

SCIENCE OF ECOLOGY AND ART OF CONSERVATION

Protection of native species by applying scientific principles of conservation can save New Zealand's threatened flora and fauna from extinction. Indeed, safeguarding species diversity and abundance will ensure today's gene pool contributes to the ability of species' to adapt in tomorrow's changing environment. Greater biodiversity thereby enhances opportunities for the future evolution of new species.

Ecological degradation began with the arrival of humans (circa 1280 AD), along with their cargo of predators to this archipelago. Many species were lost when Polynesians and Europeans respectively destroyed 32% and 38% of the country's natural forests. Polynesians caused the extinction of >70 native species and European's another 12 species. Prolonged hunting and habitat loss precipitated extinction of ~58 bird species*. Introduced predators quickly gained supremacy over smaller avian and insect species. Kiore (*Rattus exulans*) alone led to the loss of ~23 small bird, bat, reptile and invertebrate species.



Fig. 1. South Island Kokako, depicting the distinctive yellow - orange wattle, is classified as extinct (Table 1).

The recent introduction of intense agricultural practices has led to excessive soil erosion and sedimentation in streams, rivers, wetlands and estuaries and, in turn, loses in biodiversity among avian and marine species, both coastal and pelagic.

Conservation of remaining species – whether aerial, terrestrial or aquatic - is a biological necessity. The preservation of native life needs to be based on art, in the sense of devising creative measures, and on applying scientific procedures stemming from touchstones of knowledge. For instance, research on the kereru (wood pigeon) (*Hemiphaga novaeseelandiae*) has shown only 12% of chicks fledge from any one nest. Others died for reasons ranging from infertility and desertion (10%), falling from nests (6%), and predation of parents (3%), fledglings (7%) and eggs (37%). The greatest single loss, by far, has been ascribed to predation (47%).

The worldwide IUCN Red List contains 784 extinct species, of which 27 have been lost in the past 20 years. The Red List's threatened species includes 45 New Zealand birds, including the North Island kokako, kaka, kiwi, kakapo and mohua. The country's birds are prone to predation and their numbers in most cases continue to decline (Table 1). This includes extinction of the South Island kokako, last reported to occur in Teal Creek, Mount Aspiring National Park in 1967 (Fig. 1). North Island kokako (*Callaeas cinerea wilsoni*) with their aquamarine wattle are few, and limited mostly to the Mainland Island Restoration Project, Otamatuna, Te Urewera National Park.

Exotic flora and fauna have been introduced into New Zealand. Polynesian immigrants brought three new plant and two animal species. Europeans introduced >2,000 exotic plants and >90 animal species. The invasive pests - cats, hedgehogs, possums, rats, mice, stoats, ferrets, weasels – have devastated native birds.



Fig. 2. Kereru on Nikau fruiting body (Photograph: Geoffrey Moon)



Fig. 3. Possum with a kereru's egg (David Mudge)

Priority must be given to eliminating all mammalian predators, particularly Brush tail possums, stoats and rats, the major predators of kokako and kereru (kukupa). Until this objective is accomplished, New Zealand will remain, proportionately, at the top of the IUCN Red List, a poor record of accomplishment.

There are opportunities for rescuing threatened species. New Zealand has 735 islands (>1.0 ha) of which ~250 are managed by the Department of Conservation (DOC). Predators have been removed from some of these islands, by shooting, trapping and poisoning. Pests have been removed from >300,000 hectares of forest. These include Campbell Island in the Southern Ocean; Codfish, Resolution and Secretary Islands off the west coast of the South Island; and Moturoa, Motuihe, Tiritiri Matangi and Motu Kaikoura in the Hauraki Gulf, North Island, New Zealand.

Predator-free islands offer safe havens for restoration of natural ecosystems, for recovery of threatened avian species, and for seminal research on rescuing and sustaining native species.

Unfortunately, mammalian species have re-invaded predator-free islands and thereby threatened efforts to restore natural habitats and rescue endangered species. Rats are the principal culprits. A single pregnant female rat arrived in cargo on predator-free Frégate Island, Seychelles, evaded capture, and later successfully re-populated the island. In New Zealand, rats have re-invaded, *albeit* transiently, four upper Hauraki Gulf islands - Moturoa, Motuihe, Noises and Saddle Islands.



Fig. 4. Rat predated kereru eggs on nest. (Nga Manu Images)

Noises Islands have been re-invaded by rats six times in 25 years, although 2.1 km from the nearest land. Rats can swim substantial distances (<2 km) and frequently hitch rides on canoes, boats and larger vessels plying across the oceans. Hence, the small kiore arrived on Polynesian canoes, while Norway and ship rats and other predator pests, arrived later on the vessels of European whalers, sealers, traders and settlers.

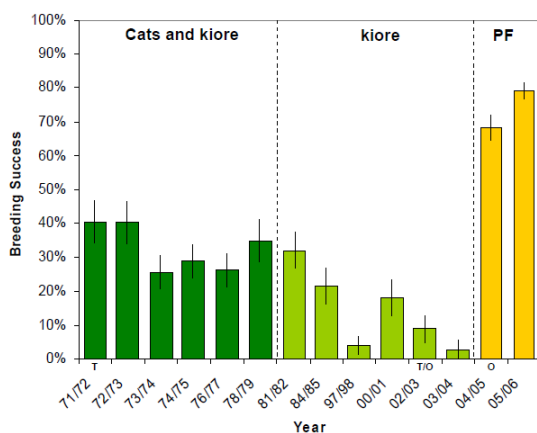


Fig. 5. Effects of predator removal on Cook's petrel. [From M. Rayner et al., 2007]

Interestingly, radio-collared rats released deliberately on Motuhoropapa, after adapting locally for three to four days, ranged widely around the island. In one case, Razza, a Norway rat disappeared from Motuhoropapa for 18 weeks, despite extensive efforts to locate the animal via its collar-tagged, radio emissions. Four months later, Razza, identified by DNA fingerprinting, was recovered from an adjacent island just 400 metres away, replete with his radio-tagged collar.

Elimination of predatory animals leads to a marked proliferation of native birds. Hauturu (Little Barrier Island), after removing cats (1980) and kiore (2004), was able to sustain an expanding colony of Cook's petrels.

Initially, in the absence of feline predators, the number of Cook's petrels actually declined due to an irruption of kiore (Fig. 5; 1980-2004). It is anticipated Cook's petrels (Titi) (*Pterodroma pelagics*) now shall expand to greater numbers, thereby ensuring their long-term survival (Fig. 6). Similarly, in other instances, caution is needed to ensure elimination of rats does not lead to an irruption of surviving mice that predate on small native birds and their eggs.



Fig.6. Numbers of Cook's petrels are increasing on Hauturu after elimination of cats and kiore.

Clearly, programmes for eliminating mammalian predators need to be designed carefully to avoid irruptive effects on other predator populations.

Protection of threatened avian species requires complementary approaches. These are to: 1) establish new reserves backed by legal protection; 2) eradicate predators; 3) translocate species to predator-free environments; and 4) undertake captive rearing, cross-fostering and supplemental feeding. Endangered kakapo (*Strigops habroptilus*), the world's largest parrot, a flightless, nocturnal herbivore is prone to predation. Consequently, all existing kakapo have been transferred to a predator-free, Codfish Island off the South Island's southwest coast. The kakapo, in rimu mast years are provided supplemental food, after egg laying, to increase their body weight and thereby enhance fledgling survival.



Fig. 7. Adult kakapo and two fledglings.

The programme, involving the World's population of ~90 kakapo is expected to expand to nearby, predator-free, Secretary Island (8,140 ha) and Resolution Island (20,086 ha). Optimistically, this step is expected to increase kakapo numbers sufficiently to ensure their survival and eventual re-population of New Zealand's mainland (Fig. 7).

Restoration of the natural environment will require sustained and consistent efforts to offset the ecological degradation that has been invoked during recent centuries. It is within our grasp to restore large regions of New Zealand back to the natural balance that prevailed for millions of years on our wandering archipelago.

This article was written by Dr Anthony R Bellvé, Chairman, Whitford Estuaries Conservation Society (WECS), based on a lecture by Dr Mick Clout, Professor of Conservation Ecology, School of Biological Sciences, University of Auckland, and also a WECS Committee Member. The lecture was presented on Thursday 12th February 2009, to Friends of Mangemangeroa, Point View Heritage Society, Tamaki Estuary Protection Society and Whitford Estuaries Conservation Society (WECS), the original four members of the now 16 societies comprising the Southeast Auckland Alliance (SEA).

***POSTSCRIPT**

In New Zealand, sixteen birds**, one freshwater fish, one reptile, nine terrestrial invertebrate and six vascular plant species have become extinct since 1840. Between 2002 and 2005 one more bird was declared extinct (South Island kokako) and six more invertebrates; however, one bird (Storm petrel) and one invertebrate were removed from the extinction list.

The total number of threatened species reported by DOC (2007) increased by 416 to 2,788 species between 2002 and 2005. Among the birds, there were net increases of 23 species listed as Nationally Critical, 32 species as Nationally Endangered and 10 species as Nationally Vulnerable.

TABLE 1: AVIAN SPECIES NOW CLASSIFIED NATIONALLY 'EXTINCT', 'CRITICAL' AND 'ENDANGERED (1840-2005)**

CLASS	NAME		
	Common	Maori	Latin
Extinct	Auckland Island merganser		<i>Mergus australis</i>
	Bush wren		<i>Xenicus longipes</i>
	Chatham Island bellbird		<i>Anthornis melanocephala</i>
	Chatham Island fernbird		<i>Bowdleria rufescens</i>
	Chatham rail		<i>Cabalus modestus</i>
	Dieffenbach's rail		<i>Gallirallus dieffenbachii</i>
	Huia	Huia	<i>Heteralocha acutirostris</i>
	Laughing owl		<i>Sceloglaux albifacies</i>
	Little Barrier Island snipe		<i>Coenocorypha aucklandica barrierensis</i>
	New Zealand little bittern		<i>Ixobrychus novaezelandiae</i>
	New Zealand quail		<i>Coturnix novaezelandiae</i>
	New Zealand storm-petrel		<i>Oceanites maorianus</i>
	North Island piopio	Piopio	<i>Turnagra capensis</i>
	South Island kokako	Kokako	<i>Callaeas cinerea cinerea</i>
	Stephens Island wren		<i>Traversia lyalli</i>
	Stewart Island snipe		<i>Coenocorypha aucklandica iredalei</i>
	Critical	Black robin	
Black stilt			<i>Himantopus novaezelandiae</i>
Bounty Island Shag			<i>Leucocarbo ranfurlyi</i>
Campbell Island snipe			<i>Coenocorypha "Campbell"</i>
Campbell Island teal			<i>Anas nesiotis</i>
Chatham Island oystercatcher			<i>Haematopus chathamensis</i>
Chatham island pigeon		Parea	<i>Hemiphaga chathamensis</i>
Codfish Island South Georgian diving petrel			<i>Pelecanoides georgicus "Codfish Island"</i>
Common noddy			<i>Anous stolidus pileatus</i>
Fairy tern			<i>Sterna nereis davisae</i>
Haast tokoeka		Tokoeka	<i>Apteryx (Haast)</i>
Kakapo		Kakapo	<i>Strigops habroptilus</i>
Kermadec petrel			<i>Pterodroma neglecta</i>
Kermadec white-faced storm petrel			<i>Pelagodroma marina albiclunis</i>
Masked booby			<i>Sula dactylatra fullageri</i>
New Zealand little bittern			<i>Ixobrychus novaezelandiae</i>
New Zealand shore plover		Tuturuata	<i>Thinornis novaeseelandiae</i>
Okarito brown kiwi			<i>Apteryx (Okarito)</i>
Orange-fronted parakeet			<i>Cyanoramphus malherb</i>

	South Island brown teal		<i>Anas chlorotis "South Island"</i>
	South Island piopio	Piopio	<i>Turnagra capensis</i>
	Southern New Zealand dotterel		<i>Charadrius obscurus obscurus</i>
	Taiko	Taiko	<i>Pterodroma magentae</i>
	Takahe	Takahe	<i>Porphyrio mantelli</i>
	White heron		<i>Egretta alba modesta</i>
	White tern		<i>Gygis alba royana</i>
Endangered	Australasian bittern		<i>Botaurus poiciloptilus</i>
	Blue duck	Phio	<i>Hymenolaimus malachorhynchus</i>
	Black-fronted tern		<i>Sterna albobriata</i>
	Brown teal		<i>Anas chlorotis "North Island"</i>
	Chatham Island tit	Tit	<i>Petroica macrocephala chathamensis</i>
	Chatham Island tui	Tui	<i>Prothemadera novaeseelandiae chathamensis</i>
	Chatham petrel		<i>Pterodroma axillaris</i>
	Chatham Island shag		<i>Leucocarbo onslowi</i>
	Crested grebe		<i>Podiceps cristatus australis</i>
	Erect-crested penguin		<i>Eudyptes sclateri</i>
	Forbes' parakeet		<i>Cyanoramphus forbesi</i>
	Hutton's shearwater		<i>Puffinus huttoni</i>
	Kea	Kea	<i>Nestor notabilis</i>
	Kermadec petrel		<i>Pterodroma neglecta</i>
	Masked booby		<i>Sula dactylatra fullageri</i>
	NZ black-browed molly mawk		<i>Thalassarche impavida</i>
	North Island kaka	Kaka	<i>Nestor meridionalis septentrionalis</i>
	North Island kokako	Kokako	<i>Callaeas cinerea wilsoni</i>
	North Island weka		<i>Gallirallus australis greyi</i>
	Reef heron		<i>Egretta sacra sacra</i>
	South Island kaka		<i>Nestor meridionalis meridionalis</i>
	South Island saddleback	Tieke	<i>Philesturnus carunculatus carunculatus</i>
	Southern falcon		<i>Falco novaeseelandiae "southern"</i>
	Stewart Island fernbird	Matata	<i>Bowdleria punctata stewartiana</i>
	Stewart Island robin		<i>Petroica australis rakiura</i>
	Stewart Island weka	Weka	<i>Gallirallus australis scotti</i>
	Yellowhead	Mohua	<i>Mohoua ochrocephala</i>

This list does not include those species that have been classified as showing 'Increased Vulnerability' or 'Greater Rates of Decline'. See also: http://osnz.org.nz/Media/2005_state_of_NZ_birds.pdf

A. REFERENCES

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B. RELATED WEBSITES

1. http://osnz.org.nz/Media/2005_state_of_NZ_birds.pdf
2. <http://www.doc.govt.nz/upload/documents/about-doc/concessions-and-permits/conservation-revealed/kereru-nz-native-pigeon-lowres.pdf>
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