A celebration of kakapo: progress in the conservation of an enigmatic parrot

MICK N. CLOUT
Chair, Kakapo Scientific and Technical Advisory Committee; Centre for Biodiversity and Biosecurity, University of Auckland, PB 92019, Auckland, New Zealand.
m.clout@auckland.ac.nz

Abstract The context of modern conservation management of kakapo is introduced and a brief overview of the research presented in this special issue of *Notornis* is provided.

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The story of the decline, rediscovery and slow recovery of the kakapo (*Strigops habroptilus)* is a conservation epic, which has captured the imagination of ornithologists and naturalists around the world. This flightless, nocturnal, lek-breeding parrot is a surviving relic of the ancient avifauna of New Zealand, which, until the arrival of humans about 800 years ago, included many other large flightless birds that are now extinct (Worthy & Holdaway 2002). Its survival is a minor miracle and is a testament to the work of many people, several of whom are contributors to this special issue of *Notornis*.

In many ways, the recent history of the kakapo reflects the development of conservation practice in New Zealand over the past century or so. Over this period, conservationists and scientists have increasingly realized the scale of the threats posed to native birdlife by invasive alien mammals and have developed responses to them. The kakapo was a focus of some of the earliest practical conservation efforts, from 1894-1900, when Richard Henry caught and transferred hundreds of kakapo and kiwi (*Apteryx australis*) to Resolution Island in Fiordland (Hill & Hill 1987). He did this in an attempt to protect them from recently introduced stoats (*Mustela erminea*), which were then completing their spread into this remotest part of New Zealand. Unfortunately, stoats reached Resolution Island in 1900. Decades later, the same technique of 'marooning' (on other islands) was successfully used to protect the last known kakapo from predation by stoats and feral cats. As the threats posed by rats (*Rattus* spp.) to native wildlife also became increasingly apparent, and techniques for clearing these invasive rodents from islands developed, kakapo were again among the key beneficiaries. As a result, all known kakapo are now on islands free of any introduced mammals. Based upon studies of their breeding biology (*Eason et al.*[1]) and productivity (*Elliott et al.*) on these island sanctuaries a simulation of the future of the species (*Elliott*) now suggests that 150 female kakapo could exist in 19-37 years. This is a significant contrast with the apparently looming extinction of only 30 years ago, prior to the discovery of a population on Stewart Island and the start of modern recovery efforts.

The kakapo was the first species for which a formal 'recovery plan' was compiled (in 1989) by the New Zealand Department of Conservation. Since the 1970s it has been, arguably, the most researched and intensively managed of all New Zealand bird species. Its natural history is consequently relatively well known (*Powlesland et al.*), although some important details, such as its diet and its former habitats in Fiordland (*Atkinson & Merton*; *Butler*), have remained unpublished until now. All known kakapo are now radio-tagged and are monitored regularly, yielding new and detailed information on behaviour (*Harper & Joice*), growth (*Farrimond et al.*), home range and habitat selection (*Farrimond et al.*; *Walsh et al.*). Supplementary food is provided to individuals as required, nests are intensively managed, and young birds are often hand-raised (*Eason & Moorhouse*).

Kakapo management is not only intensive, it is also strongly science-based. For example, when research revealed that supplementary feeding affected the sex ratio of kakapo offspring (Clout *et al.* 2002), this finding was successfully used to increase the proportion of female chicks by deliberately manipulating maternal condition (Robertson *et al.* 2006). A current challenge is to reformulate the content of supplementary food (*Raubenheimer & Simpson*) in the hope that this may yet be used to encourage kakapo breeding when it would not otherwise occur naturally.

The Department of Conservation undertakes the conservation of kakapo by employing a dedicated kakapo management team of technical and research specialists supported by field volunteers, using an external scientific and technical advisory committee, and accepting generous corporate support from Comalco New Zealand Ltd. The advisory committee, along with the kakapo management team, effectively comprises the 'recovery group' for kakapo. This group's recently-drafted *Kakapo recovery plan* (DoC in press) is the third since 1989 and covers the period from 2006-2015. This relatively long timeframe recognizes the extreme longevity and low reproductive rate of kakapo. It has become increasingly evident that this weirdest of parrots has a uniquely slow lifestyle. It subsists on an exclusively herbivorous

[1] Names in italics refer to papers by these authors in this volume (*Notornis* 53(1), 2006)

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diet (*Atkinson & Merton*; *Butler*; *Wilson et al.*) and breeds only episodically, in response to the mast fruiting of podocarp species (*Cockrem*; *Harper et al.*). It is not only the heaviest parrot in the world, but also has the distinction of having the lowest metabolic rate recorded for any wild bird (*Bryant*). Natural longevity is an evolutionary complement to low reproductive and metabolic rates. Of the 86 extant kakapo, only 42 have hatched since 1980. The remainder are now at least 30 years old, but many are probably much older. Survival rates of adult kakapo exceed 98% per annum (Clout & Merton 1998; *Elliott*), indicating a potential longevity of many decades and raising the possibility that some surviving individuals may be over a century old. Supporting this possibility is the fact that kakapo persisted in Fiordland until at least the late 1980s despite the presence of stoats there from the 1890s. Stoats are severe predators of ground or hole-nesting native birds in New Zealand, including another parrot, the kaka (*Nestor meridionalis*) (Moorhouse *et al.* 2003). Given this, and the additional risks posed by female kakapo nesting alone and regularly leaving their eggs and young unattended, few (if any) kakapo are likely to have fledged in Fiordland after stoat colonization. Unlike males, kakapo females were exposed to predation at nests, explaining why they apparently survived only on stoat-free Stewart Island. The last few kakapo found in Fiordland, including 'Richard Henry' (captured in 1975), were all males. Arguably, these survivors were hatched from eggs laid prior to the 1890s. The exciting possibility of 'molecular ageing' of kakapo (*Robertson*) may help to resolve this question.

As knowledge of the ecology, behaviour and genetics of kakapo has increased and conservation techniques have been refined, the goals of the kakapo recovery programme have changed in response (*Jansen*). Goals of the 1996-2005 plan were: to determine why kakapo breed infrequently; to increase breeding frequency; and to increase nesting productivity (leading to recruitment of eight or more females from at least 24 breeding attempts). These goals were largely met. Most notably, the goal of female recruitment was exceeded by more than twice, so that the current kakapo population has a much healthier sex and age structure than it did a decade ago. In the new recovery plan (DoC in press), a major focus is to maximize genetic diversity. Most kakapo originate from Stewart Island and are genetically similar (*Robertson*). As a possible consequence, those eggs laid have very low hatching success (*c.*40%). The sole surviving Fiordland kakapo ('Richard Henry') is genetically distinct from Stewart Island birds, but has only three progeny. A goal of the new recovery plan is, therefore, that by 2015 there will be at least 60 female kakapo (currently 41), of which 10 will have Fiordland genes (currently one). As this publication goes to press, a final search for kakapo in Fiordland is being conducted by Department of Conservation staff, volunteers, and local helicopter pilots, in an attempt to find any surviving males that might yet contribute to future genetic diversity.

Other goals of the new plan are to increase public awareness and support for the kakapo programme, to maintain and improve current 'kakapo islands' and (by 2015) to have a large, predator-safe island, which could support hundreds of kakapo in the long term. A prime candidate for this is Resolution Island (26,000ha), which would be cleared (and kept clear) of stoats to achieve this goal, potentially realising the vision of Richard Henry albeit over 100 years later.

The *Kakapo recovery plan* aims "to restore the mauri ('life force') of kakapo by establishing at least one viable, self-sustaining, unmanaged population as a functional component of the ecosystem in a protected habitat, and to establish two or more other populations which may require ongoing management". The information collated in this special issue of *Notornis* represents the current 'state of the art' of knowledge about kakapo and will hopefully aid the recovery of this enigmatic parrot to a point at which intensive management is no longer necessary.

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