

## The conservation management of Pulu Keeling National Park: challenges and perspectives

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**Abstract.** The Cocos (Keeling) Islands (CKI) are a remote group of 27 tropical islands in two separate atolls in the Indian Ocean that include North Keeling Island (Pulu Keeling National Park—PKNP) located 24 km north of the southern CKI atoll. Most of CKI's original vegetation has been cleared for coconut (*Cocos nucifera*) plantations but despite this the CKI region, particularly PKNP and CKI's marine environment, retains internationally significant conservation values. The PKNP is listed as a wetland of international importance under the Ramsar Convention and contains rainforest, lagoon and marine habitats. The PKNP provides habitat for the ground-dwelling, endangered and endemic Cocos buff-banded rail (*Gallirallus philippensis andrewsi*); an estimated 30,000 breeding pairs of red-footed booby (*Sula sula*); and contains the last significant remaining remnant of CKI's original vegetation. The CKI, including PKNP, also provides habitat for internationally endangered sea turtles. Existing invasive species, particularly yellow crazy ants (*Anoplolepis gracilipes*), and potential biosecurity threats, particularly black rats (*Rattus rattus*) and Siam weed (*Chromolaena odorata*), pose a threat to PKNP's biodiversity values.

**Key words.** Pulu Keeling, Cocos (Keeling) Islands, conservation management

### INTRODUCTION

The Cocos (Keeling) Islands (CKI) are located in the Indian Ocean approximately 2900 km north-west of Perth, 975 km west-south-west of Christmas Island and 1000 km south-west of Java Head (12°12'S, 96°54'E). They are one of Australia's most isolated territories consisting of 27 separate islands, the land area of which totals approximately 14 km<sup>2</sup>. The island group comprises two separate atolls, the southern inhabited atoll of 26 islands and North Keeling Island (Pulu Keeling National Park—PKNP) which is located 24 km to the north of the southern group. The atolls are connected by a submerged ridge at a depth of 700 to 800 m. Together they comprise a single feature rising from the surrounding ocean floor (Director of National Parks (DNP), 2004). The CKI lie in a humid, tropical zone and are subject to north-west monsoons from January to May with relatively strong, constant south-east trade winds blowing for much of the year (DNP, 2004).

Settlement of CKI commenced in the mid to late 1820s and most residents are Cocos Malay, predominantly descendants of workers bought to work on coconut plantations established in the 1830s, and government employees (DNP, 2004). The CKI

became an Australian Territory in 1955 and is administered in accordance with Australian Government legislation (the Cocos (Keeling) Islands Act 1955) which provides the legislative basis for the Territory's administrative, legislative and judicial systems (Department of Infrastructure and Regional Development, 2013). The Cocos (Keeling) Shire Council is responsible for the delivery of municipal services to residents of the territory.

The PKNP itself is managed by the Director of National Parks (DNP) and was proclaimed in December 1995. The park comprises 1.2 km<sup>2</sup> of forested land, a central lagoon and the marine waters surrounding North Keeling Island, extending out to 1.5 km from the island's high water mark (DNP, 2004). The PKNP is a Commonwealth reserve under Australian Government legislation (the Environment Protection and Biodiversity Conservation Act 1999—EPBC Act) and is divided into two zones assigned to the International Union of the Conservation of Nature (IUCN) protected area categories, 'strict nature reserve' for the terrestrial zone, and 'national park' for the marine zone (DNP, 2004).

### SUMMARY OF PULU KEELING NATIONAL PARK BIODIVERSITY VALUES

This paper will focus on the biodiversity values of PKNP (i.e., North Keeling Island and its surrounding waters). This is because the terrestrial and wetland habitats of PKNP remain comparatively intact whereas the terrestrial habitats of the other islands in the group are heavily modified. This paper will also very briefly discuss some of CKI's marine biodiversity values. However, it is not the intention here to explore in detail CKI or PKNP marine values or their management.

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The CKI rise less than 10 m above sea level and have evolved in isolation from a continental land mass through the combined forces of vulcanism, subsidence and coral growth (DNP, 2004). The native species of isolated oceanic islands generally derive from colonisers from distant land masses that arrive naturally by air or ocean currents (Beeton et al., 2010). Consequently these factors, when combined with the low terrestrial habitat diversity of CKI, have led to a native flora composition of pan-tropical Indo-Pacific origin with low endemism (Williams, 1994). For instance, of the 61 plant species recorded for CKI there is only one endemic taxon, *Pandanus tectorius cocosensis* (DNP, 2004).

The pre-settlement flora of CKI has been extensively cleared for coconut (*Cocos nucifera*) plantations except for North Keeling Island where tall *Pisonia grandis* and coconut forests, with small amounts of *Cordia subcordata* understory, remain (Williams, 1994). Despite its lack of distinctiveness, PKNP's vegetation is significant as the last intact remnant of the original CKI vegetation (DNP, 2004).

The vegetation of PKNP is also significant as waterbird habitat, with 24 species of resident and migratory waterbirds recorded. This includes 15 species that are listed under one or more international migratory bird agreements; all bird species recorded from the island are listed under the EPBC Act. The park's abundant waterbird populations contributed to its listing as a wetland of international importance under the Ramsar Convention in 1996 (Hale, 2010).

The PKNP meets six of the listed criteria under the Ramsar Convention—it is in a near natural condition and has never been permanently inhabited by humans; supports threatened species including the endemic Cocos buff-banded rail (*Gallirallus philippensis andrewsi*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) which are all listed as threatened under the EPBC Act; supports species populations important for maintaining the biological diversity of a biogeographic region; supports native species at a critical stage in their life cycles particularly breeding seabirds; regularly supports 20,000 or more waterbirds (more than 30,000 pairs of red-footed booby (*Sula sula*), up to 15,000 pairs of common noddy (*Anous stolidus*) and 3000 pairs of great frigatebird (*Fregata minor*) and lesser frigatebird (*F. ariel*) occur on PKNP); and regularly supports one percent or more of the global population of at least one species or subspecies of water bird (six percent of the red-footed booby population and three percent of the lesser frigatebird population) (Hale, 2010).

The CKI's marine environment is also internationally significant with 550 fish species recorded (Allen & Smith-Vaniz, 1994). The resident green and hawksbill turtles are nationally and internationally significant populations; growth rates for both species are in the upper range (indicating that the quality and quantity of foraging resources are adequate to support the high numbers of turtles) and nesting green turtles appear to be a unique genetic stock (Whiting, 2010). The presence of hybrid coral reef fish at both Cocos (Keeling) Islands and Christmas Island represents the greatest number

of hybrids reported from any marine location and the first recorded hybrid junction zone in tropical seas (Hobbs et al., 2008). This hybrid junction zone is also significant because it contests the notion that hybridisation is rare in the marine environment and lacking on coral reefs (Hobbs et al., 2008). The PKNP's reef fish may also be significant within the context of the wider CKI marine environment due to the occurrence of species that have not been found on the southern atoll (Hobbs, 2010).

## CONSERVATION MANAGEMENT CHALLENGES

There are several management challenges facing the conservation of the biodiversity of PKNP (and CKI more broadly). These challenges are largely related to the historical loss of CKI's original vegetation combined with the threat of invasive species, as well as human pressures on remaining habitats and biodiversity.

The ground-dwelling Cocos buff-banded rail was once widely distributed across the CKI but it is now confined to PKNP—the last confirmed southern atoll record was a specimen killed by a cat on West Island in 1991. Habitat modification, predation by cats, rats and humans and competition with jungle fowls have probably all contributed to this extirpation (Commonwealth of Australia, 2005). The recovery plan for the Cocos buff-banded rail also identifies it as being vulnerable due to a small isolated population, making it more susceptible to other threats such as cyclones and invasive species (Commonwealth of Australia, 2005). For instance, because of small founder numbers, populations on isolated islands usually have little genetic heterogeneity and limited ecological resistance to perturbations (Beeton et al., 2010). Thus, the loss of most of the CKI's native vegetation, combined with the impacts of invasive species and other potential threats has made the rail bird particularly vulnerable.

Rats are the invasive species that pose the most significant potential threat to PKNP's biodiversity. The PKNP is free of rats, however, the risk of rat introduction, as well as other invasive species, is present and has increased in recent years.

In separate incidents during 2012, three Suspected Illegal Entry Vessels (SIER) carrying people seeking asylum in Australia landed and were wrecked on PKNP, luckily with no loss of life. The immediate environmental concern was the potential for the introduction of rats and other invasive species. If introduced, rats could have a devastating impact on the Cocos buff-banded rail and seabird populations. Introduced predators are recognised as one of the most serious threats to island species worldwide and the ship or black rat (*Rattus rattus*) is perhaps the most pervasive alien predator, especially of island birds (VanderWerf et al., 2011). Eight seabird species that formerly bred in large numbers on the southern atoll of CKI no longer breed there but persist and breed on PKNP (Commonwealth of Australia, 2005). The loss or reduction of seabird populations from PKNP from rats or other threats would result in a highly significant reduction (and arguably an effective loss) of seabird populations from the entire CKI region.

Seabird populations are also subject to direct human impacts. Hunting of seabirds was once common in the CKI and, although hunting within PKNP is prohibited, poaching may continue to pose a threat to seabirds; past hunting may be partly responsible for low numbers of seabirds in the southern atoll (Hale, 2010). Additionally, hunting not only results in direct removal of seabirds but also disturbance during the breeding season and reduced recruitment (Hale, 2010). While hunting remains a threat, invasive species are considered to be the most significant threat to PKNP's biodiversity. Accordingly, protection of PKNP from the accidental introduction of invasive species is a paramount management priority (DNP, 2004). Hunting (and other unregulated or illegal entry into PKNP) may not only have direct impacts from takes or habitat disturbance but may also increase the likelihood of the accidental introduction of invasive species.

Other invasive species that pose a threat to PKNP include the yellow crazy ant (*Anoplolepis gracilipes*) and Siam weed (*Chromolaena odorata*). Crazy ants are one of the world's 100 worst invasive alien species (Lowe et al., 2000). On Christmas Island, crazy ants have caused significant declines in red crab (*Gecarcoidea natalis*) populations, the dominant consumer of the forest floor and the island's keystone species, thereby affecting forest seedling recruitment and litter breakdown. In the forest canopy, associations between crazy ants and honeydew-secreting scale insects accelerate and diversify impacts, with sustained high densities of foraging ants on canopy trees resulting in high population densities of host-generalist scale insects and growth of sooty moulds, leading to canopy dieback and even deaths of canopy trees (O'Dowd et al., 2003).

Crazy ants are present on PKNP, although it is difficult to determine exactly their potential impacts on biodiversity as the species composition and ecology of Christmas Island and PKNP differ in many ways. However, the study of crazy ants on Christmas Island provides some insights, including (as described) potential impacts on land crab populations as well as on *Pisonia grandis* forests. For instance, if the scale insect *Pulvinaria urbicola* were to find its way from Christmas Island to PKNP it would encounter a preferred host plant (*Pisonia grandis*) in the presence of a known ant mutualist and would likely be without significant natural enemies. Dieback could follow and degrade the largest stand of *Pisonia grandis* forest in the Indian Ocean, with consequent impacts on the largest breeding ground of the red-footed booby (*Sula sula*) in the Indian Ocean (Neumann et al., 2011).

Like crazy ants, Siam weed (*Chromolaena odorata*) is one of the world's worst invasive alien species (Lowe et al., 2004). Siam weed has the potential to seriously degrade wet tropics and ecologically important conservation areas (Department of Employment, Economic Development and Innovation, 2011). Although PKNP is currently free of Siam weed there is potential for it to be introduced. Siam weed has been present on the southern atoll of CKI for about 25 years (Dodd et al., 2012) and is not viewed as causing economic or environmental impacts, as coconut plantations are not used for economic production (Dodd et al., 2012).

However, significant infestations have been controlled from locations on the two inhabited islands to reduce the risk of seed spread to other parts of the island group and to the Australian mainland (Dodd et al., 2012). If Siam weed was to establish on PKNP it could degrade *Pisonia grandis* forests (especially in combination with the impacts of crazy ants and scale insects) which would also affect seabird populations through habitat loss or decline.

While not necessarily a management challenge, the varied legislative and administrative arrangements across the CKI create additional complexities in pursuing regional approaches to conservation management. For example, North Keeling Island is leased to the DNP by the Shire Council for the purposes of its administration, management and control as a national park. Similarly, Horsburgh Island in the southern atoll is owned by the Shire Council under a trust arrangement with the Australian Government and its native vegetation (apart from coconut) is protected under Australian Government legislation. The tenure complexities in the CKI have the potential to lead to varying land management goals which (without effective engagement and collaboration) may impact on regional conservation management programmes, such as the conservation of the Cocos buff-banded rail.

#### **CONSERVING THE BIODIVERSITY OF PULU KEELING NATIONAL PARK**

As PKNP is comparatively intact, is subject to relatively low levels of human disturbance and (with the exception of crazy ants) is currently free of highly invasive species, the priority conservation aim is preventing further disturbance to its natural values. Several management strategies are employed to help achieve this.

As prescribed by the most recent PKNP management plan (DNP, 2004), the terrestrial zone of the national park is assigned to the IUCN protected area category 'strict nature reserve'. The Australian IUCN reserve management principles are established by regulations under the EPBC Act and prescribe that a strict nature reserve should be managed primarily for scientific research or environmental monitoring and to preserve habitats, ecosystems and native species in an undisturbed a state as possible. The allocation of this category to PKNP provides the management framework to reduce the risk of disturbance to its natural values and is reflected in the approaches adopted for its management. For example, the most recent management plan prescribes that disturbance to wildlife by visitors will be minimised by maintaining and enforcing strict guidelines and controls on visitor access and behaviour (DNP, 2004).

Being located 24 km from the main CKI atoll, and because of the strong south-east trade winds (combined with the availability of suitable ocean capable vessels), access to PKNP can be difficult. This, in addition to the management strategies employed, helps to limit non-authorized access and direct human disturbance. While the remoteness of PKNP offers some protection from threats, it also presents considerable logistical challenges for monitoring and managing PKNP's

biodiversity. The major management programmes conducted on PKNP are environmental monitoring (focusing on the red-footed booby and the Cocos buff-banded rail); an island-wide biodiversity survey (so far carried out in 2009 and 2012); weed control; and visitor compliance. Sea conditions which restrict access can make it difficult to implement management programmes although on balance such restrictions are likely to provide a net management benefit.

One of the objectives of the Cocos buff-banded rail recovery plan is to establish a second viable population in the CKI to prevent extinction through a catastrophic event at the national park (Commonwealth of Australia, 2005). Surveys estimate the Cocos buff-banded rail population to be around 1000 individuals and numbers appear to have been relatively stable since 2008 (Woinarski & Detto, 2013). Based on scientific advice which included a risk assessment, in 2013, the DNP coordinated a programme to translocate a small number of Cocos buff-banded rails from PKNP to Horsburgh Island in the southern atoll. The translocation was planned and conducted by the DNP and researchers, with the support of the Shire Council and under the advice of a broadly-based recovery team and resulted in the successful translocation of 39 individuals to Horsburgh Island (Woinarski & Detto, 2013). While monitoring has already indicated second generation chicks in the translocated population, it is too early to determine if it will be successful (i.e., with establishment of a self-sustaining population). The translocation however demonstrates the need to manage PKNP and its biodiversity within a CKI bioregional context as well as highlighting the vulnerability of oceanic islands, even an oceanic island with a low rate of endemism.

### CONCLUSIONS

Despite the intrinsic ecological vulnerability of oceanic islands and nearly 200 years of settlement in the Cocos (Keeling) Islands which has resulted in the loss of most of its original native rainforest vegetation and the introduction of invasive species, PKNP's biodiversity values remain internationally significant. A key challenge for maintaining these values is minimising the impacts of existing invasive species and the likelihood of new invasive species entering PKNP, preventing direct human disturbance of PKNP's biodiversity, and continuing regional approaches to its and CKI's broader conservation.

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