

# Abrolhos Painted Button-Quail (*Turnix varius scintillans*) Interim Recovery Plan



Wildlife Management Program No. 63

Western Australia

Department of Biodiversity, Conservation and Attractions

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Department of Biodiversity,  
Conservation and Attractions

Wildlife Management Program No. 63

**Abrolhos Painted Button-Quail**  
***(Turnix varius scintillans)***  
**Interim Recovery Plan**

**Western Australia Department of Biodiversity, Conservation and Attractions**  
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# Foreword

Recovery plans are developed within the framework laid down in the Department of Biodiversity, Conservation and Attractions *Corporate Policy Statement No. 35* (Parks and Wildlife, 2015b) and *Corporate Guideline No. 36* (Parks and Wildlife, 2015a).

Interim recovery plans outline the recovery actions that are needed to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process. The attainment of objectives and the provision of funds necessary to implement actions are subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities.

This interim recovery plan was approved by the Department of Biodiversity, Conservation and Attractions, Western Australia. Approved interim recovery plans are subject to modification as dictated by new findings, changes in status of the taxon or ecological community, and the completion of recovery actions. Information in this interim recovery plan was accurate as of May 2018.

**Interim recovery plan preparation:** This interim recovery plan was prepared by Janet Newell (Parks and Wildlife Service, Department of Biodiversity, Conservation and Attractions).

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# Abbreviations

BCMI	Batavia Coast Maritime Institute, Central Regional TAFE
DBCA	Department of Biodiversity, Conservation and Attractions, Western Australia (formerly Department of Parks and Wildlife)
Fisheries	Fisheries Division, Department of Primary Industries and Regional Development, Western Australia (formerly Department of Fisheries)
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
IBRA	Interim Biogeographical Regionalisation for Australia
IUCN	International Union for Conservation of Nature
TBD	To be determined
WA	Western Australia

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# Summary

**Species:** *Turnix varius scintillans* (Gould, 1845)

**Family:** Turnicidae

**Common Names:** Abrolhos painted button-quail, painted button-quail (Houtman Abrolhos)

**IBRA Regions:** Geraldton Sandplain

**DBCA Regions:** Midwest

**DBCA Districts:** Geraldton

## **Current conservation status:**

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): Vulnerable
- Western Australia *Wildlife Conservation Act 1950*: Schedule 2, Endangered

## **Habitat critical to survival:**

The habitat that is critical to the survival of the Abrolhos painted button-quail includes:

- current area of occupancy of resident populations of the subspecies: East and West Wallabi, and North islands; and
- other islands of the Houtman Abrolhos archipelago with similar habitat that may act as refugial locations for the subspecies, including Oystercatcher, Pigeon, Seagull and Turnstone islands.

## **Threatening processes:**

The known and potential threatening processes of the Abrolhos painted button-quail are:

- Predation and competition by introduced fauna
- Habitat modification and degradation due to introduced fauna
- Habitat modification and degradation due to invasive weeds
- Impacts from land use and development
- Major fire events
- Effects of climatic conditions

## **Recovery goals and objectives:**

The long term goal of the Abrolhos painted button-quail recovery program is to have secure<sup>1</sup> populations of the button-quail on the three largest islands where the taxon is a resident: East and West Wallabi and North islands.

This interim recovery plan guides recovery actions for the Abrolhos painted button-quail for the next 10 years. The recovery objectives of this plan are to:

- Restore a secure<sup>1</sup> population of Abrolhos painted button-quail on North Island.
- Protect habitat critical for survival to maintain secure<sup>1</sup> populations of Abrolhos painted button-quail.
- Increase understanding of the Abrolhos painted button-quail's effective population size, capacity to move between islands, and clarify taxonomic relationships.

### **Criteria for success**

The recovery plan will be deemed successful if, within a 10 year period, all of the following are achieved:

- Secure<sup>1</sup> populations of Abrolhos painted button-quail persist on East and West Wallabi islands;
- A secure<sup>1</sup> population of Abrolhos painted button-quail is restored on North Island.

### **Criteria for failure**

This recovery plan will be deemed unsuccessful if, within a 10 year period, any of the above criteria for success have not been achieved.

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<sup>1</sup> Secure population is defined as a persistent population that is stable and thus not declining due to threats of introduced fauna, invasive weeds or land use impacts.

# 1 Introduction

The Abrolhos painted button-quail (*Turnix varius scintillans*) is a small ground-dwelling bird with a distribution restricted to seven small islands of the Houtman Abrolhos archipelago (hereafter referred to as the Abrolhos) off the west coast of Western Australia. This subspecies has been identified as one of the most imperilled birds in Australia, with a probability of extinction of around 70% in the next 20 years (H. Geyle, pers. comm., September 2017).

## 1.1 Description

The Abrolhos painted button-quail is a small (14-17 cm) ground-dwelling bird. Adults have upperparts that are mainly grey or brownish-grey, but are heavily marked with a combination of white, reddish-brown and black spots, blotches, bars and streaks, and a large reddish-brown patch on each shoulder (Marchant and Higgins, 1993). Its underparts consist of a white chin and throat, a grey breast with buff spots, a white, buff-white or cream belly, and a buff to reddish-buff undertail. The sexes are similar in appearance, although adult females are substantially brighter and somewhat larger than adult males (Storr and Johnstone, 1984).

The button-quail on the Abrolhos were first named *Hemipodius scintillans* (sparkling hemipode) by John Gould in 1845 (Proceedings of the Zoological Society of London, 1845, p. 62) and then later reclassified as a subspecies of *Turnix varius*. Alexander (1922) and Storr and Johnstone (1984) provided evidence for the validity of the subspecies as the birds differ from mainland birds by being smaller (52-82g compared with 85-112g on the mainland) and paler in coloration. The Abrolhos birds have narrower black barring and more conspicuous white edging on back and rump feathers, more conspicuous white spotting on wings, and paler belly (white or buffy white) (Johnstone and Storr, 1998).

## 1.2 Conservation status

The subspecies *Turnix varius scintillans* has been listed since 1990 as specially protected fauna that is rare or likely to become extinct under the *WA Wildlife Conservation Act 1950*, and is ranked as Endangered (B1ab(v)+2ab(v), C2a(ii)) under the Department of Biodiversity, Conservation and Attraction policy using IUCN criteria. It was originally listed as Vulnerable (D2) and then upgraded to Endangered in 2012, based on a review in the *Action Plan for Australian Birds 2010* (Garnett *et al.*, 2010).

This subspecies is also listed nationally as Vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.



The mainland subspecies *Turnix varius varius* (south-west Australia, Tasmania and eastern Australia) is classified as Least Concern (Garnett *et al.*, 2010), although it may be declining in some regions, in particular in populated areas and in Tasmania (Marchant and Higgins, 1993). It is listed as Rare in South Australia under the *National Parks and Wildlife Act 1972* (Horton *et al.*, 2013). Another subspecies (*T. v. novaecaledoniae*) endemic to New Caledonia is possibly extinct (Garnett *et al.*, 2010).

## 1.3 Distribution

The Abrolhos painted button-quail is endemic to seven islands of the Abrolhos, which lies approximately 60 to 80 km off the western coast of Western Australia (Figure 1). It is resident on three islands of this archipelago: East Wallabi Island (321 ha), West Wallabi Island (587 ha) and North Island (181 ha) of the Wallabi group of islands (Storr *et al.*, 1986; Garnett *et al.*, 2010). The button-quail has also been recorded on four small islands near East: Oystercatcher (4.6 ha) (R. Johnstone, pers. com., 10 August 2017), Turnstone (1.4 ha) (J. Newell, pers. obs., 19 September 2017), Seagull (7.7 ha) (Storr *et al.*, 1986) and Pigeon (4.3 ha) (Alexander, 1922) islands. Due to the small size of these islands, it is thought that the button-quail are unlikely to be resident (Garnett *et al.*, 2010).

Whether the birds move between the islands is unknown. It is assumed they fly between East and West Wallabi islands and the smaller nearby islands (<1 km between each of these islands) as the four smallest islands they have been recorded on (Oystercatcher, Turnstone, Seagull and Pigeon) are possibly too small to support a self-sustaining population<sup>2</sup>. The mainland subspecies is known to be able to fly considerable distances, so it is also possible they fly from the Wallabi Group to North Island (18 km from the other islands) (S. Garnett, pers. comm., August 2017).

This button-quail occupies all available habitats on these islands except bare limestone pavements (Garnett *et al.*, 2010), favouring *Spinifex longifolius* open grassland on low sand dunes and *Atriplex cinerea* and *Tecticornia halocnemoides* open shrubland on coral grit flats (Storr *et al.*, 1986).

The mainland subspecies, *Turnix varius varius*, is widespread but uncommon throughout suitable habitat (thickets, scrubs, forests and woodlands, preferring closed canopies with some understory and leaf litter on the ground) along the east coast of Australia, southern South Australia and south-west WA, including mainland areas adjacent to the Abrolhos islands.

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<sup>2</sup> In this plan the term population is used for a geographically distinct group of individuals (i.e. islands). Whether there is genetic exchange between these populations is unknown.

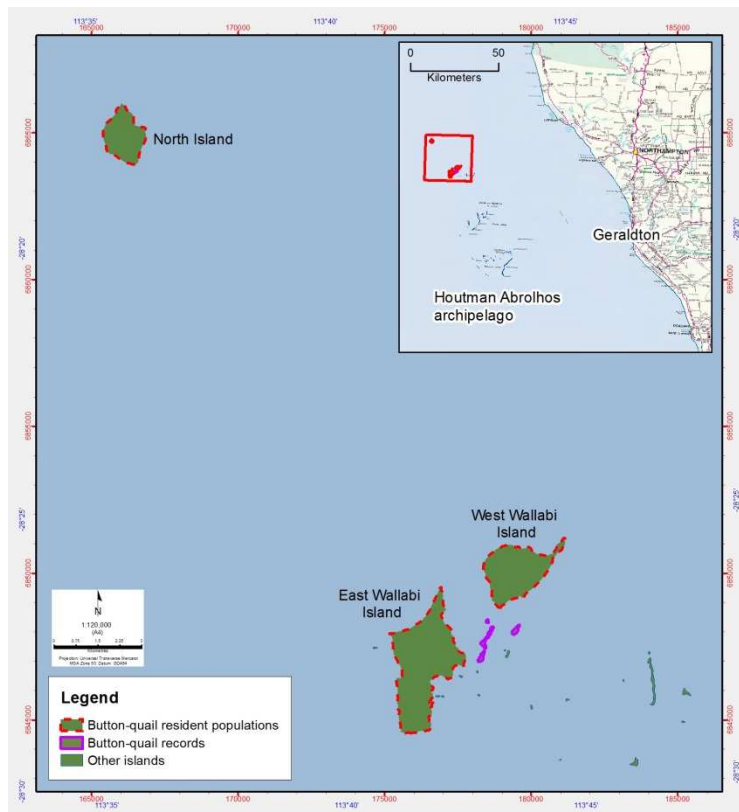


Figure 1: Distribution of the Abrolhos painted button-quail (*Turnix variegatus scintillans*).

## 1.4 Abundance

The abundance of Abrolhos painted button-quail is unknown. It has been recorded as being common on East and West Wallabi and North islands since the late 1800s (Alexander, 1922; Storr *et al.*, 1986; Garnett *et al.*, 2010), except on North Island where observations indicate the population may have gone through at least two declines and could currently be locally extinct.

On North Island, the button-quail was recorded as common in 1840 and 1913 (Alexander, 1922). However in 1959 it was not seen by an expedition of scientists from the University of Western Australia and was therefore presumed extinct on the island (Storr, 1960). The reason for this change in abundance is unknown though could have been due to fires in 1935 and 1945, and/or the introductions of tamar wallabies (*Notamacropus eugenii derbianus*), rabbits (*Oryctolagus cuniculus*) and cats (*Felis catus*). None of these introductions persisted and the button-quail was again observed to be common on the island in the 1970s and 80s (R. Johnstone, pers. comm. August 2017). Tamar wallabies were again introduced to the island in 1985 and successfully established, to the extent that a significant decline in the vegetation was clearly noticeable by the early 2000s. With this impact on the vegetation, button-quail numbers on North Island were observed to decline significantly, with only low numbers found in 2006 (Blyth *et al.*, 2006). They have not been observed on the island since despite searches in 2013 (Blyth *et al.*, 2014) and 2017 (Newell *et al.*, 2017).

## 1.5 Biology and ecology

The Abrolhos painted button-quail feeds by scratching and gleaning seeds and insects from the ground, and also foraging for scraps from around the fishing camps (Storr *et al.*, 1986). Like the mainland subspecies, while feeding they create distinctive circular depressions in the soil or leaf litter (known as platelets) by scratching two to three times with one foot, half-rotating the body and scratching with the other foot (Marchant and Higgins, 1993; Johnstone and Storr, 1998).

The Abrolhos painted button-quail's nest is a scrape in loose soil approximately 10 cm in diameter and 2 cm deep, lined with fine twigs and concealed from above by an overhanging bush (O'Loughlin, 1965; Storr *et al.*, 1986). A clutch of three eggs is laid, with laying occurring from April to October. Parental care in this subspecies is unknown, but the mainland subspecies is polyandrous (female breeds with several males) and the male incubates and rears the young (Frith, 1969). The young are agile on hatching and quickly follow the male parent, who at first feeds them and then attends to the foraging chicks (Shephard, 1989).

A generation length of five years has been estimated from an age at first breeding of one year and a maximum longevity of nine years. However, this has been extrapolated from expert opinion for the related *T. melanogaster* (Garnett *et al.*, 2010).

Little is known about the behaviour of the Abrolhos painted button-quail except that it is usually seen in pairs (Johnstone and Storr, 1998). The mainland subspecies is nocturnal and crepuscular with the females making low booming advertising calls, often at night (Marchant and Higgins, 1993). Females respond aggressively to imitations of their booming call by giving rapid drumming calls and walking about trying to find the intruder. When disturbed, they will freeze or run quickly in spurts with head carried high. When flushed they will fly a metre or two above the ground for some distance before dropping and running. They usually fly low but may fly up to 6 m above the ground and travel considerable distances.

The carpet python (*Morelia spilota imbricata*), which occurs on East and West Wallabi and Seagull islands, is known to predate on the button-quail (Pearson *et al.*, 2002), and the King's skink (*Egernia kingii*) is likely to eat its eggs. The house mouse (*Mus musculus*) has been introduced to North Island and may compete with the button-quail for food or eat their eggs or prey on young birds (Garnett and Crowley, 2000).

## 2 Habitat critical to survival and important populations

The habitat that is critical to the survival of the Abrolhos painted button-quail includes:

- current area of occupancy of resident populations of the subspecies: East and West Wallabi, and North islands; and
- other islands of the Houtman Abrolhos archipelago with similar habitat that may act as refugial locations for the subspecies, including Oystercatcher, Pigeon, Seagull and Turnstone islands.

## 3 Threatening processes

Under the EPBC Act, a threatening process is defined as a factor that threatens or may threaten the survival, abundance or evolutionary development of a native species.

For the Abrolhos painted button-quail, the known and potential threatening processes are:

- Predation and competition by introduced fauna
- Habitat modification and degradation due to introduced fauna
- Habitat modification and degradation due to invasive weeds<sup>3</sup>
- Impacts from land use and development
- Major fire events
- Effects of climatic conditions

### 3.1 Predation and competition by introduced fauna

As a ground-dwelling bird resident on only three small islands, the Abrolhos painted button-quail is especially susceptible to rapid decline or local extinction caused by the introduction of a non-endemic fauna species that predated on or competes with the button-quail. Species that would have the potential to cause rapid decline or extinction of the button-quail include rats (*Rattus* sp.), cats (*Felis catus*), foxes (*Vulpes vulpes*) or other predators.

Exotic fauna have been, and could be, introduced to the Abrolhos islands by humans, both intentionally and accidentally transported aboard boats or planes. The islands are at least 60 km from the mainland, and it is unlikely exotic species such as rodents, cats or foxes would be able to swim that distance. However, rats have colonised islands up to 1 km offshore (Russell *et al.*, 2008), so as there is 500m or less between many of the islands of the Wallabi Group, an incursion onto one of these islands could easily spread onto both East and West Wallabi islands.

The black or ship rat (*Rattus rattus*) is considered the worst rodent threat on Australian islands (DEWHA, 2009a) and if introduced to any of East or West Wallabi or North islands is highly likely to cause the local extinction of the button-quail through predation of eggs and competition for food resources. The black rat was discovered on Pigeon Island in 1965 by an Aquinas College expedition (O'Loughlin, 1965). From Pigeon Island, the rats could have easily invaded both West and East Wallabi islands as they are adept swimmers and will cross channels hundreds of metres in width (DEWHA, 2009a). The rats were eradicated from Pigeon Island (Burbidge, 2004) and have not been detected on East or West Wallabi islands.

There are currently no cats or foxes on any of the Abrolhos islands, but both species have played a major role in the decline of other ground-nesting birds (DEWHA, 2008b; DoE,

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<sup>3</sup> Invasive weed is defined as a weed that can establish in undisturbed native vegetation communities, with the potential to over time outcompete native plant species and form dense populations.

2015), including nesting seabirds on Rat Island (in the Easter Group, Arolhos) where black rats and cats were introduced in the early 1900s (Storr *et al.*, 1986). Storr (1960) recorded the presence of two domestic cats that had gone wild on North Island in 1959, but they did not establish a population on the island. He proposed that they were a factor in the then decline of the button-quail on the island.

The house mouse (*Mus musculus*) was introduced to North Island in the 1970s, presumably from the fishing camps on the island, and is still likely to be present (Garnett and Crowley, 2000), although its distribution or abundance is unknown. Impacts of the house mouse on the button-quail are unknown, although it seems likely they would compete for food (e.g. seeds and invertebrates) and may eat eggs or prey upon young birds. On Southern Ocean islands, it has been found that where mice are the only introduced rodent, they have more severe impacts including predation on seabird eggs and chicks (Angel *et al.*, 2009).

## 3.2 Habitat modification and degradation due to introduced fauna

Resident on only three relatively small islands, the Arolhos painted button-quail would be especially susceptible to rapid decline or local extinction if there was degradation of their habitat. The current situation on North Island, where the button-quails declined to possible local extinction in less than 20 years following the destruction of habitat by introduced tamar wallabies (*Notamacropus eugenii derbianus*), is an example of this. The introduction of other non-endemic grazers, such as rabbits or goats, would also impact the button-quail through habitat grazing and trampling. Historically, goats were pastured on East Wallabi Island and rabbits introduced to North Island, but neither species established and are thought to have had no lasting effect (Storr, 1960; Storr *et al.*, 1986).

In the Arolhos, tamar wallabies naturally occur on East and West Wallabi islands, co-existing with the button-quail. These are a Priority 4<sup>4</sup> medium-sized wallaby that was formerly widespread in south-western WA and the south coast of South Australia, but are now known from only seven islands and some scattered locations on the mainland of south-west WA. These wallabies did not naturally occur on North Island, but there has been two introductions of this species to the island, first in the 1920s and again in 1985 (Morris *et al.*, 2003). The first introduction did not persist, but the 1985 introduction of five individuals by fishermen did establish, possibly due to the fishermen's settlement providing additional shelter, food and water. The airstrip also provides additional grazing area, with the highest densities of wallabies seen along the airstrip. By 2006, it was estimated there were 500 individuals on the island (Herbert, 2006), although this turned out to be an underestimate (A. Desmond, pers. com., August 2017).

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<sup>4</sup> Priority 4 species are rare species included on DBCA's Priority species list as they are rare but not threatened, are near threatened, or have been removed from the list of threatened species during the past five years.

Vegetation monitoring on North Island in the early 2000s showed that the wallabies were having a significant impact on the vegetation of the island, in particular in the south east where the decline in vegetation condition and cover was obvious (Morris *et al.*, 2003; Chant, 2005). The wallabies were degrading the vegetation through over-grazing, ring barking and trampling. This apparently caused a significant decline in the button-quail population as a survey for the button-quail on North Island in 2006 only sighted one bird and found little evidence of foraging (Blyth *et al.*, 2006).

In 2003 the North Island community raised concerns about the impacts of the wallaby grazing, including declining button-quail populations. Following this a number of management actions were undertaken to determine the level of impact and attempt to control wallaby numbers as detailed in Section 9. The number of wallabies was reduced to an estimated 50-70 animals in 2009, but not eradicated from the island.

Following this reduction in wallaby numbers, the vegetation was noted to recover significantly (A. Desmond, pers. com., August 2017). However wallaby numbers increased again and by 2012 their impact on the vegetation was again obvious. Survey for button-quail in 2013 (Blyth *et al.*, 2014) and 2017 (Newell *et al.*, 2017) found no sign of the species, leading to the conclusion that the button-quail may be locally extinct from North Island.

### **3.3 Habitat modification and degradation due to invasive weeds**

The introduction of an invasive weed that impacted the structure and/or composition of the islands vegetation could have a significant impact on the Abrolhos painted button-quail through habitat degradation or reduced food resources. Weeds could be inadvertently introduced to the islands from the mainland by seeds transported in cargo, gravel, or on visitors' clothing and luggage. Many of the introduced plants on the Abrolhos islands were originally transported to the islands as garden plants.

On East and West Wallabi and North islands 20-35% of plant species are introduced species (Harvey *et al.*, 2001). These occur particularly in areas that have been disturbed by humans and have not had a significant impact on these islands.

The invasive species golden crownbeard (*Verbesina encelioides*) and Paterson's curse (*Echium plantagineum*) were introduced to East Wallabi Island in gravel used for airstrip repairs in 1998. The golden crownbeard has since been found on North and Rat islands as well. Control measures to date have prevented their spread. The golden crownbeard and Paterson's curse are of significant concern as both species are serious environmental weeds that could potentially invade and displace the native vegetation on the islands. Both species also produce large amounts of seeds that can germinate at any time of year and may remain dormant in the soil for a number of years. They can also form dense monotypic stands, particularly in disturbed sandy areas (Brown and Bettink, 2016). The golden crownbeard is

of particular concern for off-shore islands as it can cause substantial degradation to seabird nesting habitat by creating a physical barrier to nesting birds (Feenstra and Clements, 2008).

### **3.4 Impacts from land use and development**

Land use and development of the islands that the Abrolhos painted button-quail occur on has the potential to impact the subspecies through direct disturbance of the birds, impacts on their habitat or the introduction of non-endemic fauna or flora.

It is expected that recreation and tourism in the Abrolhos islands will increase in the future (DoF, 2012). Recreation activities currently include boating, fishing, diving and wildlife and heritage photography and appreciation. There is public infrastructure (airstrip, helipad, jetty, public boat moorings, boardwalks and toilet facilities) on East Wallabi as it is one of the main islands that is visited, in particular with the growing industry of air charter tours. There is currently no public accommodation on the islands, although options are being considered including visitor accommodation on East Wallabi. It will be important that any change in recreational use of these islands carefully considers potential impacts on the button-quail.

Licensed rock lobster fishermen have established permanent camps on some Abrolhos islands. The main settlements in the Wallabi Group are Pigeon and Little Pigeon islands, on which infrastructure now covers most of the land area. There are also smaller settlements on West Wallabi and North islands. These were originally occupied mostly only during the western rock lobster season (March-June) but the change to a quota-based crayfishery in 2010 has changed the fishing practices and the settlements are now used less intensively but over most of the year.

### **3.5 Major fire events**

A major fire event could have a significant impact on the button-quail through loss of habitat until the vegetation recovers. If all or most of an island is burnt, the button-quail population on that island would likely significantly decline or become locally extinct.

There have been two fires recorded in the eastern dunes of North Island, one in October 1935 and another in about 1945 (Storr, 1960). Following these fires, the vegetation was slow to recover and large sand blowouts formed. It appears that the button-quail population on North Island declined significantly after 1945, as Storr (1960) did not see them on the island in 1959. However, it is unknown whether this decline was related to the fires or to the introduction of non-endemic fauna (tammar wallabies, rabbits and domestic cats) over the same time period.



## 3.6 Effects of climatic conditions

The Abrolhos islands have a Mediterranean climate, with warm dry summers and cool, wet winters. Long term climate projections for WA suggest the already variable climate will become more variable with wet years likely to become less frequent and dry years (drought) likely to become more frequent (Department of Agriculture and Food, 2015; CSIRO, 2016). The frequency and intensity of storms is also likely to increase. As the button-quail is restricted to small islands, it would be susceptible to declines or local extinctions due to extremes in climatic conditions (i.e. storms or droughts).

With the changing climate it is also predicted that there could be a sea level rise in WA of 0.3 to 0.9m by 2090 (CSIRO, 2016). Most of the islands in the Wallabi group do not exceed 2m in elevation, though parts of East and West Wallabi and North island are up to 15m in elevation (Harvey *et al.*, 2001). Therefore a rise in sea level could have a significant impact on these islands and could result in loss of button-quail habitat.

## 4 International Obligations

This plan is consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention.

The islands on which the Abrolhos painted button-quail occur are also foraging or breeding areas for a number of seabirds and migratory shorebirds. This plan is consistent with Australia's obligations and responsibilities under international agreements relating to seabird and migratory shorebird conservation including the Convention on Conservation of Migratory Species of Wild Animals and the agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

## 5 Affected Interests

The Abrolhos islands, where the Abrolhos painted button-quail occurs, are managed by the Department of Primary Industries and Regional Development (formally Department of Fisheries) as part of the Class A Houtman Abrolhos Nature Reserve (Reserve no. 20253) vested with the Minister for Fisheries for the purposes of '*Conservation of flora, fauna, tourism and for purposes associated with fishing and aquaculture industries*' (DoF, 2012).

The Minister for Fisheries is able to lease or license land use on the islands. Commercial fishers are the only users who have permission to live on the islands. In the Wallabi group there are settlements on Pigeon, Little Pigeon, West Wallabi and North islands. These settlements are managed by a Houtman Abrolhos Islands Bodies Corporate.

The City of Greater Geraldton, Tourism WA and other tourism or recreational bodies have an interest in the Abrolhos islands as recreational use of the islands includes boating, fishing, diving and wildlife photography and appreciation. It is considered that recreation and tourism will increase (DoF, 2012), with public accommodation options being considered, including visitor accommodation on East Wallabi Island.

The Western Australian Museum and the Heritage Council of Western Australia have interests in the management of heritage values of the Abrolhos islands. West Wallabi Island includes significant heritage values from shipwrecks and historic guano mining.

Other interested parties potentially affected by, or involved in the implementation of this recovery plan include:

- Department of Biodiversity, Conservation and Attractions,
- Australian Government Department of the Environment and Energy,
- Australian Government Bureau of Meteorology (which has a weather station on North Island),
- Central Regional TAFE's Batavia Coast Maritime Institute (BCMI), and
- Northern Agricultural Catchments Council (NACC).

## 6 Role and interests of Aboriginal people

There is no evidence of Indigenous occupation on the Arolhos since sea levels rose several thousand years before present (Davies *et al.*, 2008). Input and involvement in implementation of the recovery actions would be welcomed from any local Aboriginal groups with an active interest in the Arolhos painted button-quail.

## 7 Social and economic interests

The implementation of this plan is unlikely to cause significant adverse social or economic impacts to current interests.

The requirement to protect habitat critical to the survival of the Arolhos painted button-quail, as outlined in Section 2, could impose some restrictions on land use and development of the islands on which the button-quail occur. Any land use proposal on East and West Wallabi and North islands would need to consider its potential impact on the button-quail. If there was the potential for the proposal to have a significant impact it would need to be assessed under referral and/or environmental assessment mechanisms of the State and Federal governments.

There could be negative public perception if tammar wallabies are culled on North Island, as the tammar wallaby is a species native to Australia and is on DBCA's priority fauna list. To reduce negative perceptions, any program to reduce the wallaby's impacts on North Island would need to consider all potential options and also include publicity to explain the importance of the program.

## 8 Broader biodiversity benefits

Recovery actions implemented to abate threatening processes and maintain or enhance Abrolhos painted button-quail populations will also have broader biodiversity benefits through the protection of North, East and West Wallabi, Oystercatcher, Seagull, Turnstone and Pigeon islands. This would include the other threatened and priority fauna (Table 1), breeding seabirds, migratory shorebirds and vegetation communities of these islands.

Table 1: The threatened or priority fauna and flora that occur within the range of the Abrolhos painted button-quail: East Wallabi (Ew), West Wallabi (Ww), North (Nth), Oystercatcher (Oc), Seagull (Sg), Pigeon (Pn), Turnstone (Ts) islands. \* indicates taxa that are endemic to the Abrolhos islands.

Taxa	Conservation Status <sup>#</sup>			Occurrence across button-quail range						
	WA	EPBC	IUCN	Ew	Ww	Nth	Oc	Sg	Pn	Ts
FAUNA										
Australian lesser noddy ( <i>Anous tenuirostris melanops</i> )	EN	VU	LC							
Curlew sandpiper ( <i>Calidris ferruginea</i> )	VU	CR	NT							
Greater sand plover ( <i>Charadrius leschenaultii leschenaultii</i> )	VU	VU	-							
*Houtman Abrolhos spiny-tailed skink ( <i>Egernia stokesii stokesii</i> )	P4	-	-							
Tammar wallaby (WA subsp.) ( <i>Notamacropus eugenii derbianus</i> )	P4	-	LC							
Eastern curlew ( <i>Numenius madagascariensis</i> )	VU	CR	EN							
Australian sea lion ( <i>Neophoca cinerea</i> )	VU	VU	EN							
*Brush bronzewing (Abrolhos subsp.) ( <i>Phaps elegans</i> (Abrolhos subsp.))	P4	-	-							
* Abrolhos dwarf bearded dragon ( <i>Pogona minor minima</i> )	VU	-	-							
Fairy tern ( <i>Sterna nereis nereis</i> )	-	VU	VU							
FLORA										
Woolly beauty-heads ( <i>Balladonia aevoides</i> )	P3	-	-							
<i>Chthonocephalus tomentellus</i>	P2	-	-							

<sup>#</sup> Ranked as Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) under Western Australia's Wildlife Conservation Act 1950 (WA), the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC) or the IUCN Red List (IUCN). DBCA also maintains a list of Priority species that are data deficient which are ranked P1 to P3 in order of priority for survey and evaluation of conservation status. P4 species are rare but not threatened or other specially protected species.

West Wallabi island is an important nesting site for wedge-tailed shearwater (*Ardenna pacifica*), little shearwater (*Puffinus assimilis*), and fairy tern (*Sternula nereis*). Other migratory birds protected under an international agreement that occur on the same islands as the button-quail include Caspian tern (*Hydroprogne caspia*), ruddy turnstone (*Arenaria interpres interpres*), sanderling (*Calidris alba*), white-bellied sea-eagle (*Haliaeetus leucogaster*), roseate tern (*Sterna dougallii*), bridled tern (*Onychoprion anaethetus*) and eastern reef egret (*Ardea sacra*).

These islands also include vegetation communities of special conservation interest, in particular mangroves on West Wallabi, Oystercatcher, Turnstone and Seagull islands, saltbush flats on North Island and West Wallabi and *Eucalyptus oraria* clumps on East Wallabi. The vegetation on East and West Wallabi and North islands is relictual, rich and diverse, but easily disturbed and slow to regenerate (Harvey *et al.*, 2001).

# 9 Previous and existing conservation and management actions

## 9.1 Monitoring and surveys

Most records of Abrolhos painted button-quail have been from biological surveys of the islands or anecdotal reports by fishermen. In 2017 DBCA and BCMI undertook a survey for the button-quail on all islands where they had previously been recorded (Newell *et al.*, 2017). Button-quail were seen on West Wallabi and Seagull islands, with their foraging platelets also found on East Wallabi, Oystercatcher and Turnstone islands.

Following the concern that the button-quail was declining on North Island, a day-long targeted survey was undertaken in 2006. Only one button-quail was seen and there was little sign of foraging (only 1 or 2 platelets) on North Island, compared with 2 sightings and more signs of foraging (>20 platelets) on East Wallabi Island (Blyth *et al.*, 2006). During this survey 50-100 tammar wallabies were seen on North Island, compared with <10 on East Wallabi. A short follow-up survey of 1.5 hours (4 people) in 2013 on North Island found no sign of the button-quail (Blyth *et al.*, 2014). Further survey in 2017 (3 hours, 6 people) on North Island also found no sign of the button-quail, with 100+ wallabies sighted (Newell *et al.*, 2017).

As the button-quails are cryptic, they are rarely seen and therefore difficult to monitor. However, their foraging platelets are relatively distinctive and easy to find. In 2016 BCMI in conjunction with DBCA began a trial of using transects on East Wallabi Island to monitor platelet numbers as a possible indicator of population trends. These transects have only been sampled three times to date (September and December 2016, September 2017).

## 9.2 Tammar wallaby control on North Island

In 2003 the North Island community raised concerns about the impacts of the wallaby grazing on the island vegetation, including a decline of the button-quail. The impacts of the wallabies on the vegetation included loss of foliage, ring barking of shrubs, plant deaths and an increase in the area of bare ground throughout the dunes (Chant, 2005).

Following this a number of management actions were undertaken to determine the level of impact and control options, including installation and monitoring of vegetation exclusion plots (Morris *et al.*, 2003) and monitoring of wallaby numbers (CALM, 2006). By June 2005 the vegetation was showing a continuing decline in cover of vegetation and litter in the south east of the island where the wallabies were most numerous (Chant, 2005). The condition of the vegetation was also continuing to decline. The sparse open heath in the

area of the island that burnt in 1935 did not change, suggesting the wallabies were not impacting that area of the island.

Relative abundance and condition monitoring of the wallabies on North Island was undertaken in May 2005 and April 2006 using capture/recapture techniques (CALM, 2006). It was estimated that there was approximately 500 individual wallabies (Herbert, 2006). The condition monitoring showed a general decline in condition of the animals over that 11 month period, suggesting that the wallabies were beginning to outstrip their available resources.

From 2005 to 2006 an experimental program of fertility treatment of female wallabies on the island was undertaken to gradually reduce the population. A total of 164 animals were implanted with a deslorelin implant, with a 91% success rate after 11 months (CALM, 2006). However this control method did not have an immediate impact on animal numbers (as these wallabies can survive up to 11 years) and required the implants to be replaced every 2 years. The program did not continue.

To further aid in reducing wallaby numbers on the island, 143 wallabies were removed to universities around Australia for research purposes. These wallabies are not deemed suitable for conservation translocations to the mainland to supplement wild populations because the North Island population established from only five founder animals and therefore have low genetic diversity and display some morphological abnormalities associated with inbred populations (Miller *et al.*, 2011).

Over this period, information was also provided to the North Island community to try and discourage feeding and watering of the wallabies (CALM, 2006). It was considered that this had some effect but it was known that some feeding still occurred.

A cull of the wallabies was not initially undertaken due to concerns regarding the acceptability of this technique by the North Island and wider community. However in 2006 the impacts on the vegetation were continuing and there was increasing public support to significantly reduce or remove the wallaby population (Driscoll, 2006) and so a cull of the wallabies was considered. A cull was undertaken between July 2007 and the summer of 2008/2009 with 1186 animals killed. After this, an estimated 50-70 animals remained but eradication was not completed due to a lack of funding.

Following the cull, an improvement in vegetation cover and condition was noted (A. Desmond, pers. com. August 2017). However, wallaby numbers quickly increased and by 2012 impacts on the vegetation were again being noticed. In 2015 a review of possible management options for the tamar wallabies on North Island was undertaken (Bamford and Browne-Cooper, 2015).



## 9.3 Restoration and weed control

The invasive species golden crownbeard (*Verbecina encelioides*) and Paterson's curse (*Echium plantagineum*) were introduced to East Wallabi Island in airstrip gravel used for repairs in 1998, and the golden crownbeard was subsequently found on North Island as well. Fisheries has funded an on-going control program for these species that has been undertaken since 2001 by DBCA and BCMI, with the aim of eradication.

Between 2013 and 2017 BCMI undertook an Abrolhos Islands Restoration Project in conjunction with NACC. On East Wallabi Island, this included beach clean-ups and revegetation on Signal Hill after a communications tower was constructed (M. Gray, pers. comm., August 2017). On North Island there were also beach clean-ups as well as some revegetation of the area that has not regenerated after the 1935 and 1945 fires. This included wallaby exclusion fencing built around two revegetation areas (0.7 and 5.5 hectares) into which 21,635 plants were planted. Some erosion control was also undertaken in the revegetation areas and along a quad bike trail.

# 10 Management practices and policies

Management practices (policies, strategies, plans) that have a role in the protection of the Abrolhos painted button-quail include, but are not limited to, the following:

- The Houtman Abrolhos Islands management plan (DoF, 2012)
- The action plan for Australian birds 2010 (Garnett *et al.*, 2010)
- Threat abatement plan to reduce the impacts of exotic rodents on biodiversity on Australian offshore islands of less than 100 000 hectares (DEWHA, 2009b)
- Threat abatement plan for predation by the European red fox (DEWHA, 2008b)
- Threat abatement plan for predation by feral cats (DoE, 2015).
- Threat abatement plan for competition and land degradation by rabbits (DOEE, 2016)
- Threat abatement plan for competition and land degradation by unmanaged goats (DEWHA, 2008a)
- Policy Statement No. 35 Conserving threatened species and ecological communities (Parks and Wildlife, 2015b)
- Corporate Guideline No. 36 Recovery of threatened species through translocation and captive breeding or propagation (Parks and Wildlife, 2015a)
- North Island Houtman Abrolhos Restoration Programme; Management Plan for the Tamar Wallaby *Macropus eugenii* (Bamford and Browne-Cooper, 2015)

# 11 Guide for decision-makers

Any proposed land use or action that may significantly impact the Abrolhos painted button-quail or habitat critical to its survival may require environmental impact assessment under the Western Australian *Environmental Protection Act 1986* and/or the Commonwealth *Environment Protection and Biodiversity Act 1999*. Any person proposing to undertake actions that may have a significant impact on any listed threatened species or ecological community should refer the action to the Commonwealth Minister for the Environment. The Minister will then determine whether the action requires EPBC assessment and approval.

Actions which could have a significant impact on the Abrolhos painted button-quail include actions that may result in any of the following in habitat critical to the survival of the subspecies:

- Direct disturbance of button-quail.
- Direct removal or disturbance of native vegetation.
- Increased grazing or degradation of native vegetation.
- Introduction, or increased likelihood of an introduction, of non-endemic fauna or flora to the islands.
- Increase in likelihood of fire.

# 12 Recovery

## 12.1 Recovery goals and objectives

The long term goal of the Abrolhos painted button-quail recovery program is to have secure<sup>1</sup> populations of the button-quail on the three largest islands where the taxon is a resident: East and West Wallabi and North islands.

This interim recovery plan guides recovery actions for the Abrolhos painted button-quail for the next 10 years. The recovery objectives of this plan are to:

Objectives	Priority <sup>5</sup>
1 Protect habitat critical for survival to maintain secure <sup>1</sup> populations of Abrolhos painted button-quail.	1
2 Restore a secure <sup>1</sup> population of Abrolhos painted button-quail on North Island.	1
3 Increase understanding of the Abrolhos painted button-quail's effective population size, capacity to move between islands, and clarify taxonomic relationships.	3

### Criteria for success

The recovery plan will be deemed successful if, within a 10 year period, all of the following are achieved:

- Secure populations of Abrolhos painted button-quail persist on East and West Wallabi islands;
- A secure population of Abrolhos painted button-quail is restored on North Island.

### Criteria for failure

This recovery plan will be deemed unsuccessful if, within a 10 year period, any of the above criteria for success have not been achieved.

## 12.2 Recovery actions

Recovery actions associated with each of the recovery objectives identified for the recovery of the Abrolhos painted button-quail are described below. All recovery actions are assigned a priority ranking separately (see Section 12.1 for priority ranking definitions).

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<sup>5</sup> Three Priority levels – Priority 1: taking prompt action is necessary in order to mitigate the threats and ensure the persistence of the species; Priority 2: action is necessary to mitigate threats and work towards the long-term recovery of the species; Priority 3: action is desirable, but not critical to recovery at this time but will provide for longer term maintenance of recovery.

## Objective 1: Protect habitat critical for survival to maintain secure populations of Abrolhos painted button-quail.

The most significant risk to Abrolhos painted button-quail is the introduction of non-endemic fauna or flora species to any of the islands, especially exotic rats, cats or foxes. As the islands are small, the introduction of any of these species has the potential to cause a quick decline of the button-quail. Also as all the islands except North Island are <1 km apart, it would be possible for an incursion to spread between these islands. Therefore it is particularly important that an incursion of any of these species is recognised and managed quickly.

To minimise the risk of the introduction of non-endemic fauna or flora, there are three basic aspects to island biosecurity: quarantine, surveillance and contingency responses (Russell *et al.*, 2008). The New Zealand Department of Conservation has developed best practice guidelines for island biosecurity (DOC, 2008). The biosecurity required depends on the island, the invasion pathways and vectors, the risks of these invasions and the resources available to undertake the biosecurity.

Action	Description	Priority <sup>5</sup>	Performance Criteria	Responsibility
1.1	Coordinate the implementation of recovery actions for the Abrolhos painted button-quail as detailed in this plan.	1	5 year review of plan undertaken in 2022. The criteria of success are achieved within the 10 year life of this plan (2027).	DBCA
1.2	Develop and maintain good quarantine measures for East and West Wallabi and North islands to prevent the introduction of new non-endemic fauna or flora species to these islands.	1	There is no new introduced fauna or invasive weed introduced to East and West Wallabi or North islands.	Fisheries, tour operators, island users
1.3	Develop and implement an exotic rodent, cat and fox surveillance program on East and West Wallabi and North islands using techniques such as tracking tunnels, chew blocks and/or motion-detection cameras.	1	Surveillance program set up on all three islands by 2019. Any incursions of introduced rodents, cats or foxes are identified within 6 months.	Fisheries

1.4	Eradicate any new incursions of introduced rodents to East and West Wallabi and North islands as quickly as possible.	1	No introduced rodents become established on East and West Wallabi and North islands.	Fisheries
1.5	Continue the eradication program for golden crownbeard ( <i>Verbesina enceliodes</i> ) and Paterson's curse ( <i>Echium plantagineum</i> ) on East Wallabi and North islands.	1	Golden crownbeard ( <i>Verbesina enceliodes</i> ) and Paterson's curse ( <i>Echium plantagineum</i> ) have been eradicated from East Wallabi and North islands.	Fisheries, DBCA, BCMI
1.6	Develop and implement an invasive weeds surveillance program for East and West Wallabi and North islands. Eradicate any new incursions of invasive weeds.	1	No new incursions of invasive weeds become established on East and West Wallabi and North islands.	Fisheries
1.7	At least once every 5 years, undertake a survey for the button-quail on all the islands where it is known to occur or has occurred.	2	Persistence of the button-quail on each of the islands it occurs on is known through a survey being undertaken at least once every 5 years.	DBCA
1.8	Continue monitoring biannually the 12 monitoring transects on East Wallabi Island to trial monitoring button-quail population trends. Following each monitoring session, assess the effectiveness of this protocol and consider improvements as required.  Consider extending this monitoring to other islands if considered useful to the management of the populations.	3	A monitoring protocol for button-quail population trends is developed and trialed on East Wallabi island for at least 5 years.	BCMI, DBCA
1.9	Undertake an awareness program targeting users of the settlements on the Wallabi Group islands, and other island users, to raise awareness of the button-quail and ask for sightings to be reported to DBCA. Could include a flyer or brochure that is distributed to users of the islands.	2	80% of users of the settlements on Wallabi Group islands are aware of the button-quail and its significance by 2020.  DBCA receives >1 reporting annually of sightings of the button-quail.	Fisheries, DBCA

## Objective 2: Restore a secure population of Abrolhos painted button-quail on North Island.

The introduction of tamar wallabies onto North Island in 1985 resulted in significant and continuing damage to the islands vegetation, which led to a decline in the button-quail population, so that it is now locally extinct or nearly so. Possible management options to reduce the impacts of the tammars on North Island are summarised in Bamford and Browne-Cooper (2015). To restore the islands vegetation and button-quail population, tamar wallabies need to be eradicated from the island. Other management options have been trialed including no management, temporary reduction of population through cull or translocation, and population reduction or eradication through contraceptive control. However these options have either not reduced the impacts of the tammars, or would require long-term ongoing management, which is not sustainable due to the associated costs and remoteness of the island.

With the removal of the tammars, the vegetation on the island should recover and button-quail numbers increase. If not, a reintroduction from East or West Wallabi islands will be considered.

There are also currently house mice on North Island, although their abundance and distribution is unknown. The impact of these mice on the button-quail is unknown although it seems likely they would compete for food and may impact on eggs or young birds. Therefore the house mice should be eradicated from the island, which may be easiest to do in conjunction with a tamar wallaby eradication program before button-quail recolonisation or reintroduction.

Action	Description	Priority <sup>5</sup>	Performance Criteria	Responsibility
2.1	Eradicate tamar wallabies from North Island to allow recovery of button-quail habitat. The eradication program would need to include consideration of alternative methods and public consultation.	1	Development of a tamar wallaby eradication plan by March 2018. Eradication of tamar wallabies from North Island by 2020.	Fisheries, DBCA
2.2	Undertake surveys for button-quail at least annually for 5 years following tamar wallaby eradication to determine if the button-quail population recovers or the island is recolonised.	2	The recovery of button-quail numbers on North Island is monitored at least annually for 5 years following the removal of tamar wallabies.	DBCA

2.3	Monitor vegetation recovery following tammar wallaby eradication.	3	Vegetation monitoring plots or photo points set up by end of 2018. Or vegetation recovery has been monitored using satellite imagery.	Fisheries, DBCA
2.4	Assist the rehabilitation of the vegetation if required	2	If the vegetation is not recovering within two years of tammar wallaby eradication rehabilitation actions are undertaken.	Fisheries, DBCA
2.5	Survey North Island for house mouse distribution and abundance, to determine whether an eradication program is required.	2	The distribution and abundance of house mice on North Island is known by 2020.	Fisheries, DBCA
2.6	Eradicate house mice from North Island if required before the recolonisation or reintroduction of button-quail.	2	There are no house mice on North Island by 2025.	Fisheries, DBCA
2.7	Reintroduce button-quail to North Island from East or West Wallabi islands if required.	1	There is a self-sustaining population of button-quail on North Island by 2027.	Fisheries, DBCA



### Objective 3: Increase understanding of the Abrolhos painted button-quail to support the conservation of the subspecies.

Little is known about this subspecies of painted button-quail. A greater understanding of the button-quail's biology, ecology and potential threatening processes could support the conservation and management of the subspecies. An understanding of whether there is movement of button-quail between the islands and an estimate of population size would be particularly useful for the management of this subspecies.

Action	Description	Priority <sup>5</sup>	Performance Criteria	Responsibility
3.1	Undertake genetic analysis to estimate effective population size, determine if there is movement of button-quails between the islands, and quantify relatedness with <i>Turnix varius varius</i> .	2	By 2022, genetic analysis of the button-quail has been undertaken to determine: (a) Effective population size. (b) Levels of gene flow between islands. (c) The degree of genetic relatedness between island and mainland subspecies.	DBCA
3.2	Encourage research programs relating to the button-quail that would support the management of the subspecies.	2	Research relating to the button-quail is undertaken.	DBCA
3.3	Preserve the subspecies genes by including tissue samples of the button-quail in a gene bank, if possible.	3	The subspecies is included in a gene bank.	DBCA

## 13 Implementation and evaluation

The coordination and implementation of this interim recovery plan will be overseen by the Western Australian Department of Biodiversity, Conservation and Attractions. DBCA recognises that partnerships will need to be developed to assist in the coordination and delivery of the recovery actions.

This plan will be implemented for a minimum of 10 years from the date of its approval, or until replaced by another approved plan. DBCA, in consultation with relevant partners, will review and evaluate the performance of this interim recovery plan, and in particular the performance against the success criteria. The interim recovery plan must be reviewed at intervals of no longer than five years, or sooner if necessary. The interim recovery plan may be revised in light of such review and as other information or research findings become available.

The estimated cost of implementing this Recovery Plan is \$532,500 over the first five years (Table 2). However, this estimated figure does not include costs associated with the ongoing management of habitat by Fisheries, eradication of new introduced species (if required), or translocation (if required).

Table 2: Summary of costs associated with recovery objectives over the first five years of this Recovery Plan.

Recovery Actions	Year 1	Year 2	Year 3	Year 4	Year 5	Total
<b>Objective 1: Protect habitat critical to species survival</b>						
1.1. Coordination	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$5,000
1.2. Quarantine measures	\$5,000	operational	operational	operational	operational	\$5,000 <sup>#</sup>
1.3. Biosecurity surveillance	\$10,000	\$1,200	\$1,200	\$1,200	\$1,200	\$14,800 <sup>#</sup>
1.4. Eradicate new incursions of rodents						TBD
1.5. Golden crownbeard eradication program	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$25,000
1.6. Eradicate new incursions of weeds						TBD
1.7. Survey of all islands (every 5 years)					\$10,000	\$10,000
1.8. Monitor population trends	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$20,000
1.9 Awareness program	\$5,000	\$5,000				\$10,000
<b>Objective 2: North Island restoration</b>						
2.1 Eradicate tammar wallabies from Nth Is	\$90,000	\$90,000	\$90,000			\$270,000
2.2. Button-quail survey						Included in 1.1 and 1.3
2.3. Monitor vegetation recovery	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500	\$12,500
2.4. Assist rehabilitation					\$20,000	\$20,000
2.5. Survey North Island for house mice	\$2,000					
2.6. Eradicate house mice from Nth Is.			\$30,000	\$30,000		\$60,000
2.7. Reintroduce button-quail to North Island						TBD
<b>Objective 3: Increase understanding of button-quail</b>						
3.1. Genetic analysis			\$100,000			\$100,000
3.2. Management research programs						TBD
3.3. Gene Bank						TBD
<b>Annual Cost</b>	<b>\$124,500</b>	<b>\$108,700</b>	<b>\$233,700</b>	<b>\$43,700</b>	<b>\$43,700</b>	<b>\$532,500</b>

<sup>#</sup> The budget estimate does not include the cost of salary or boat/plane transport to the islands, as the actions would be undertaken as part of regular management operations on the islands.

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## 14.1 Personal Communication References

Personal communications that are referenced in this document in text include:

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