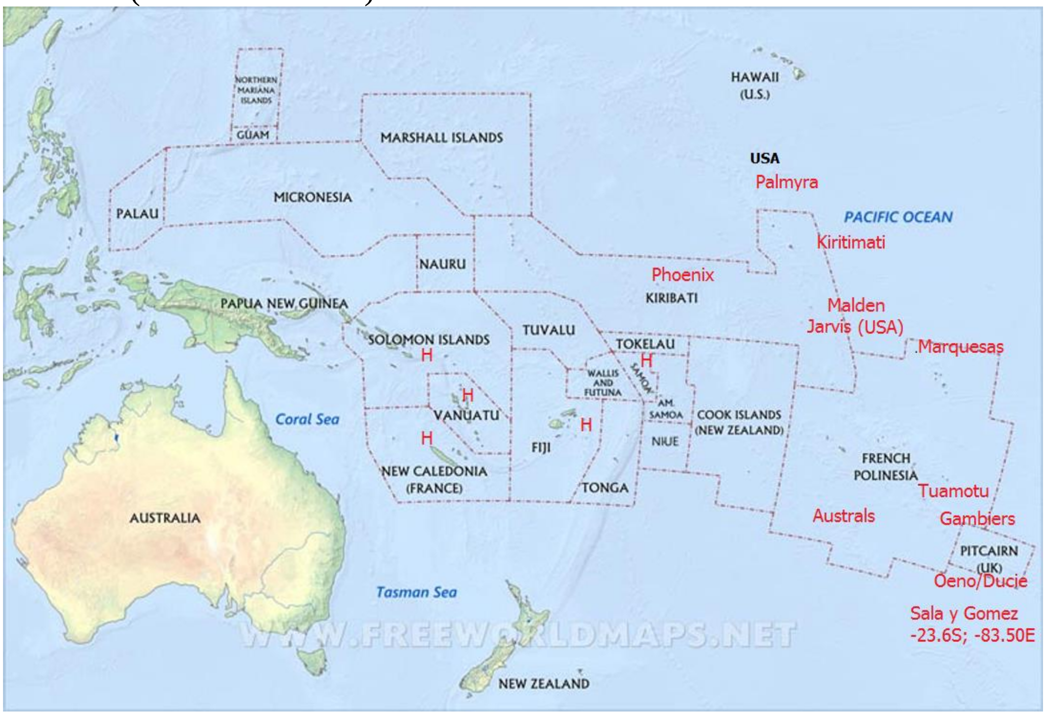

Fig 3.1 Breeding distribution of PHPE and PSP. Red-coloured island group names indicate current breeding and/or proposed restoration sites. H = historical reports of PSP breeding.

Table 3.1. Estimated breeding pairs of PHPE and PSP on different islands 1990-2020. Note: *indicates islands where rats or cats are currently absent** or absent from some motu*

Island Group and Country	Island name*	Breeding pairs (date)	Area (ha)	Reference
Phoenix Petrel				
Phoenix, Kiribati	Rawaki**	20+ (2006-11)	c.50	Pierce et al. 2006, 2013
Phoenix, Kiribati	Kanton	<5 (2006-11)	c.1000	Pierce et al. 2006, 2013
Line, Kiribati	Kiritimati*	10,000+ (2010-15)	38800	Pierce et al 2010, 2017
Marquesas, Fr Polynesia	Hatuta'a	250 (2007)	647	Thibault et al 2013
Marquesas, Fr Polynesia	Fatu Huku	1+ (July 2011)	130	Thibault et al 2013
Marquesas, Fr Polynesia	Motu Iti	1+ (March 2010)	27	Thibault et al 2013
Pitcairn, UK	Oeno**	12-20 (1997, 1998)	2000	Bell and Bell 1998
Polynesian Storm-petrel				
Phoenix, Kiribati	Rawaki**	20-100 (2006-11)	c.50	Pierce et al 2006, 2013
Line, Kiribati	Kiritimati*	300+ (2007-15)	38800	Pierce et al 2007, 2011
Line, USA	Jarvis**	3 (2002), 0 2004-10	450	Rauzon et al. 2011
Marquesas, Fr Polynesia	Ua Pou	1 (1989)	10600	Thibault et al 2013
Austral, Fr Polynesia	Rapa islets**, possibly Rapa	Few hundreds 2019-20	<100	SOP Manui 2010, Thibault & Withers 2019
Gambier, Fr Polynesia	Manui**	100-300 (1996);	8	Thibault & Bretagnolle

		c.400 (2018)		1999; T Ghestemme
Gambier, Fr Polynesia	Motu Teiku**	100-200 (1996)	1	Thibault & Bretagnolle 1999
Islets off New Caledonia	Many islets	3-4 (1996-97), few offshore (2007)	?	Collins 2011, J. Baudat-Franceschi 2007
Kadavu, Fiji	A volcano	0 (2004)	41100	Watling 2004
Samoa,	Islets*	None since 2000	?	Watling 2004
Sala y Gomez, Chile	Sala y Gomez*	More recent survey?	15	Vilina and Gazitua 1999

<u>Population trends</u>

Making population comparisons between the 20th and 21st centuries is difficult because there have been few surveys, they were undertaken at different seasons and used different methods. Both species have clearly, however, suffered serious contractions in breeding distribution and numbers over the past 100 years or more. For example, in the Phoenix Islands during the 1960s, there were c.1000 pairs of PSP breeding on McKean Island and fewer on Rawaki, but by 2006-08 the McKean breeding population was all but extirpated. Similarly, there were 50+ pairs of PHPE reported breeding on cat and rat-infested Kanton in the 1980s (Teebaki 1987), but none were seen in the 1990s (Flint et al. 1996) and only 4 prospecting birds were seen in 2006-09 (Pierce 2011). The survival of both species in the Phoenix Islands had by the early 2000s become dependent on Rawaki with c.100 pairs or fewer of each species in 2006-11.

Meanwhile, on Kiritimati in the Line Islands the estimated 1000 PSP breeding in the 1960s were reduced to only a few hundred pairs by 2010 (Schreiber and Ashmole 1970, Perry 1980, Pierce et al 2007, 2015). The current estimate of 10,000 pairs of PHPE on Kiritimati in 2015-17, however, is similar to estimates from the 20th century, probably in part because of improved methods for estimating numbers, but also because of increased conservation effort locally (Section 6).

Most population data of PHPE and PSP in French Polynesia, Pitcairn and Chile are from about 2000 onwards with good baselines currently being established in French Polynesia (e.g. Withers et al. 2017). Elsewhere, recent surveys suggest that PSP have disappeared from several former locations in the western part of their range including in Vanuatu, New Caledonia, Samoa and Fiji, but local updates and further survey is warranted.

From the above information sources, both species have clearly declined in numbers overall, with PSP possibly now being eliminated from large parts of Western Polynesia and both species having been lost from many islands elsewhere. Restoration of key motu on Kiritimati may have arrested declines in the large populations of PHPE and PSP there and those important populations can therefore be considered stable and possibly increasing, at least for the time being. However, the vulnerability of those same Kiritimati populations to IAS (rats and cats) and to climate change effects (especially sea-level rise and storm events) present challenges to sustain viable populations (Section 5).

4. Breeding and diet

Prior to the arrival of humans and their predators, PHPE and PSP are likely to have nested on a wide range of island types including large volcanic islands from which they are now extirpated or nearly so. Today breeding is mainly on small islands or on small motu within the lagoons of larger islands.

PHPE and PSP can nest year-round, but with peaks mid-year and at the end of the year. At Kiritimati, PHPE nesting currently peaks at the end of the year (November-January) but with a smaller pulse midyear (May-July) with no evidence of birds from the two pulses mixing (Schreiber and Ashmole 1970, Jones 2000, Pierce et al. 2017). In the Australs, however, PSP breed at the end of the year (Thibault and Withers 2019). The genetic relationships of birds in these different pulses is unknown however, and this needs to be researched. Other seabird "species" with seasonal pulses of this kind have sometimes been shown to comprise separate species or races.

PHPE typically nest in an excavated bowl beneath tall (often flattened) grasses or prostrate shrubs. Where there are high densities of petrels competing for space on small motu, nests can also be placed under more open vegetation, e.g. prostrate *Cassytha filiformis*, *Tribulus* spp. and bushes of *Sida fallax*, *Scaevola*, *Tournefortia*, and *Pemphis*, and entrances to abandoned burrows of Wedge-tailed Shearwaters (*Puffinus pacificus*). PSP tend to nest under more dense vegetation, especially grasses, also at the end of tunnels beneath mats of *Sesuvium* or *Cassytha*, in coral crevices and beneath coral slabs. Both lay one-egg clutches and incubation is shared by the sexes. The incubation and nestling periods of both species are unknown and precise data on laying, hatching, and fledging are needed. A *Pterodroma* species of the size of PHPE would likely have an incubation period of 45-48 days and fledging period of 75-90 days (G. Taylor pers. comm.).

Ashmole and Ashmole (1967) found that Kiritimati Phoenix Petrels consumed squid (78% by volume), also fish (14%) and small arthropods (8%), taken from or near the sea surface, possibly forced to the surface by schools of tuna or other fish. Fewer data are available on PSP which are thought to take crustaceans, cephalopods and small fish from the surface or during shallow dives (Del Hoyo et al 1992). Surface-feeding on small prey during their return to lagoon motu at Kiritimati suggest that PSP also take zooplankton.

Figure 4.1. Nests of PHPE on Kiritimati Island, Kiribati. Most nests are under grass or shrubs. Photos by Eric VanderWerf.

Figure 4.2. Nests of the PSP on Kiritimati Island, under grass (left) and *Cassytha* vine (right). Photos by Eric VanderWerf.

5. Causes of Decline and Current Threats

Invasive species

Invasive species have played a key role in the decline of Pacific Island-breeding endemics generally (Atkinson 1985, Brooke 1995, Steadman 1989) and this appears to be true of PHPE and PSP. Circumstantial evidence indicates that invasive rats and/or cats associated with human activities have caused at least some of these population crashes. Meanwhile invasive rabbits previously caused some damage to habitat on two islands as well as trampling and consuming eggs there, while goats and pigs have damaged habitat on many potential breeding islands.

Some examples of these invasive species impacting on PHPE and PSP are as follows:

- On McKean Island in the PIPA where PSP were common in the 1960s (Garnett 1983), a shipwreck caused an invasion of Asian Rats (*Rattus tanezumi*) in 2003-08 which eliminated PSP and most other small seabird species (Pierce et al. 2006, 2013).
- On Kanton (which is infested with feral cats and *Rattus rattus* and *R. exulans*) the Phoenix Petrel colony of c.200 birds in the 1990s had been reduced to a few prospecting birds by 2009 (Pierce 2011).
- At Kiritimati inaccessible islets in the landlocked Manulu Lagoon harboured the bulk of PSP breeding pairs in the 1960s (Schreiber and Schreiber reference), but the subsequent artificial lowering of the water level allowed easier access by *Rattus exulans* and feral cats. By 2007-18, PSP were breeding on fewer than 10 small motu in this lagoon with only a few pairs on each (Pierce et al. 2018).
- Elsewhere on Kiritimati feral cats and rats can gain access to several lagoon motu with many cat-killed carcasses of PHPE being found in 2007-18. This applies particularly to islands in the land-locked lagoons where drought can lead to lower water levels and easier mammal access (Pierce et al. 2018).
- Throughout their ranges the known productive populations of PHPE and PSP in 2006-20 were all on motu that were free of rats and cats, being Rawaki (Phoenix Islands), Motu Tabu and many other rat-free motu (Kiritimati), and for PSP on rat-free Manui Island (Gambier Islands), and on rat-free islets at Rapa in Austral Islands.
- Some motu at Kiritimati where *R exulans* has been removed have been accompanied by an increase in breeding numbers of PHPE at least (Pierce et al 2017).
- Some large islands with cats and/or rats have PHPE and PSP visiting but not establishing, e.g. Malden (Line Islands - cats and mice), Enderbury (Phoenix Islands - *Rattus exulans*), mainland Kiritimati (cats and *Rattus rattus*, *R exulans*) (Pierce 2013, Pierce et al 2006, 2007, Pierce and Brown 2015).
- Removal of feral cats from Jarvis Island in the 1980s was followed by detections of PSP (Rauzon et al. 2011).
- Two islands that harboured rabbits as the only invasive mammals, also supported PSP and one of them also PHPE. Rabbits did, however, destroy nesting cover, trample eggs and consume/drink egg fluid of PHPE, but they failed to eliminate PHPE (Pierce 2013).

Table 5.1 – Comparison of nesting stages on some islands with and without rats, Kiritimati, June 2007.

Nesting stages of PHPE sampled on different islands June 2007	Motu Tabu	Motu Upua	Drum	Isles I1, I3, II2

Rattus status	Rat-free	R. exulans	R. exulans	R. exulans
Stage				
Prospect	28 (56%)	35 (83%)	45 (70%)	40 (69%)
Failed egg	1 (2%)	5 (12%)	12 (19%)	9 (15%)
Incubate	17 (34%)	2 (5%)	6 (9%)	8 (14%)
Chick	4 (8%)	0	1 (2%)	1 (2%)
Total	50	42	64	58
Total incubate/chick	21 (42%)	2 (5%)	7 (11%)	9 (16%)

Yellow Crazy Ants (YCA), which can severely impact seabird colonies, currently occur on two of the PHPE/PSP breeding islands, Kiritimati and Manui, but both incursions are being managed. The incursion on Kiritimati has been reduced to one or two nests by 2019 (R. Pierce pers. obs. 2019, WCU pers. comm. 2019), while at Manui the eradication attempt failed.

Habitat loss from sea-level rise

Global climate change is perhaps the most serious long-term threat to many low-lying Pacific islands, including most of the islands used for nesting by the PHPE and PSP. Some of the Marquesas Islands are currently the only places where PHPE nest at significant elevation, while several in the Marquesas, Gambier and Rapa offer elevated breeding sites for PSP. The severity of impacts on low-lying islands will vary depending on their topography, geomorphology, latitude, and other factors (Woodroffe 2008, McLean and Kench 2015). The effects of climate change have already been documented in Kiribati and include sea level rise, increased temperature, higher but more variable rainfall, and increasing ground water salinity caused by saltwater intrusion (Kiribati Meteorology Service and Pacific-Australia Climate Change Science and Adaptation Planning Program 2015). These impacts are known to be affecting important seabird nesting areas at Kiritimati already, where some key motu are already suffering erosion of shorelines and degradation of nesting habitat, particularly death of grasses, which could increase and ultimately result in total loss of some motu vegetation (K. Taabu, R. Pierce pers. obs.). Compounding this are extreme weather events causing high water levels especially in the land-locked lagoons which contributes to periodic die-offs of grass and shrubs for long periods.

Hunting

Some areas have a traditional harvest of small seabirds, including in the past for storm-petrels at Rapa (T. Withers pers obs.), but today education and adaptation to alternative foods has resulted in lower harvest pressures. Probably the main harvest pressure still being exerted on these two seabird species is at Kiritimati. For the past 40 years the hunting targets at Kiritimati have primarily been six large seabirds (frigatebirds 2 species; boobies, 3 species; and Red-tailed Tropicbird), all used as local food. As these species have become depleted in numbers or locally extirpated, PHPE and other Procellariiform species are being targeted (Fig 5.1; Pierce et al. 2007). Even noddies (2 species) have been targeted and cooked and eaten on site in firepits, therefore the small PSP could also be randomly included in these smaller-bird harvests. The accessibility of motu to communities (some of them squatters), with two island groups particularly having suffered much poaching pressure in the 2000s, has been a key problem, but Kiribati authorities are currently addressing these issues.

Fig 5.1. Evidence of seabird poaching on on Motu Upua, Kiritimati, June 2007. Left: skulls of 10 PHPE (right), two Wedge-tailed Shearwaters (top left) and two Christmas Shearwaters found in one pile. Right poacher with freshly killed PHPE.

Marine issues

Seabird species in general suffer from human impacts on the ocean including depletion of food resources, ingestion of plastics, and entrapment in fishing lines or nets. Currently it is not known whether any of these issues are also a problem for PHPE and PSP. There may be food web related impacts involving pelagic fish such as tuna species forcing prey for petrels and other seabirds to the surface. The depletion of pelagic fish may be having an impact on food availability for Phoenix Petrels in particular.

Entrapment in plants

At Kiritimati, the vine *Cassytha filiformis* often snares PHPE and other seabirds by the wings where the birds subsequently die. In the Gambier Islands weeds such as Molasses Grass (*Melinis minutiflora*) can also trap small seabirds via a sticky secretion.

Structures and Lighting

On Rapa, PSP and other seabirds are attracted to lights (road lights) where they sometimes fall prey to feral or domestic cats.

6. Recovery efforts since 1990

Predator removal

Most islands within the former range PHPE and PSP are overrun by IAS, particularly rats, and others also have feral cats, dogs and pigs. In the 1990s-early 2000s invasive species were present on all mainland islands within their range, plus all 8 of the Phoenix Islands (only one was free of cats and rats, but it had rabbits), all 12+ of the Line Islands (one was rat-free but it had cats and mice), all but two of the 80+ Tuamotu-Gambier Islands which were infested with rats and some of them cats and rabbits as well, all 4 of the Pitcairn Islands, all of the Marquesas Islands except one islet and all of the Austral Islands except some islets.

Since the late 1990s restoration efforts have improved the local situation for PHPE and PSP (and many other species) and these are summarized in Table 4.

Table 4 – Restoration work undertaken on islands in 1995-2018 aimed to benefit PHPE and/or PSP.

Island	Target	Outcome	Reference
Phoenix Is			
Howland	Cat removal 1986	Successful, no recolonization yet?	Rauzon et al. 2011.
Rawaki	Rabbit removal 2008	Successful, PHPE, PSP breed	Pierce et al. 2009
McKean	*R. tanezumi* removal 2008	Successful, response unknown	Pierce et al. 2009
Birnie	*R. exulans* removal 2011	Successful, response unknown	Pierce et al. 2013
Enderbury	*R. exulans* removal 2011	Unsuccessful, to be repeated	Pierce et al. 2013
Phoenix Is	Biosecurity 2013	Action Plan adopted 2013	Pierce et al. 2016
Line Islands			
Kiritimati	Cat control 1990 onwards	Cat predation continues	Pierce et al. 2007, '18
Kiritimati	Anti-poaching ongoing	Periodic poaching continues	
Kiritimati	*R. exulans* removal 2009-11	20+ rat-free motu for PHPE/PSP	Brown & Pierce 2011
Kiritimati	Biosecurity 2007-15	Biosecurity action plans in place	Pierce et al. 2016
Kiritimati	Population monitoring	Periodic motu monitoring	Pierce et al. 2018
Palmyra	*R. rattus* removal 2011	Successful, introductions possible	TNC/USFWS
Palmyra	Biosecurity	Protocols	TNC/USFWS
Jarvis	Cat removal by 1990	PSP recorded Mar 2000, 2002, but not 2004-10	Flint & Aycock 2000 Rauzon et al. 2011
Tuamotu-Gambier			
Tenarunga	*R. rattus* and *R. exulans* and feral cat removal 2015	Successful, potential PSP	SOP Manu
Vahanga	*R. exulans* removal 2015	Successful, potential PSP	SOP Manu
Temoe	*R. exulans* removal 2015	Successful, potential PSP	SOP Manu
Manui	Rabbit, YCA removal 2015	Successful rabbit removal, PSP	SOP Manu
Makaroa	*R. exulans* removal 2015	Goat removal, potential PSP	SOP Manu
Motu Teiku	Rat-free, biosecurity	PSP breed	SOP Manu
Pitcairn			
Oeno	*R exulans* removal 1997	Successful, PHPE status to check	Bell and Bell 1998
Ducie	*R exulans* removal 1997	Successful, potential PHPE	Bell and Bell 1998

<u>Biosecurity</u>

Biosecurity action plans have been completed for much of Kiribati, some of the USA Line Islands, the Acteon, Gambier and Austral Islands, and some of the Pitcairn Islands, all associated with community consultation. Plans developed for the Phoenix Islands and Kiritimati (Appendix 1, Pierce et al 2016) have also been incorporated into the PIPA Management Plan, while these needs are currently being addressed for the Southern Line Islands MPA Management Plan.

<u>Compliance and Education</u>

At Kiritimati, MELAD through the WCU has placed considerable effort into minimizing harvest of seabirds including PHPE. This has included decades of year-round WCU patrols of the main breeding areas along with school and community education visits, and specialist support from NZDOC law enforcement staff. A fundamental problem is that the increasing human population of Kiritimati includes many low-income families who rely on lagoon fish for protein and are sometimes tempted to hunt seabirds at the same time. Attempts to provide better access to farmed chickens for protein have to date been of limited success, but this needs readdressing.

7. Monitoring and surveillance guidelines

Monitoring seabirds

Table 5 describes general monitoring guidelines that have been developed to suit different physical situations for PHPE and PSP.

Table 5 – Some monitoring guidelines

Question	How	Where	Method
Presence/ absence	1. Fly-on surveys	Small oceanic islands	Evening surveys have been effective in detecting presence of both species. Observers need to position themselves on the lee side of the island (i.e. birds approach into the wind) and count all PHPE and PSP and other sensitive species from 1700 h to dark.
	2. Recorders	Restored islands	Set up sound recorders/song meters at likely fly-on sites (leeward) and potential nesting areas (tall grass and other cover)
No. breeding pairs	1. Evening counts for PHPE	Lagoon motu	On Kiritimati a correlation was found between the number of birds circling the motu in the evening (1700-dark) in late November-December and the number of active nests on the ground (1 circling bird represents 4+ pairs on the ground, Pierce et al. 2017). Observers need to observe from a consistent site that provides a view of the entire motu and count the circling birds as below – when there are 100+ birds circling, accurate counts may be more readily achieved by using a video camera and viewing results on a computer screen.

			
	2. Transects/ quadrants for both species	Motu	Contact searches within random transects or quadrants to work out average density of nests. More effective in flat terrain e.g. motu. Carefully check beneath flattened grass, in crevices etc for PSP which are more cryptic than PHPE. If vegetation is dense, war-whoop to elicit a response from nesting PHPE. Refer also Actions 6.1, 6.2 in Objective 6 of Action Plan.
Index of PHPE breeding success	Nest inspections	Any island	For one-off visits during the breeding season it is possible to gain an index of breeding success by determining the proportion of young (downy chicks, and older chicks) in the nest sample, especially useful when checking adjacent motu suspected to have IAS presence (Table 3).
Where are the oceanic feeding areas?	Pelagic transects	Tropical Pacific	Counts of PHPE and PSP can be undertaken during general pelagic seabird transects on vessels that afford good views. Aim to cover a 300 m x 300 m sector of ocean and 8 x hourly counts per day (VanderWerf *et al.* 2006, Pierce *et al in litt.*).

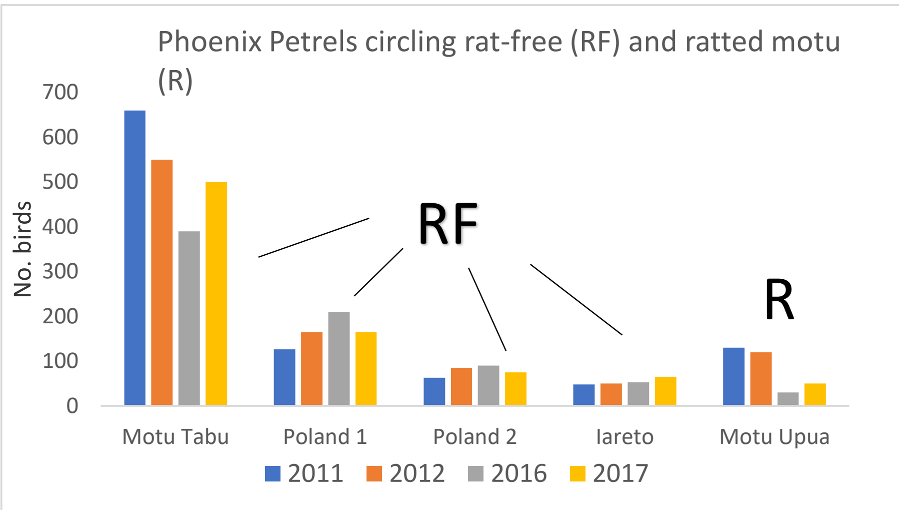

Fig 7.1 –PHPE numbers circling five motu in late Nov-early Dec evenings at Kiritimati 2011-17.

IAS Surveillance Procedures

On islands the key IAS surveillance approaches are:

Rats – undertake snap-trapping using cooked coconut flesh or other suitable lures and, if possible, operate traps for at least two nights two allow for neophobia. Night spotting is also useful. If overnight work is not feasible undertake surveys for sign of predated birds-egg shells that have fine jagged edges (Fig 7.2) and search for rats and their sign (droppings, gnaw marks) in dry sites of debris, in buildings, beneath fallen coconut fronds, etc. Untreated wooden stakes soaked with vegetable oil (could also trial coconut oil) is also good for detecting gnaw marks. If available use lured trail (motion-detecting) cameras for a few nights of surveillance, or long-term time-lapse monitoring (e.g. one frame per hour) for invasives generally and birds.

Cats – search for footprints in sand and droppings, and eye shine at night. Search for sign of seabirds that are decapitated and/or have visceral organs removed (Fig 7.2). PHPE hunted by people are decapitated and wings cut off and all discarded on the motu.

Fig 7.2 – Jagged edges characterize rat-predated tern shells (left) and a cat-predated shearwater (right)

YCA and LFA – Check *Morinda citrifolia* (Noni) for ants and identify ant species (Fig 7.3) and check bird carcasses for ant swarms. YCA are 4-5 mm long, yellowish-tan colored, with square antennae. LFA are tiny (1 mm), sluggish, orange-colored ants. If there are no natural lures use peanut butter and jam placed on opposite corners of manty cards and operate in cool, shaded sites for 30-60 minutes.

Fig 7.3 – YCA on *Morinda citrifolia* (L) and swarms of tiny, sluggish LFA on peanut butter lure (R).

B. RECOVERY GOAL, OBJECTIVES AND ACTIONS

Long-term Recovery Goal

The long-term goal is to prevent the extinction of Phoenix Petrels and Polynesian Storm-petrels in their strongholds. Ultimately the target is for both species to recover sufficiently to be removed entirely from the IUCN Red List of threatened species (currently Endangered). This will be achieved through partnerships between governments, communities and specialists which will aim to establish and maintain viable and self-sustaining breeding populations on as many and diverse islands as feasible within their natural range and favouring more bio-secure and physically secure situations.

Recovery Objectives and Actions for 2020–2025

Conservation work in 2020–2025 will focus on reducing the threat from invasive species in the Phoenix and Line Islands and in French Polynesia, establishing/attracting additional island populations in invasive-free locations in the Line, Phoenix, and Tuamotu-Gambier Islands, and maintaining and advocating for a high level of biosecurity throughout. These actions and stakeholders are detailed below, with country-specific actions highlighted by flag.

Roles

Coordination and implementation include primarily in-country roles from various agencies identified in the table below. Sometimes there is one clear lead agency, e.g. MELAD or PIO in Kiribati, but in French Polynesia and USA, government agencies are supported by NGOs, the latter of whom often carry out much of the work, e.g. SOP Manu, TNC and Pacific Rim Conservation. For rapid reference, each of the objectives 2-7 depicts a country flag, which should be read as including these agencies.

Table – Suggested key agencies involved in project coordination, implementation and research.

Country and main islands	Key agencies and support
Kiribati – Phoenix, Line Islands	MELAD (Kiribati), PIO (PIPA)
USA – Line Islands	US Fish and Wildlife Service, supported by many others including TNC, Pacific Rim Conservation.
Fr Polynesia – Tuamotu, Austral, Gambier, Marquesas	Direction de l'Environnement (supported by SOP MANU and others)
UK – Pitcairn Group	Govt. of Pitcairn Islands supported by RSPB and others
Chile – Sala y Gomez	Ministry of the Environment?
Solomon Islands – many provinces	Ministry of Environment, Climate Change, Disaster Management & Meteorology
Vanuatu – many provinces	Dept. of Environmental Protection and Conservation
New Caledonia – islets	Government of New Caledonia supported by NGOs
Fiji – all groups	Department of Environment supported by NGOs
Samoa – offshore islands	Ministry of Natural Resources and Development

The above agencies are supported directly or indirectly by many technical agencies such as BirdLife International, Eco Oceania, Pacific Rim Conservation, The Nature Conservancy, Department of Conservation (NZ), Island Conservation, Pacific Invasives Initiative, RSPB, SPREP and many others, including funding agencies.

Objective 1 – Develop and implement this PHPE and PSP Action Plan

Background

This Action Plan addresses international threats and draws on knowledge from many country initiatives to restore islands and their habitats for these seabirds and other threatened biota. The actions include recommendations from the PIPA Management Plan, draft Southern Line Islands Management Plan and their related documents, Palmyra and TNC objectives, and initiatives from French Polynesia, Pitcairn Islands and Chile. The Action Plan draws on additional guidance from BirdLife Pacific and other Pacific conservation biologists.

Action 1.1 – Finalize this Action Plan and support teams in 2020.

Action 1.2 – Network with stakeholders via internet and Skype/Zoom etc. to refine and agree on progressing this action plan, including agreeing on a participants, roles and timetables.

Recommended expertise needed for a Steering Committee include:

- Leader or co-leaders from e.g. Kiribati and French Polynesia, potentially led or co-led by a seabird biologist as needed
- Country representatives e.g. at MELAD, SOP Manu, Hawaii, others
- Seabird researchers/conservation biologists (e.g. Ray Pierce, Eric VanderWerf)
- An invasive species specialist (e.g. Steve Cranwell, Derek Brown)
- Biosecurity (PIPA/Kanton rep, e.g. Aata Binoka, Fr Polynesia rep)
- BirdLife and other representatives to help with research, communications and finding funds (e.g. BirdLife Pacific Fiji Office).
- Note that representatives could cover multiple roles.

Timing – Provide input to and revise this plan during 2020. Meet/discuss opportunistically thereafter.

Action 1.3 – Update this Action Plan regularly, e.g. every two years, and recirculate.

Objective 2 – Monitor Breeding Populations at Key Sites

Background

Population monitoring needs to take place not only at the breeding strongholds of both species, but also at sites where restoration programs are planned or underway. This will help answer questions about the local security of breeding populations (e.g. Kiritimati to predators and climate change) and how populations are responding to restoration efforts (e.g. Phoenix Islands, Line Islands, Tuamotu, Pitcairn). All actions below include updating, maintaining, and sharing of the monitoring databases.

Action 2.1 – Kiritimati. Monitor PHPE and PSP at the top 12 restored motu at Kiritimati every 2nd year, i.e. Motu Tabu, Motu Upua, Big Drum, Big Nimroona, SW Nimroona, S Nimroona, Iareto, Poland Channel 1 and 2, Isles a, Big Ambo, and Tonga-Fred, following established monitoring protocols especially evening fly-ons (Section 7). Also, survey presence/absence of IAS (Obj. 3). MELAD.

Action 2.2 – Rawaki. Monitor PHPE and PSP presence/absence at this PIPA stronghold of

PHPE and PSP. Evening fly-ons from a vessel stationed offshore on lee side of island at any time of year (ideally May-July, November-January) is adequate for trained observers to determine whether PHPE and PSP are using the island. Landing is discouraged here because of Rawaki's sensitivity, but if landing is permitted by PIO then searches of grassland breeding areas in the central island would enable breeding status to be determined, these being more effective at night following guidelines in Section 1.7. MELAD/PIO

Action 2.3 – McKean and Birnie. Survey PHPE and PSP on McKean and Birnie where Asian Rats and Pacific Rats were removed in 2008 and 2011, respectively. As with Rawaki, evening fly-ons and night-time searches are important, but because recolonizing birds could still be scarce or absent, it is advisable to use audial lures in conjunction with recorders/song meters. Undertake this work as part of PIO monitoring and/or opportunistically with each science visit following guidelines of section 1.7. Also, survey to determine presence absence IAS (Obj. 3). MELAD/PIO.

Action 2.4 – Jarvis. Monitor PHPE and PSP at restored USA islands, e.g. Jarvis, and others e.g. Howland and Baker in the northern Phoenix Islands, when IAS are removed. Use evening fly-ons (Section 1.7), nocturnal searches and audial lures in conjunction with recorders/song meters (Flint and Aycock 2000). USFWS

Action 2.5 – Marquesas. Monitor PHPE and PSP recovery on islands being targeted for IAS removal, using fly-on observations (Section 1.7) for the inaccessible islands plus transects on the more accessible islands e.g. Hatuta'a targeting the breeding seasons. Song meters (calibrated with audial lures) could be tried on islands where these species are of uncertain status. Maintain databases of monitoring. DIREN/SOP MANU

Action 2.6 – Gambier-Tuamotu-Australs. Monitor PSP populations on islands free of IAS, i.e. Motu Teiku and Manui and others for both species after IAS are removed, including Temoe and Acteon Islands. Also Rapa islets that are IAS-free (i.e. Tarakoi, Rarapai, Tapiko, Karapoo iti; Aturapa/Tapui) and at sites of future restoration projects e.g. Rapa iti, Tauturau, Karapoo rahi and the Tarakoi peak on Rapa. As with Marquesas, include fly-on monitoring from a vessel or from ashore, transects on accessible islands targeting breeding seasons where possible, and consider using song meters on the less accessible islands or less frequently visited, e.g. Acteon and Temoe. DIREN/SOP MANU

Action 2.7 – Undertake a survey of Oeno and Ducie to determine PHPE and potentially other seabird responses to rat removal in the 1990s, targeting likely late year breeding season if possible. Use fly-on surveys (checking for PSP and other potentially colonising species and on-island transects particularly for PHPE (Section 1.7). Repeat as opportunities arise and make this monitoring a condition of any research approvals for the islands. Pitcairn Government/RSPB

Action 2.8 – Undertake surveys of Sala y Gomez breeding islands to set baseline monitoring depending on physical situation (e.g. fly-on surveys if inaccessible, Section 1.7) and evaluate ongoing monitoring needs as well as needs for IAS management.

2021 Update

Objective 3 – Monitor for IAS on key breeding islands and respond accordingly

Background

The key breeding islands of PHPE and PSP are free of rats, feral cats, and other invasive species and need to stay that way for these seabird species to reproduce. Regular surveillance of these islands is needed to ensure IAS have not reinvaded or others invaded. Many islands are easily accessible for regular surveillance by qualified staff, e.g. WCU surveillance of the Kiritimati motu. Isolated islands elsewhere in the Line Islands, the PIPA, and French Polynesia are less frequently visited, and so every opportunity to survey for invasives needs to be taken as they arise. Although rat invasions are the main concerns, all likely IAS should be surveyed for, spanning feral cats and other mammals, invasive ants, and weeds.

Action 3.1 – Undertake annual IAS surveillance of the top 12 Kiritimati motu in Objective 2 to check for sign of rats, invasive ants and other IAS following the surveillance guidelines identified in Section 1.7, e.g. sign of rat-predated eggs, gnaw marks on coconuts, soaked timber, potentially trained dogs, etc. Access these motu by vessel or wading in the case of the Nimroona Islands. Two of these motu (SW and Big Nimroona) have recently been reinvaded by *Rattus exulans* after 8 years of rat-free status (K Taabu pers. comm., RP, EAV pers. obs.) and need a second eradication when higher water levels allow. Assess effectiveness of setting up permanent rat bait stations on the crab-free motu (e.g. SW/Big Nimroona) that are nearest the mainland and implement post-eradication. Consider other top priority motu as well (e.g. Drum, Motu Tabu) if the *Rattus rattus* threat increases. WCU/MELAD

Action 3.2 – Undertake IAS surveillance of PIPA islands, particularly the rat-free islands of Rawaki, Birnie and McKean as opportunities arise and following surveillance guidelines in Section 1.7. These opportunities are often provided via research visits sanctioned by the PIO, and a prerequisite for each trip is for scientists and GOK representatives to check for sign of rats, invasive ants and other IAS using standard procedures identified in the PIPA Biosecurity Action Plan. PIO/MELAD

Action 3.3 – Undertake IAS surveillance of the USA restored islands of Palmyra and Jarvis as opportunities arise following the surveillance guidelines in Section 1.7. All research and management visits should include IAS surveillance as a prerequisite. USFWS

Action 3.4 – Undertake IAS surveillance of all rat-free islands in Tuamotu-Gambier including Manui, Temoe, Motu Teiku (Gambier) and Tenarunga, Vahanga and Morane (the Acteon Group) and Morane. Include trapping, luring, searching for sign and night observations where possible as per Section 1.7. DIREN/SOP MANU

Action 3.5 – Undertake general IAS surveys of Oeno and Ducie during seabird monitoring (Action 2.7) with targeting of rodents and invasive ants being a priority but following surveillance guidelines in Section 1.7. Pitcairn Government/RSPB

Action 3.6 – Undertake periodic IAS surveillance at Sala y Gomez at the same time as monitoring Action 2.8 following guidelines in Section 1.7.

Action 3.7 – Add additional islands to the surveillance schedule where there are plans for restoration, e.g. Marquesas, Enderbury and Rapa islets, and continue surveillance into future.

2021 update

Objective 4 – Improve Biosecurity for Key Breeding Islands

Background

Without effective biosecurity, seabird islands can easily be invaded or reinvaded by IAS. Investment in good biosecurity is more cost-effective than having no biosecurity which may result in the need for expensive eradication programs, or worse, not having the capacity or techniques to be able to remove an IAS, resulting therefore in the loss of a breeding population. Successful biosecurity programs begin with risk assessments, which include identification of sources and transport of potential IAS, and an action plan addressing prevention and mitigation for IAS travel to specific islands.

Action 4.1 – With stakeholders, review effectiveness of those existing Biosecurity Action Plans including for PIPA, Kiritimati and Line Islands. Potentially collaborative projects.

Action 4.2 – Where there are no Biosecurity Action Plans (e.g. Tuamotu-Gambier, Marquesas) work with stakeholders to develop appropriate biosecurity plans or routine actions. Interim measures could include raising awareness of biosecurity needs and techniques amongst shipping agencies and communities, plus working with captains to inspect vessels and deploy rodent control and other IAS measures. Additionally, French Polynesia needs formal discussion and agreement on developing and actioning biosecurity within the country generally. Appendix 1 lists key points addressed in biosecurity plans. Possibly DIREN supported by others e.g. SPREP, BirdLife

2021 update

Objective 5 – Restore former breeding islands

Background

Most former breeding islands have been overrun by IAS, including nearly all islands in the extreme western parts of range, particularly on high islands or maketu. There are current initiatives for IAS removal from many islands in the central part of the species' ranges which need supporting.

Action 5.1 – Gain and/or maintain support for those existing plans for IAS removal that are at different stages of development for islands within these species' ranges, namely Enderbury (Phoenix, rats), Malden (Southern Line, cats), Marquesas (several islands, rats, cats, sheep), Gambier Islands (Kamaka 800 m from Manui, rats), Australs (rats), Henderson (Pitcairn, rats), Walpole (New Caledonia, rats), Aleipata (Samoa, rats and potentially YCA). Potentially collaborative projects.

Action 5.2 – Assess species continued survival and potential for islands to be restored at the extremes of species' ranges in e.g. Vanuatu, Solomon's, New Caledonia, Fiji, Samoa, and any

other sites within historic ranges. This may require gaining permission and developing plans to survey islands using standardized methods described in Objectives 2-3. Include islands that are high islands in order to buffer sea-level rise, e.g. raised atolls (like Henderson), and many volcanic islands. Country governments and NGOs. Action 5.3 – Scope and develop and implement eradication plans with governments, communities, international agencies/NGOs.
2021 update

Objective 6 – Restore PHPE and PSP populations using translocations and audio lures

Background The removal of IAS is a critical first step to restoring populations of PHPE and PSP on islands within their former range. However, recolonization may be a slow process particularly if the restored islands are a long distance (100+ km) from the nearest source population. The rate of recolonization could be accelerated by using audio lures and/or by translocating chicks to the restored islands. Audio lures rely on the species passing by or roosting on these islands at night. Translocations rely on shifting unfledged young to the restored islands where a high proportion of them become imprinted on the new "home".
Action 6.1 – Review success of current audio lures at Jarvis Island National Wildlife Refuge and compare with island-distance results from non-lured islands (e.g. Howland, Baker, McKean, Birnie), to assess adequacy of PSP audio. USEPA, MELAD and supporters Action 6.2 - Refine procedures from 6.1 for attracting PHPE and PSP at restored islands generally, including Palmyra, Phoenix Islands. Artificial nests (50 and caller) established for PSP at Makaroa (Gambier) in 2017. USFWS, MELAD, SOP-Manu, Pacific Rim Conservation, and supporters Action 6.3 –Establish new populations of PHPE and PSP using translocated birds from the largest populations (e.g. Kiritimati, Manui) to nearby restored islands, e.g. Jarvis to south and Palmyra to the north of Kiritimati, Makaroa near Manui, and other islands once they are restored, including Kamaki in Gambier, Malden to the south and Enderbury to the west (PHPE visit the latter two, but unlikely to be at sufficient rates to ensure rapid recolonization). Follow existing petrel translocation protocols supplemented with additional research (Obj. 7). USFWS, MELAD, PIO, Pacific Rim Conservation, and supporters
2021 update

Objective 7 – Research species' biology and threats to help guide recovery efforts

Background

The genetics, breeding biology and diet of PHPE and PSP are poorly known. A better knowledge of these along with the potential impacts of El Niño and other climatic events, plastics, and other threats, is needed to provide better guidance for future conservation efforts.

Action 7.1 – Determine the genetic relationships within both species to determine differences in birds that breed between e.g. extra-limital sites (e.g. Pitcairn, Gambier, Austral) and core areas (e.g. Kiritimati), and differences between birds that breed in different seasons (e.g. at Kiritimati). Best undertaken in collaboration with university researchers and use opportunities provided by expeditions to remote islands to collect feather samples, etc.

Action 7.2 – Determine key breeding parameters such as foods fed to chicks, plastic consumption, chick growth rates, incubation periods, hatching dates, fledging period, and other information that will assist with translocation initiatives, initially of PHPE. Kiritimati research would offer synergies with MELAD's Bokikokiko and other conservation work (VanderWerf and Pierce 2019), and developing a cooperative research focus between Kiribati, USA, and research specialists is recommended. USFWS, MELAD, PIO, Pacific Rim Conservation, and supporters.

Action 7.3 - Determine general patterns of sea movement of both species using pelagic transects and of PHPE using satellite tags.

Actions 7.1-7.3 collaborative with strong university support

2021 update

Objective 8 – Raise Local Capacity and Public Awareness

Background

PHPE and PSP occur in widely differing island situations including on some inhabited islands where they are exposed to different levels of IAS impact and sometimes illegal hunting for food as is the case at Kiritimati and previously at Australs. IAS reinvasion issues at Kiritimati have been addressed via biosecurity programmes, surveillance and management supported by outside technical advice. Hunting of PHPE has been addressed at Kiritimati via compliance and law enforcement measures (especially targeted surveillance from vehicles) plus education of communities and school children. Here and elsewhere there is a need to maintain training in wildlife techniques as well as assist in raising awareness amongst communities about threatened species and IAS. On all inhabited islands there is a need to work with traditional owners to arrive at effective and sustainable solutions.

Action 8.1 – Kiritimati IAS management. Continue to support MELAD in rat and cat surveillance and rapid responses to any reinvasions of key islands. This principally involves funding purchase of rodenticide every few years for responding to rat incursions on motu and providing technical advice as needed. MELAD and supporters

Action 8.2 – Law enforcement. Continue to support MELAD in its targeted surveillance of the key petrel etc. sites, i.e. Motu Tabu, Motu Upua and the Nimroona, Drum, Poland areas of the Central Lagoons. This involves maintenance of vehicles and vessels for island access, law enforcement advice, etc. MELAD

Action 8.3 – Chicken farming at Kiritimati. Support MELAD in evaluating the feasibility for establishing a broiler chicken breeding programme on Kiritimati, and other means of getting animal protein cheaply available to the local communities. The ongoing availability of supermarket chicken at affordable prices has probably been the key reason why large seabirds have recovered in the Tokelau Islands since the 1970s (Pierce et al 2012). Establishing chicken farming at Kiritimati would, however, need to be evaluated for disease risk and satisfy veterinarian examination. MELAD and supporters

Action 8.4 - Education. International community needs to continue to support the MELAD/WCU in its education programs which includes providing information to schools, interactive materials, photos, videos, etc. on the birds and invasive species, emphasizing the importance of the Kiritimati populations to the species' survival, etc. MELAD and supporters

Action 8.5 – Support SOP-MANU and authorities in building on their general education and awareness programmes in French Polynesia, particularly in areas in and around sensitive breeding grounds of PHPE and/or PSP, e.g. in Rapa area. SOP-MANU and supporters

Action 8.6 – Support regional initiatives by SPREP and others to raise awareness amongst governments and fishing industries of the important dependance of petrels and other seabirds on pelagic fish and sustainable industries. Includes attention to sustainable harvest quotas and advocating biosecurity on ships - free of IAS.

2021 update

Objective 9 – Raise funds to achieve objectives 1–8

Background

The actions 1–8 above all involve costs. Stakeholders need to identify costs and potential sources of funding to cover these costs, some preliminary estimates of which are below:

Objectives	Actions involving	Ballpark funds needed if possible + agency
1. Action Plan	Developing and reviewing Draft	Covered by OSNZ and countries
2. Monitoring of birds	2.1 - Kiritimati fly-ons every 2nd year 2.2 – Rawaki offshore fly-on 2.3 - Birnie/McKean monitoring 2.4 – Jarvis/Palmyra song meters etc. 2.5-2.6 - Marquesas-Gambier-Austral 2.7 - Oeno/Ducie survey 2.8 – Sala y Gomez	Operating covered by MELAD Costs borne by research/PIO patrol Costs borne by research/PIO patrol US Agency/expedition + USD c.10k SOP Manu expedition + CFP…. UK expedition costs + equipment Chile expedition costs + equipment
3. Surveillance of IAS	3.1 - Kiritimati motu, rats annually 3.2 – Rawaki – as per PIPA IAS Plan 3.3 – Birnie/McKean surveillance 3.4 – Jarvis/Palmyra surveillance 3.5-3.6 - Marquesas-Gambier-Austral	Surveillance covered by MELAD PIO/research + minor equipment PIO/research + minor equipment US Agency? + minor equipment SOP-MANU follow-up

	3.7 – Oeno/Ducie surveillance 3.8 – Sala y Gomez	UK expedition costs + equipment Chile expedition costs + equipment
4. Biosecurity Plans	4.1 - Review Kiribati, US plans 4.2 - Develop Biosecurity plans Fr Poly, Pitcairn, etc as needed	Staff time for MELAD, US agencies USD c.20 k per plan, Pitcairn in draft.
5. Island Restoration	5.1 – Enderbury rats 5.1 – Malden cats 5.1 – Marquesas 5.1 - Australs 5.1 – Gambier (Kamaka) 5.1 - Henderson/Pitcairn 5.2 – Surveys needed for others	USD 1 m, plan and bid prepared. AUD 200 k, plan prepared CFP 3+m€ – plans in train USD c.250 k – plans in train CFP? – in train UK£ – 3+ m – plans in train Nothing definite
6. Translocations and lures	6.1 – Review lure effectiveness 6.2 – Implement island lures 6.3 – Translocations	USD – visits to Jarvis as per 2.4 Dependent on PIPA funds as per 2.3 Contingent on research in 7.1. Funds already secured for audio lures (Pacific Rim Conservation)
7. Research to aid conservation	7.1 - Kiritimati research	USD – funds already secured for research (Pacific Rim Conservation)
8. Public Awareness, capacity	8.1 – Education/awareness Kiritimati 8.2 – Law enforcement Kiritimati 8.3 – IAS management Kiritimati 8.4 – Feasibility of chickens Kiritimati 8.5 – Education/awareness Fr Poly	AUD – MELAD to provide estimate AUD – MELAD to provide estimate MELAD operations and contingency NZD – veterinary advice CFP – SOP-MANU costings?

CONCLUSION

It is hoped that this Action Plan will assist in securing funds and guiding ongoing conservation activities for the recovery of these two Endangered seabirds. It is a live document and should be revised and updated by stakeholders every 1-2 years incorporating details of progress.

ACKNOWLEDGEMENTS

Many people and institutions contributed to developing this action plan and we particularly thank the Watson Trust and OSNZ and their staff for funding its development. Technical contributions were provided by V. Bretagnolle, D. Brown, H. Shirihai, G. Taylor, G. Wragg, staff of BirdLife, MELAD (Kiritimati, Kiribati), PIO (Tarawa, Kiribati) and SPREP (Samoa), and members of SOP Manu (French Polynesia).

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APPENDIX 1 – EXAMPLE OF CONTENTS OF A BIOSECURITY ACTION PLAN

TITLE: A Biosecurity Action Plan for the Republic of Kiribati with Particular Emphasis on Protecting the PIPA and Kiritimati (Pierce *et al.* 2016)

CONTENTS: Summary

Acronyms and Key Definitions

1. Purpose of the Plan
2. Governance of the Plan
3. Context
4. Risk Pathways
5. Pathway Analysis
6. Prevention Measures
   Goods – covers procedures at key departure wharves, other departure points
   Vessels – covers procedures for domestic and international vessels, police patrol boats, private yachts, research and tourism vessels and fishing vessels
   Vessel Inspections and Briefings
   Quarantine Rooms
   Signage
   Landing Precautions
   Prevention Measures at Airports (where relevant)
7. IAS Surveillance
   General Surveillance at Departure Ports
   Rodent Surveillance
   Invasive Ant Surveillance
   Other IAS Surveillance
8. Incursion Response After IAS Detection
9. Staff Training
10. Community and Public Awareness and Education
11. Monitoring of Plan Implementation and Revision
12. Resources Needed – covering human, technical, financial
13. References and Appendices.

APPENDIX 2 – EXAMPLE OF DATA SHEETS FOR KEEPING FLY-ON DATA, KIRITIMATI

1. PHPE

PHPE evening count data in December 2011					
Motu	Date	Time	Observers	No. PhPe	Weather/notes
Big Nimroona	1/12/11	1710	RP	450	440 at 1745; mod SE
SW Nimroona	1/12/11	1715	RP	240	210 at 1710; mod SE
Poland 1 north	1/12/11	1740	RP	126	mod SE
Poland 2 south	1/12/11	1745	RP	63	mod SE
S Nimroona	1/12/11	1820	RP	30	mod SE
Little Nimroona	1/12/11	1700	RP	15	mod SE
Big Drum	2/12/11	1715	RP	230	210 at 1815 mod SE
Isles a	2/12/11	1735	RP	50	mod SE
N of Nimroona	2/12/11	1755	RP	48	mod SE
W of Drum	2/12/11	1805	RP	38	mod SE
Carver 2b	2/12/11	1738	RP	8	mod SE
Isles b	2/12/11	1742	RP	13	mod SE
Carver1	2/12/11	1730	RP	3	mod SE
Motu Upua	6/12/11	1700	RP KK	130	mod SE
Motu Tabu	6/12/11	1735	RP KK	60	mod SE

2. PSP

PSP evening counts and nest searches in December 2012					
Motu	Date	Time	Observers	Min no. PSP	Weather/notes
Carver1	12/12/12	1801-10	AT	0	Moderate E wind
Carver 2a	12/12/12	1814-20	AT	1	Moderate E wind
Carver 2b	12/12/12	1814-20	AT	3+	Viewed with binoculars
Carver 1	13/12/12	1820-24	AT	0	Light SE wind
Carver 1	14/12/12	1325-50	AT, KT	5 pairs	Landed and searched, 4 nests and 1 chick, no rat sign