

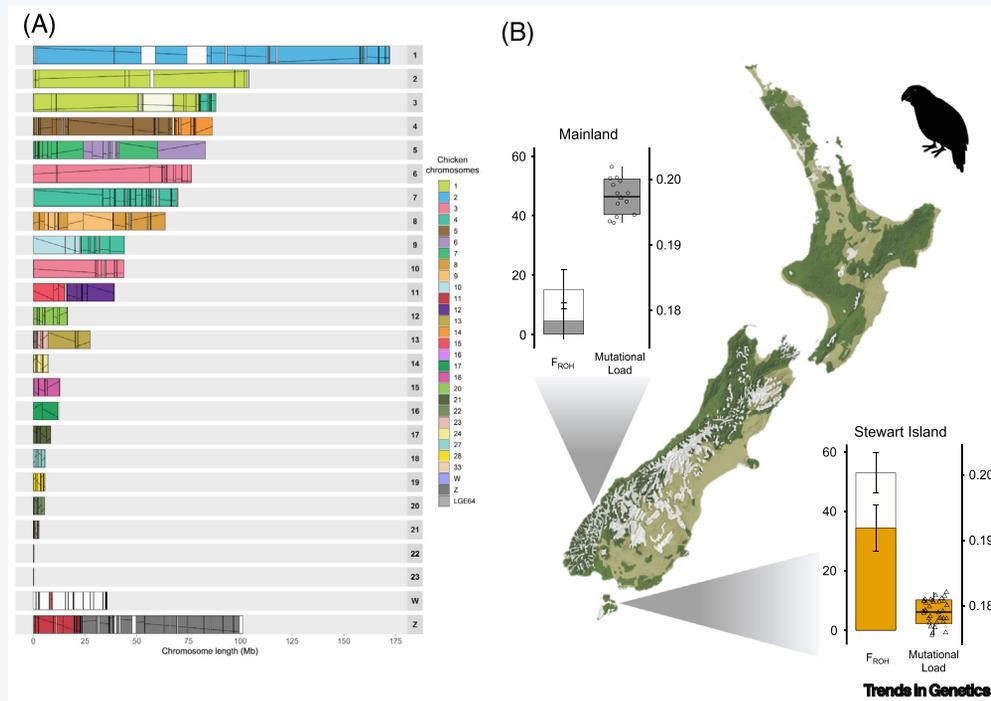
The kākāpō (*Strigops habroptilus*)Nicolas Dussex¹,^{2,3,*} Bruce C. Robertson,⁴ Love Dalén,^{1,2,3} and Erich D. Jarvis^{5,6,7,*}¹Centre for Palaeogenetics, Svante Arrhenius väg 20C, SE-10691, Stockholm, Sweden²Department of Bioinformatics and Genetics, Swedish Museum of Natural History, Box 50007, SE-10405, Stockholm, Sweden³Department of Zoology, Stockholm University, SE-10691 Stockholm, Sweden⁴Department of Zoology, University of Otago, PO Box 56, Dunedin 9054, New Zealand⁵Vertebrate Genome Laboratory, The Rockefeller University, New York, NY 10065, USA⁶Laboratory of Neurogenetics of Language, Box 54, The Rockefeller University, New York, NY 10065, USA⁷Howard Hughes Medical Institute, Chevy Chase, MD, 20815, USA

Figure 1. (A) Ideogram of kākāpō chromosomes relative to chicken. Numbered rectangles represent chromosomes, and colored blocks inside represent regions of homology with chicken chromosomes. Lines within the colored blocks represent block orientation. The Z chromosome homolog is fused with the chromosome 11 equivalent of other bird species based on read and mapping data. (B) Inbreeding and mutational load estimates in mainland (extinct) and Stewart Island (extant) kākāpō. Individual inbreeding coefficients are estimated using runs of homozygosity (ROH). Mutational load is estimated based on genomic evolutionary rate profiling (GERP) scores.

Lessons learned

The kākāpō, *Strigops habroptilus*, is a flightless and critically endangered parrot from New Zealand. The species belongs to a unique lineage of parrots, endemic to the archipelago that diverged from other parrots ~82 million years ago (mya), as New Zealand split from Gondwana. The kākāpō genome represents one of the first high-quality chromosome-level reference genomes sequenced by the Vertebrate Genomes Project (VGP) and is an important resource for future studies on evolution and conservation. Analyses of this new genome provide key insights into kākāpō breeding and recovery. Comparison of modern and historical genomes show that kākāpō experienced a reduction in mutational load through genetic drift and purging. These findings indicate that even extremely inbred and bottlenecked species can survive in the wild, but also caution about the future management strategy for the species. Because kākāpō is a taonga, or treasure for Māori, the project was established in collaboration with Te Rūnanga o Ngāi Tahu.

Fun fact about the Genome

The Z sex chromosome fused with the chromosome 11 equivalent of other bird species, and this since has been found for other parrot species, indicating that the fusion may have occurred at the origin of parrots.

GENOME FACTS:

The kākāpō genome comprises 23 chromosomes (2n), making for a total genome size of ~1.19 Gbp. It has a repeat content of 15% and a GC content of 42%.

A total of 16 053 annotated protein-coding genes were identified. Kākāpō is one of the most inbred species on earth with 0.4–0.5 heterozygote sites per 1000 bp and an inbreeding coefficient (F_{ROH}) of ~53%.

The kākāpō diverged from flying New Zealand parrots (kea and kākā) ~28 mya.

Population genomics analyses revealed that the divergence time between the extinct mainland and the extant Stewart Island populations dates back to the end of the last glaciation ~15 thousand years ago (kya).

SPECIES FACTS:

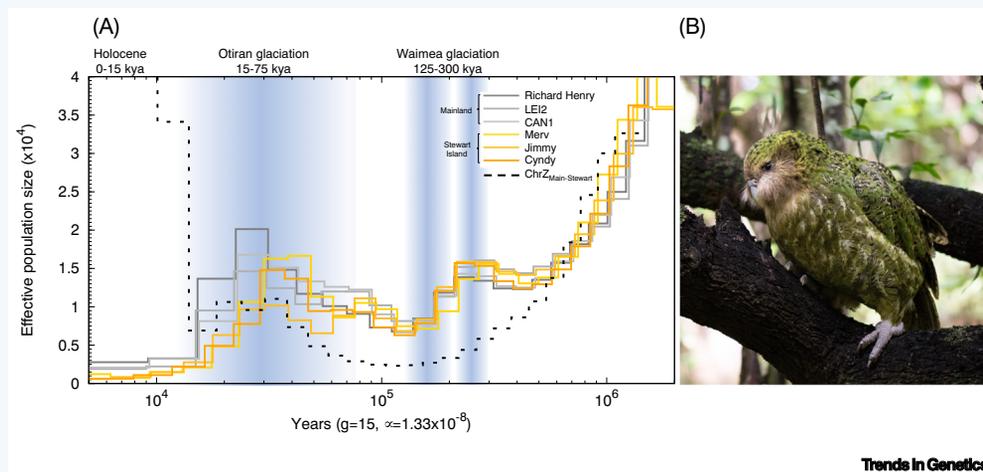
The kākāpō used to be one of most common and widespread birds in New Zealand. There are now only 202 kākāpō surviving on island sanctuaries that are part of an intense breeding program.

Only one mainland bird, called Richard Henry, and 39 Stewart Island birds survived an extreme bottleneck in 1995 and reproduced.

Kākāpō are flightless, nocturnal with a probable well-developed sense of smell and with a pronounced sexual dimorphism in body size.

Contrary to other parrots, kākāpō have a polygynous lek breeding system. They only reproduce every 2–5 years, during years of heavy rimu (*Dacrydium cupressinum*) fruiting. Females reach sexual maturity between 5 and 18 years and males between 11 and 23 years.

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Kākāpō are believed to be exceedingly long-lived, with one male, Richard Henry, having lived up to ~80 years old.

TAXONOMY AND CLASSIFICATION:

KINGDOM: Animalia

PHYLUM: Chordata

CLASS: Aves

ORDER: Psittaciformes

FAMILY: Psittacidae

GENUS: *Strigops*

Figure 2. (A) Demographic history for the mainland and Stewart Island population inferred using the Pairwise Sequentially Markovian Coalescent (PSMC). Broken curve depicts the divergence time between populations. (B) Picture of a kākāpō on Whenua Hou. Photo credit: Jake Osborne. Abbreviation: kya, thousand years ago.

Literature

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