Science and sanctuaries: spotlight on genetics

Helen Taylor

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Conservation geneticist?


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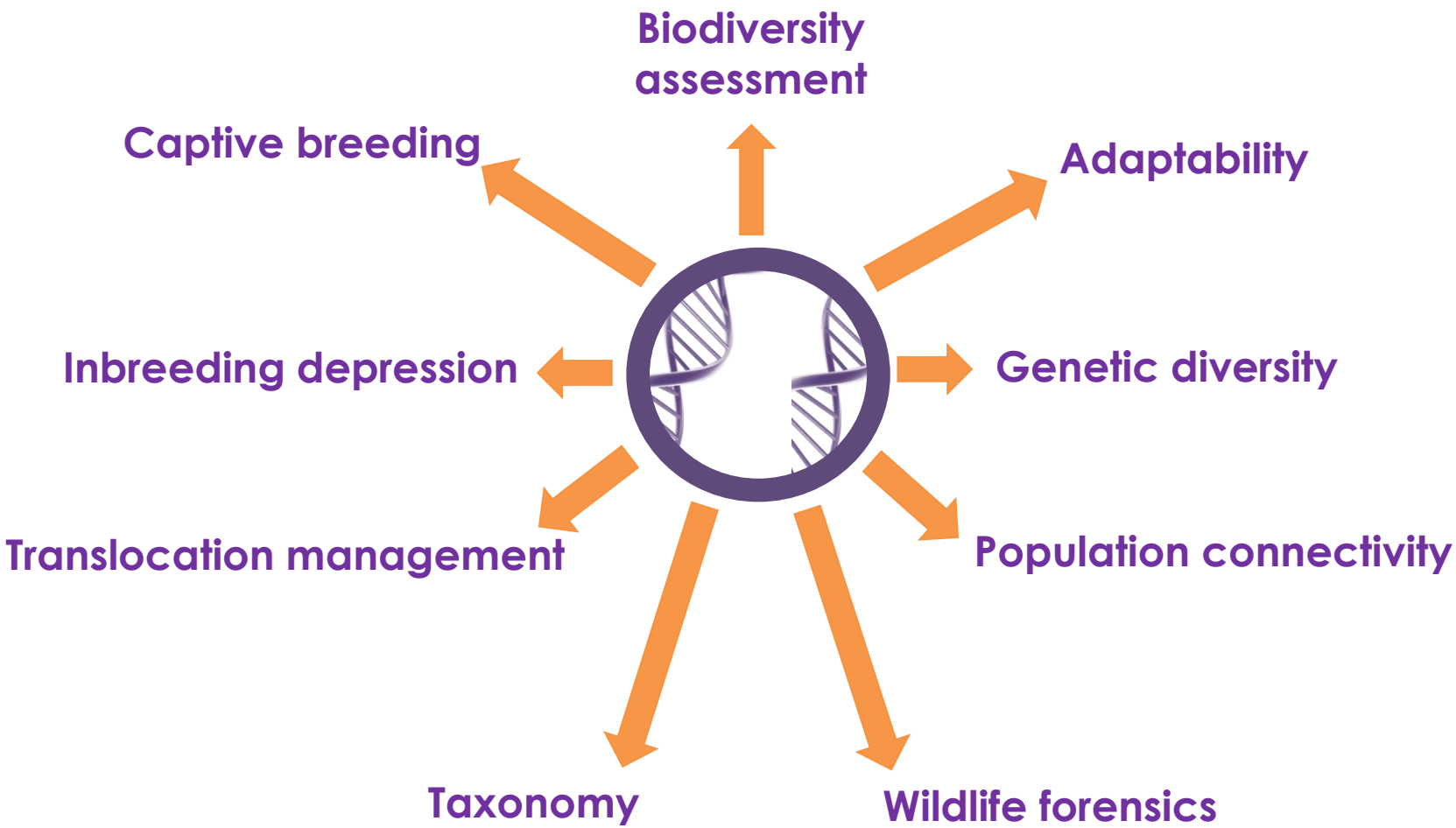
Genetics for conservation



The conservation genetics gap

Diversity

Where's the Conservation in Conservation Genetics?

CRISTIANO VERNESI,* MICHAEL W. BRUFORD,† GIORGIO BERTORELLE,‡ ELENA PECCI
ANNAPAOLA RIZZOLI,* AND HEIDI C. HAUFFE*§

Conserv Genet (2010) 11:349–354
DOI 10.1007/s10592-009-0037-4

COMMENTARY

Genetic diversity is overlooked in international conservation policy implementation

Linda Laikre

Conservation Genet Resour
DOI 10.1007/s12686-013-9859-y

APPLICATION ESSAYS

Bringing genetic diversity to the forefront of conservation policy and management

Sean M. Hoban · Heidi C. Hauffe · Sílvia Pérez-Espona · Jan W. Arntzen · Giorgio Bertorelle · Josef Bryja · Katie Frith · Oscar E. Gaggiotti · Peter Galbusera · José A. Godoy · A. Rus Hoelzel · Richard A. Nichols · Craig R. Primmer · Isa-Rita Russo · Gernot Segelbacher · Hans R. Siegismund · Marjatta Sihvonen · Cristiano Vernesi · Carles Vilà · Michael W. Bruford

American Genetic Association

Journal of Heredity, 2015, 423–427
doi:10.1093/jhered/esv052
Letter to the Editor
OXFORD

Letter to the Editor

Finding the "Conservation" in Conservation Genetics—Progress in Latin America

Kathryn M. Rodríguez-Clark, María A. Oliveira-Miranda, Marisol Aguilera Meneses, Ángela Martino, Marco A. Méndez, Cristina Miyaki, María G. Montiel-Villalobos

Evolutionary Applications
Open Access
Evolutionary Applications ISSN 1752-4571

PERSPECTIVE

The conservation genetics juggling act: integrating genetics and ecology, science and policy

Susan M. Haig,[1] Mark. P. Miller,[1] Renee Bellinger,[2] Hope M. Draheim,[3] Dacey M. Mercer[4] and Thomas D. Mullins[1]

1 U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, OR, USA
2 Department of Biology, Tropical Conservation Biology and Environmental Science, University of Hawaii, Hilo, HI, USA
3 Pacific States Marine Fisheries Commission, Eagle Fish Genetics Laboratory, Eagle, ID, USA
4 Hatfield Marine Science Center, Oregon State University, Newport, OR, USA

Conserv Genet (2015) 16:503–512
DOI 10.1007/s10592-014-0684-y

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REVIEW ARTICLE

How to make landscape genetics beneficial for conservation management?

Daniela Keller · Rolf Holderegger · Maarten J. van Strien · Janine Bolliger

What causes the gap?

Inbreeding and Endangered Species Management: Is New Zealand Out of Step with the Rest of the World?

IAN G. JAMIESON,*‡ GRAHAM P. WALLIS,* AND JAMES V. BRISKIE†

*Department of Zoology, University of Otago, P.O. Pox 56, Dunedin, New Zealand
†School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand

An inside perspective

Global Ecology and Conservation 10 (2017) 231–242

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: www.elsevier.com/locate/gecco

Original research article

Bridging the conservation genetics gap by identifying barriers to implementation for conservation practitioners

Helen R. Taylor [a,*,1], Nicolas Dussex [a,1,2], Yolanda van Heezik [b]

[a] Department of Anatomy, University of Otago, Great King Street, Dunedin, 9016, New Zealand
[b] Department of Zoology, University of Otago, Great King Street, Dunedin, 9016, New Zealand

What causes the gap?

Department of Conservation
Te Papa Atawhai

- Positive perception of genetics for conservation
- Want to use genetic tools more
- Lack money and expertise
- Don’t know who to talk to

Building bridges

Improve Communication

- Genetics "surgery"
- Speed dating
- Sabbaticals/exchanges

Increase expertise among practitioners

- 1 day workshops
- YouTube channel
- Online self-taught courses

Create conservation genetics hub

- Point of contact
- Large-scale funding opportunities

Improved understanding and integration of genetics into conservation management

From Taylor et al. 2017 GECCO 10 231-242


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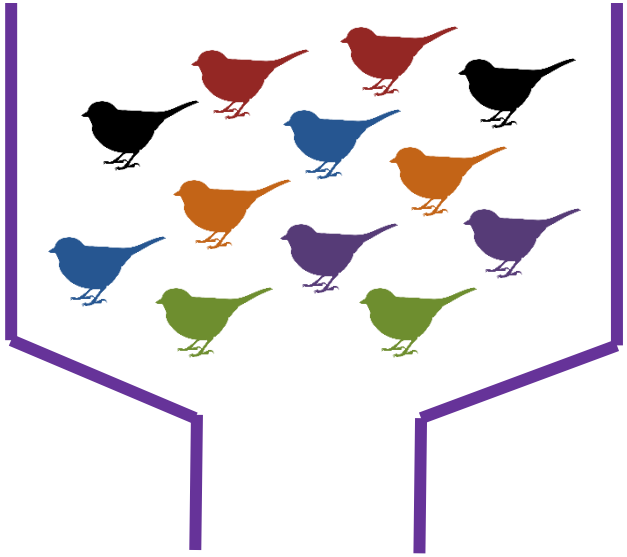
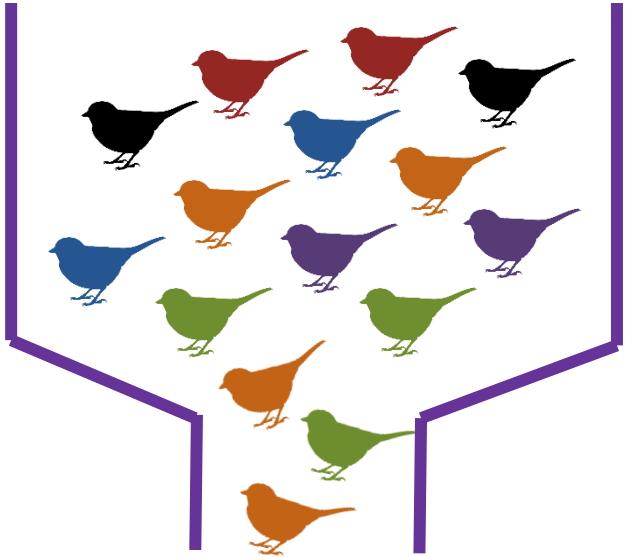
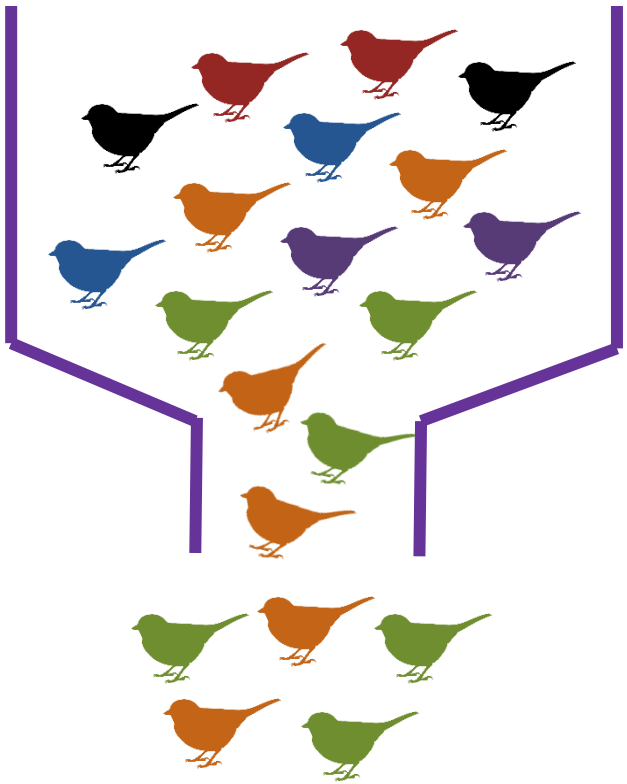
Population bottlenecks



Population bottlenecks



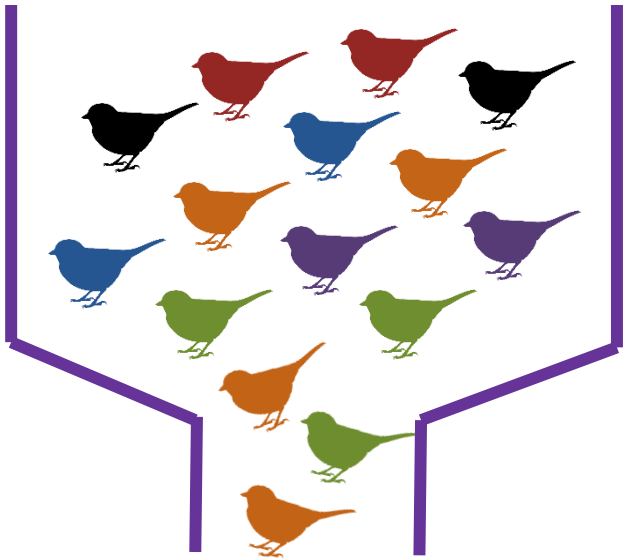
Population bottlenecks

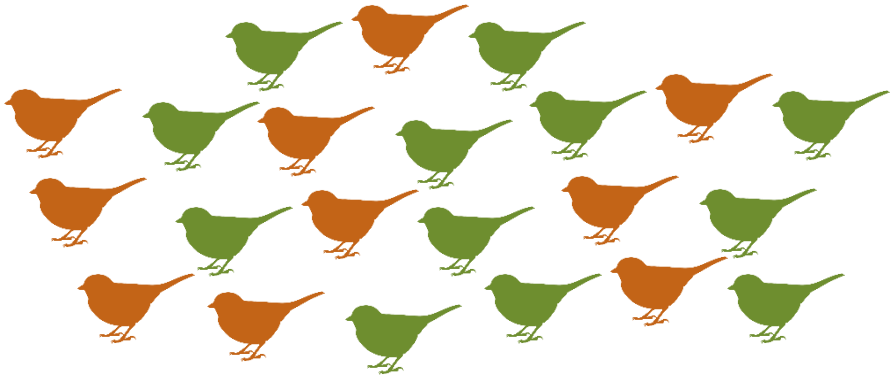


- Loss of heterozygosity
- Loss of allelic diversity

- Prone to inbreeding

Population bottlenecks

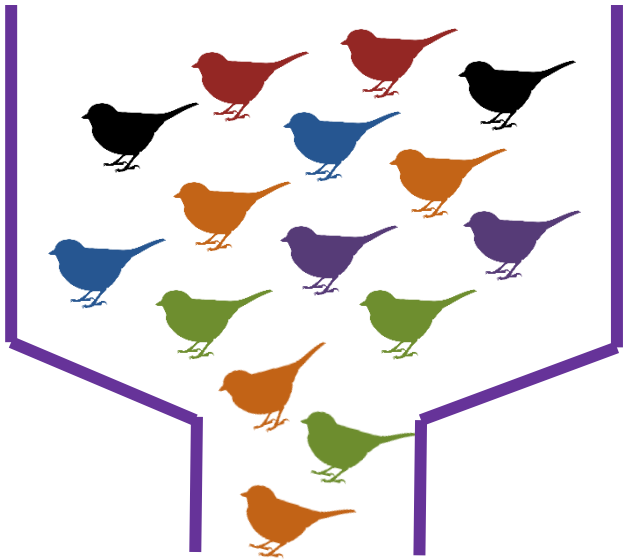


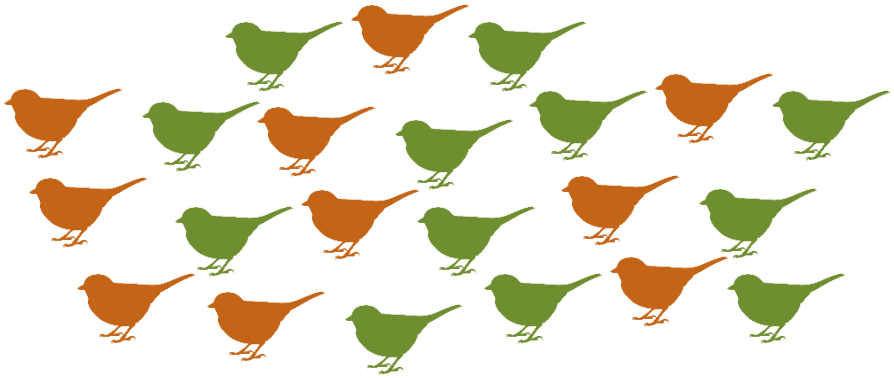


- Loss of heterozygosity
- Loss of allelic diversity

- Prone to inbreeding

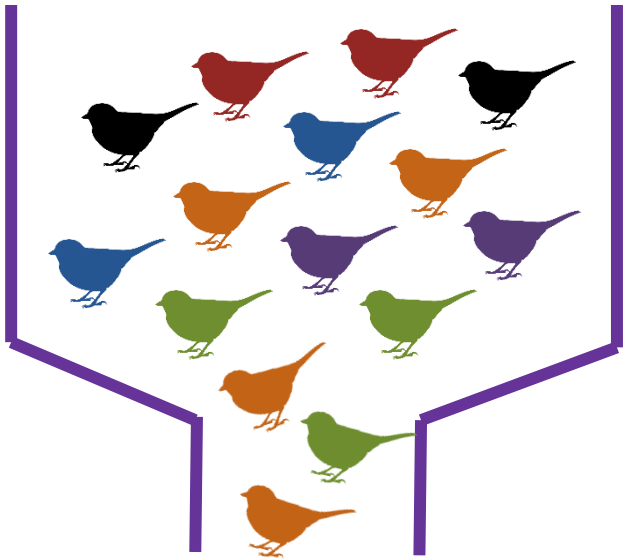
Population bottlenecks

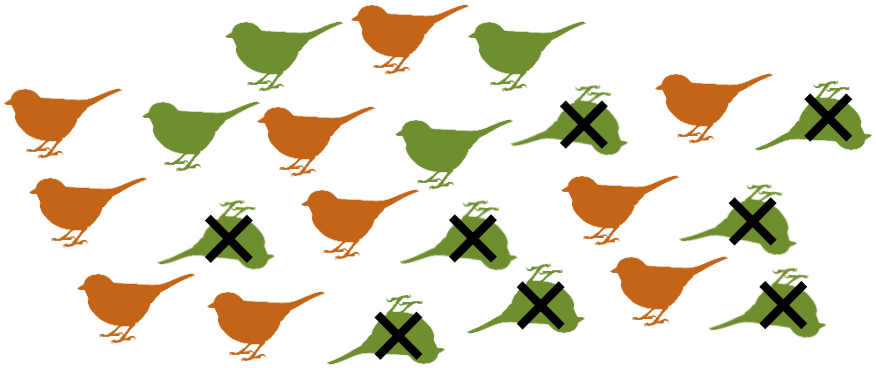




- Loss of heterozygosity
- Loss of allelic diversity
- Prone to inbreeding
- Inbreeding depression

Population bottlenecks



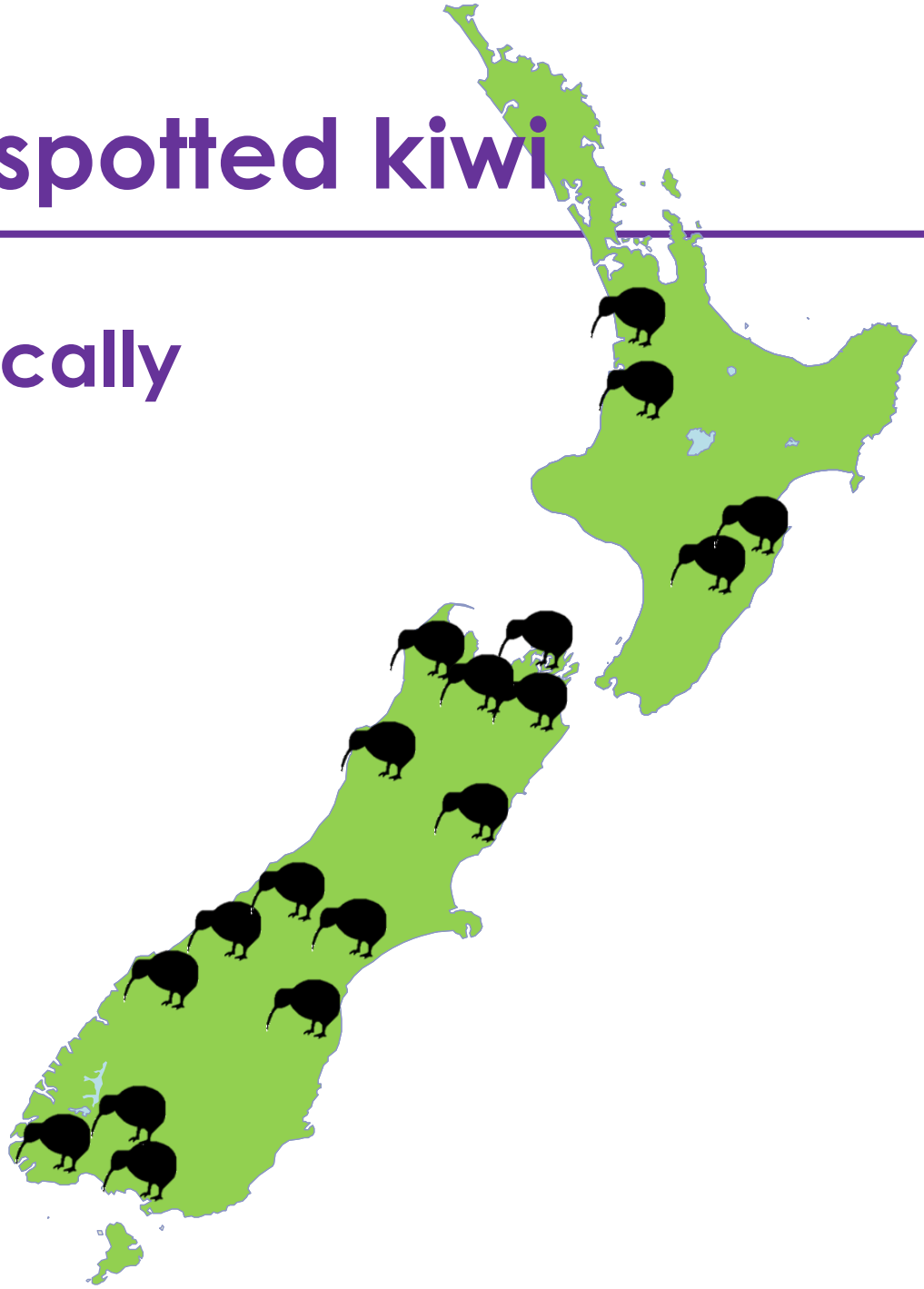


- Loss of heterozygosity
- Loss of allelic diversity
- Prone to inbreeding
- Inbreeding depression
- Increased extinction risk

Case study: Little spotted kiwi

Little spotted kiwi

Historically

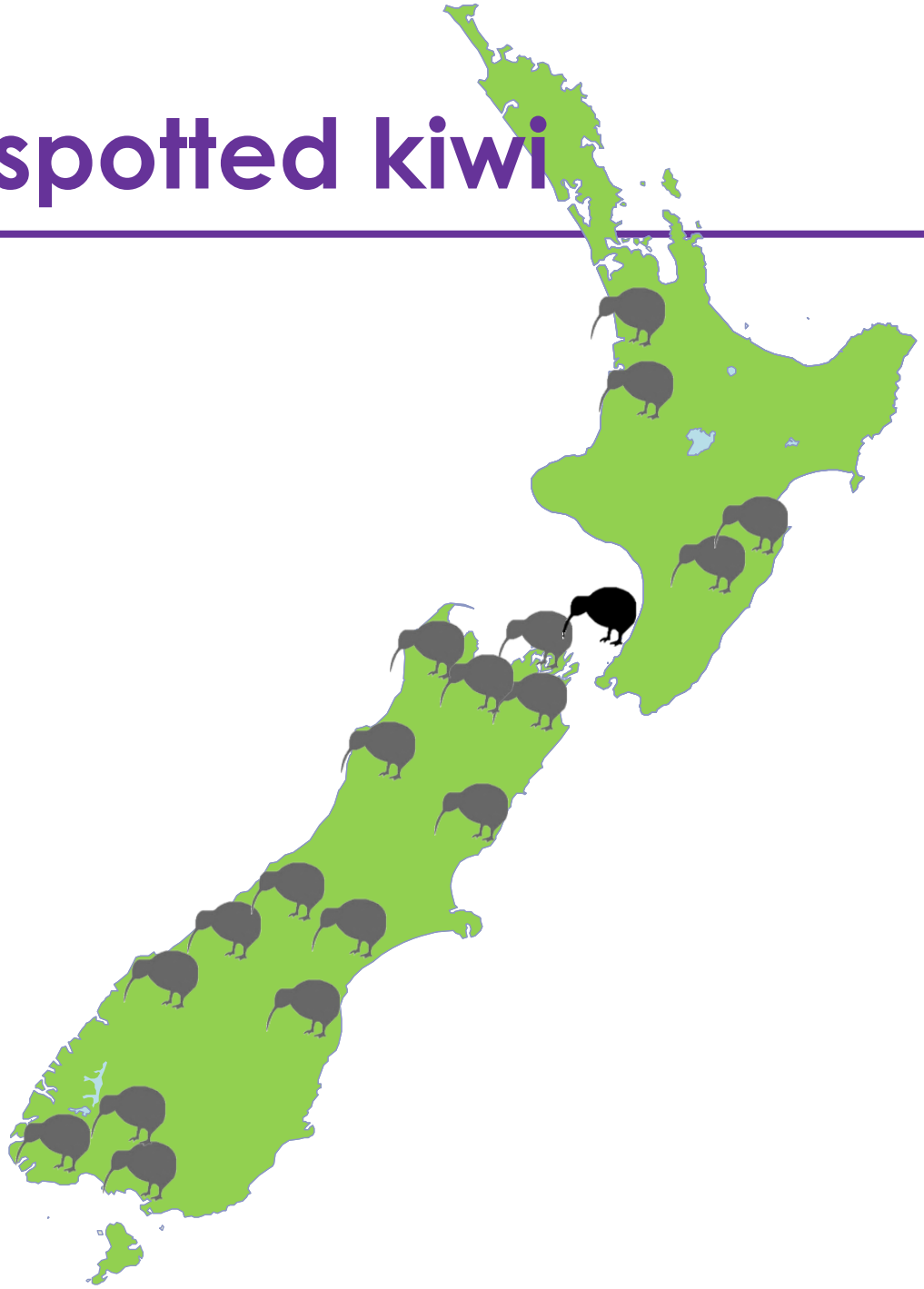


Little spotted kiwi

1912

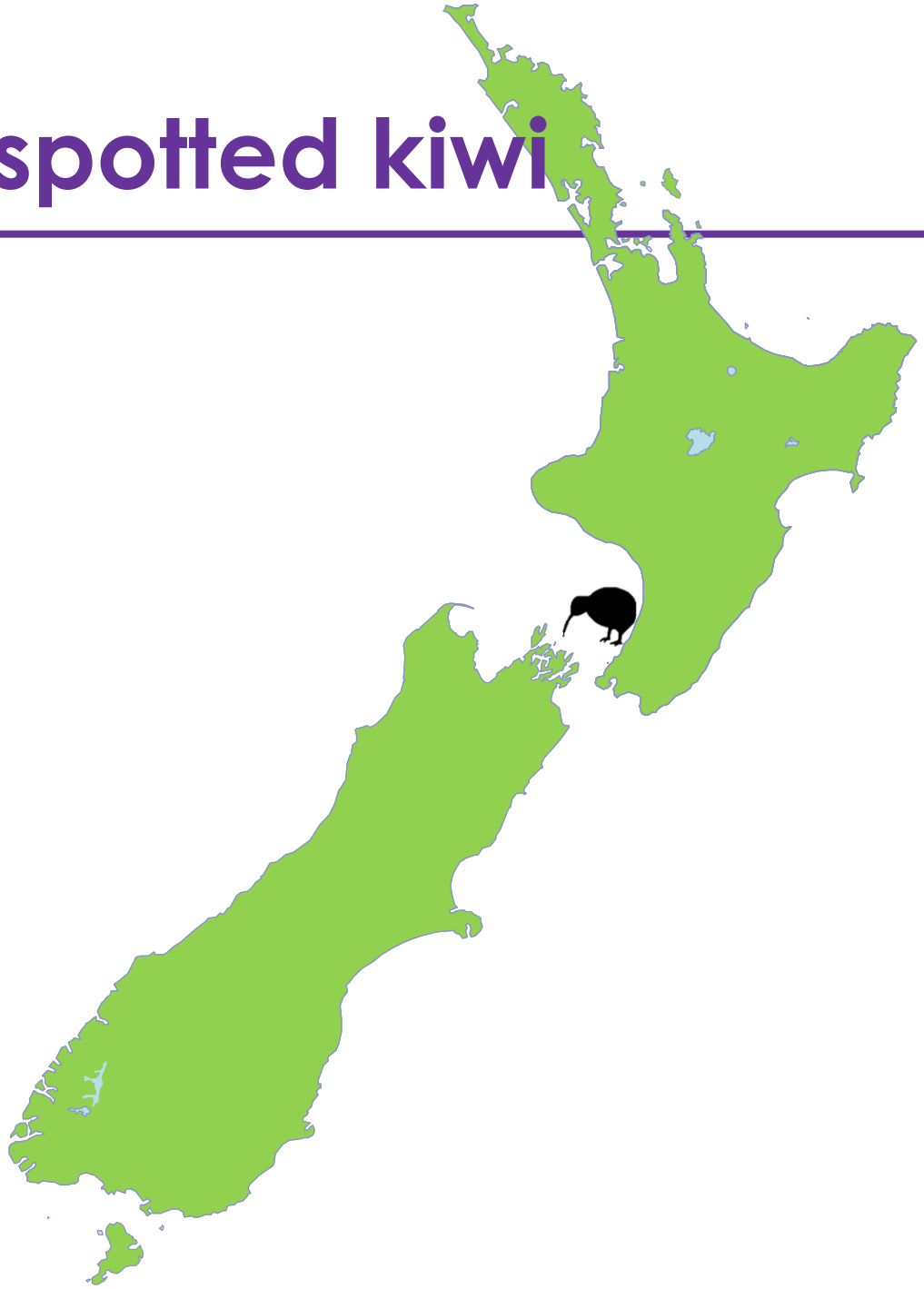
Little spotted kiwi

1912



Little spotted kiwi

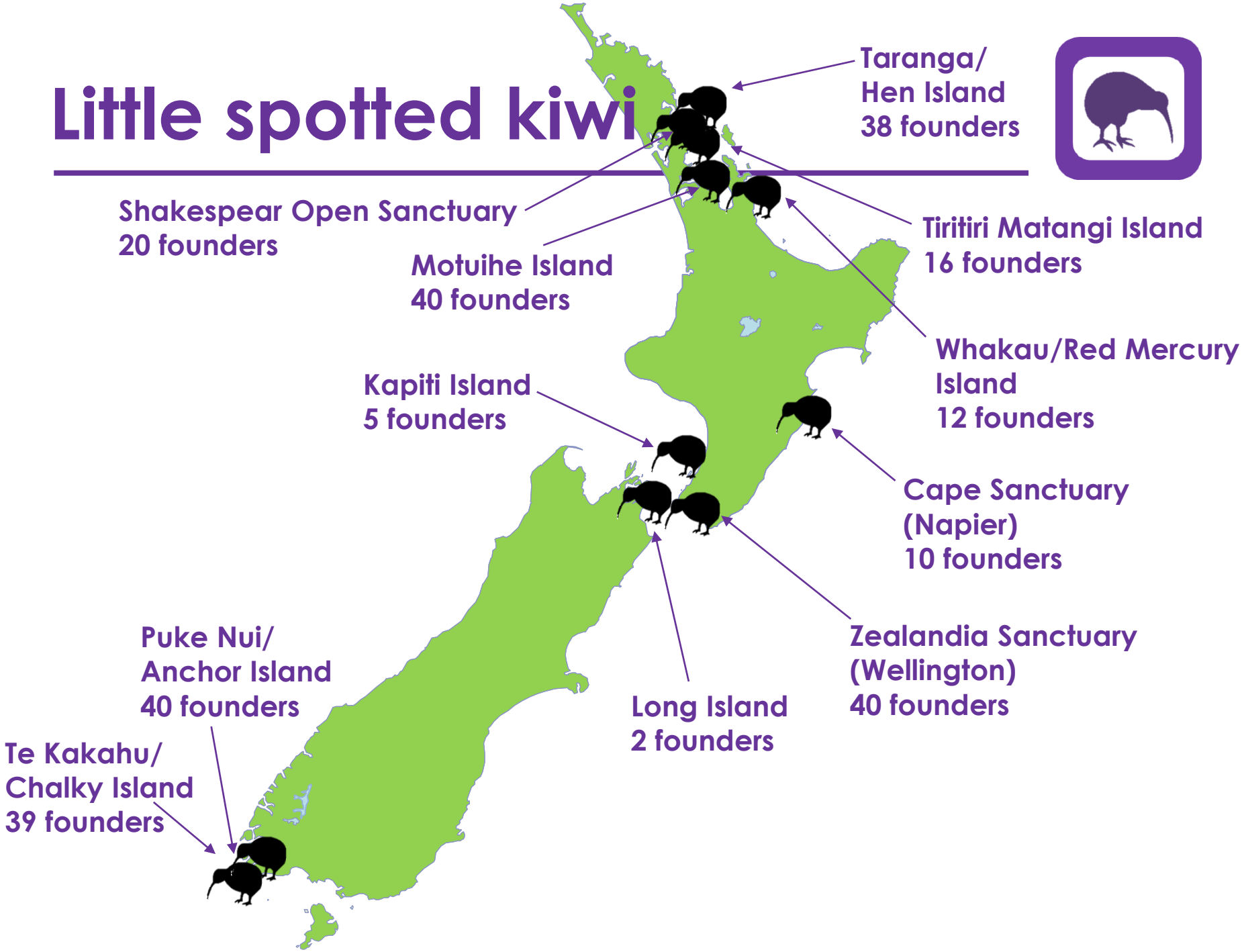
1980s



Little spotted kiwi

1980-Present

Little spotted kiwi



Little spotted kiwi

- Positive annual population growth
- ~~Vulnerable~~ -> Near Threatened
- A conservation success!

But…

- Extremely low genetic diversity
- Varied risk of inbreeding

Little spotted kiwi - data

PROCEEDINGS OF THE ROYAL SOCIETY B

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Research

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Cite this article: Ramstad KM, Colbourne RM, Robertson HA, Allendorf FW, Daugherty CH.

Genetic consequences of a century of protection: serial founder events and survival of the little spotted kiwi (*Apteryx owenii*)

Kristina M. Ramstad[1], Rogan M. Colbourne[2], Hugh A. Robertson[2], Fred W. Allendorf[1,3] and Charles H. Daugherty[1]

[1]Allan Wilson Centre for Molecular Ecology and Evolution, School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington, New Zealand
[2]Department of Conservation, Research and Development Group, PO Box 10-420, Wellington, New Zealand
[3]Division of Biological Sciences, University of Montana, Missoula, MT 59812, USA

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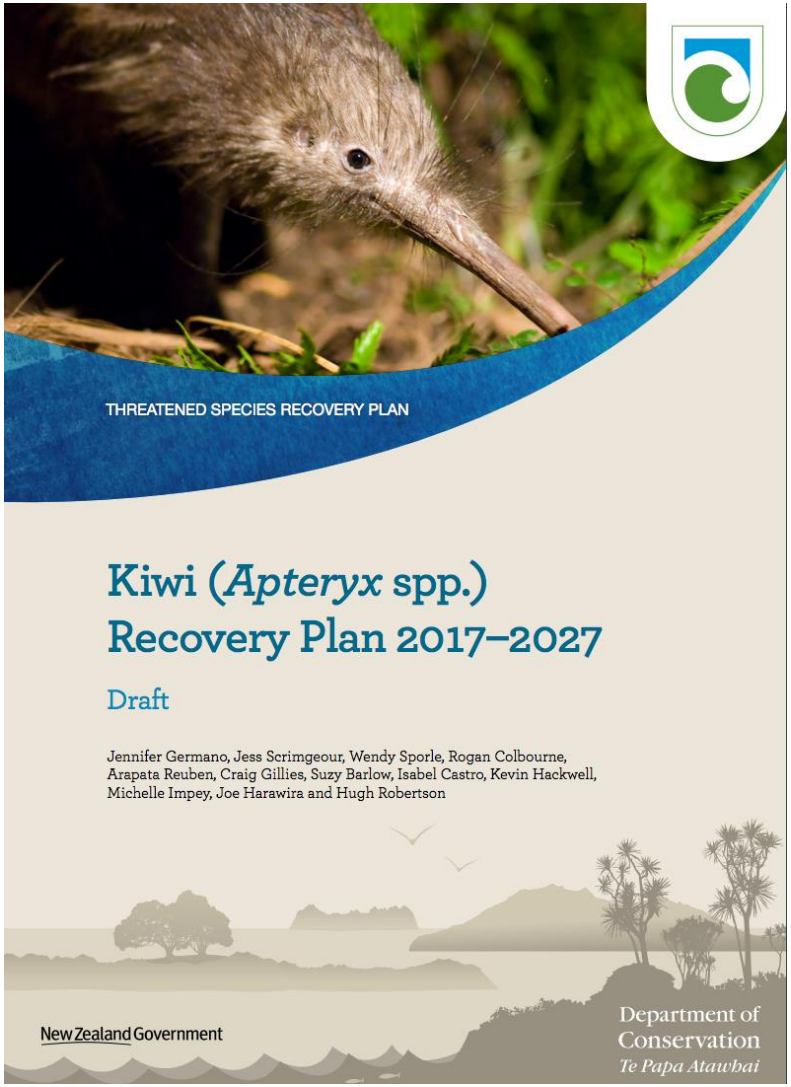
Cryptic inbreeding depression in a growing population of a long-lived species

HELEN R. TAYLOR,* ROGAN M. COLBOURNE,† HUGH A. ROBERTSON,† NICOLA J. NELSON,* FRED W. ALLENDORF‡ and KRISTINA M. RAMSTAD§

**School of Biological Sciences, Victoria University of Wellington, Kelburn Parade, Wellington, New Zealand, †Department of Conservation, Manners Street, Wellington, New Zealand, ‡Montana Conservation Genetics Lab, University of Montana, Missoula, MT, USA, §Department of Biology & Geology, University of South Carolina Aiken, 471 University Parkway, Aiken, SC, USA*

Little spotted kiwi - action



Issue 3.6: Little spotted kiwi have very low genetic diversity due to extreme bottlenecking.

Objective 3.1: To maintain the existing genetic diversity of all kiwi, especially little spotted kiwi, rowi and Haast tokoeka.

Action 3.8: Manage little spotted kiwi as a metapopulation to ensure the best chance of survival. Priority: Essential.

Other examples

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Proc. R. Soc. B
doi:10.1098/rspb.2010.1144
Published online

Sensitive males: inbreeding depression in an endangered bird

Patricia Brekke[1,2,*], Peter M. Bennett[3], Jinliang Wang[1], Nathalie Pettorelli[1] and John G. Ewen[1]

Other examples

An available tool

MOLECULAR ECOLOGY
RESOURCES
Molecular Ecology Resources (2012) **12**, 1161–1167 doi: 10.1111/j.1755-0998.2012.03176.x

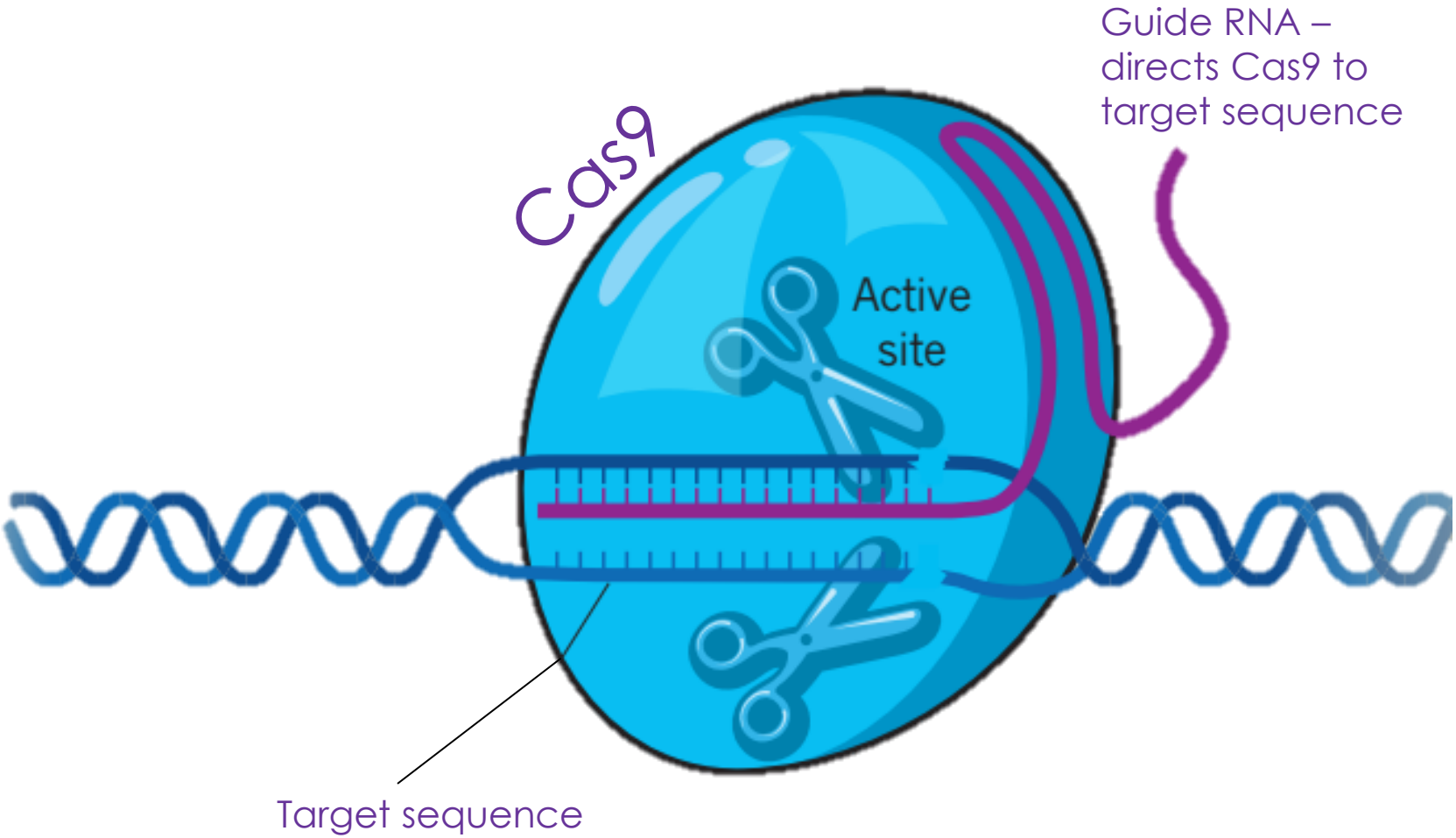
AlleleRetain: a program to assess management options for conserving allelic diversity in small, isolated populations

E. L. WEISER,* C. E. GRUEBER and I. G. JAMIESON
Department of Zoology, Allan Wilson Centre for Molecular Ecology and Evolution, University of Otago, PO Box 56, Dunedin, 9054, New Zealand

Planning translocations and managing sanctuary populations

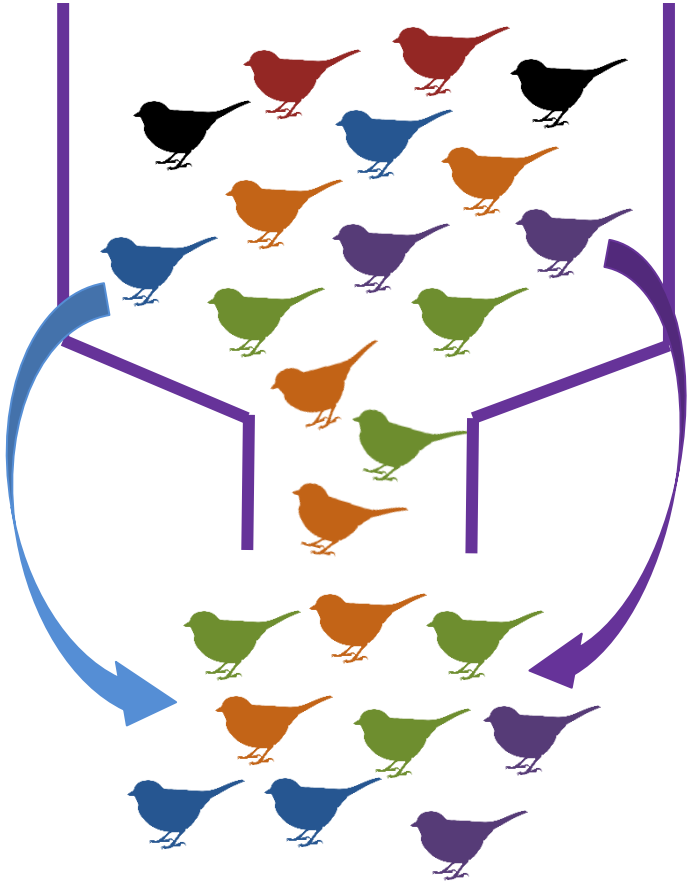
- How many founders?
- Where should founders be sourced from?
- Will we need top up translocations?

Gene-editing: a new tool



Modified from Nature 2016 531: 166-159

Gene-editing: uses



Gene drives
Gene editing

©Dave Hallett

Gene-editing: attitudes

nature ecology & evolution

PUBLISHED: 22 JUNE 2017 | VOLUME: 1 | ARTICLE NUMBER: 0198

correspondence

De-extinction needs consultation

Helen R. Taylor, Nicolas Dussex & Yolanda van Heezik


GIZMODO AU

New Zealand Could Use Gene Editing To Kill Off Its Cutest Predator

Kristen V. Brown
Apr 7, 2017, 4:00pm · Filed to: conservation

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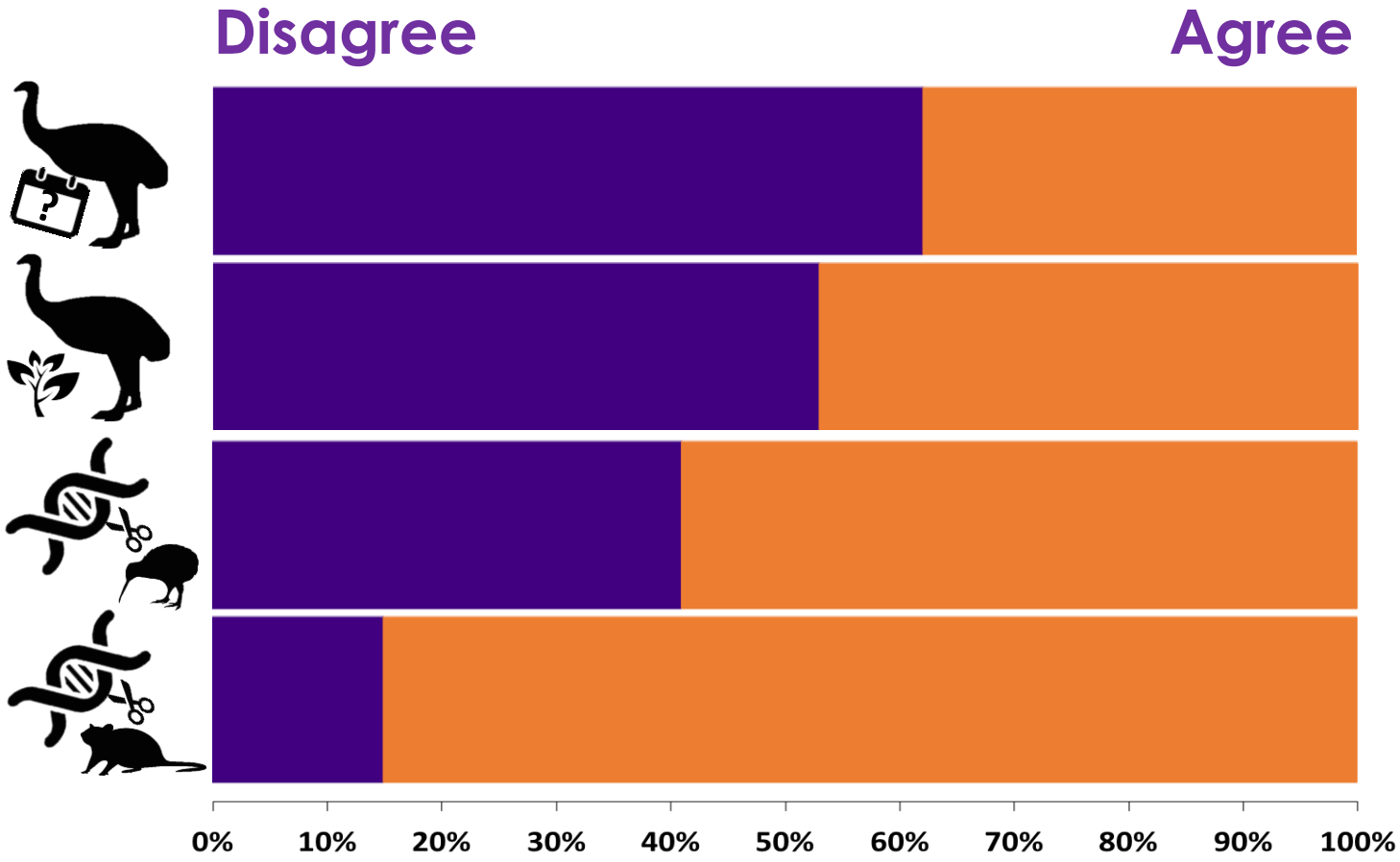
Gene-editing: attitudes



From Taylor et al. 2017 Nature Eco. Evo. 1: 0198

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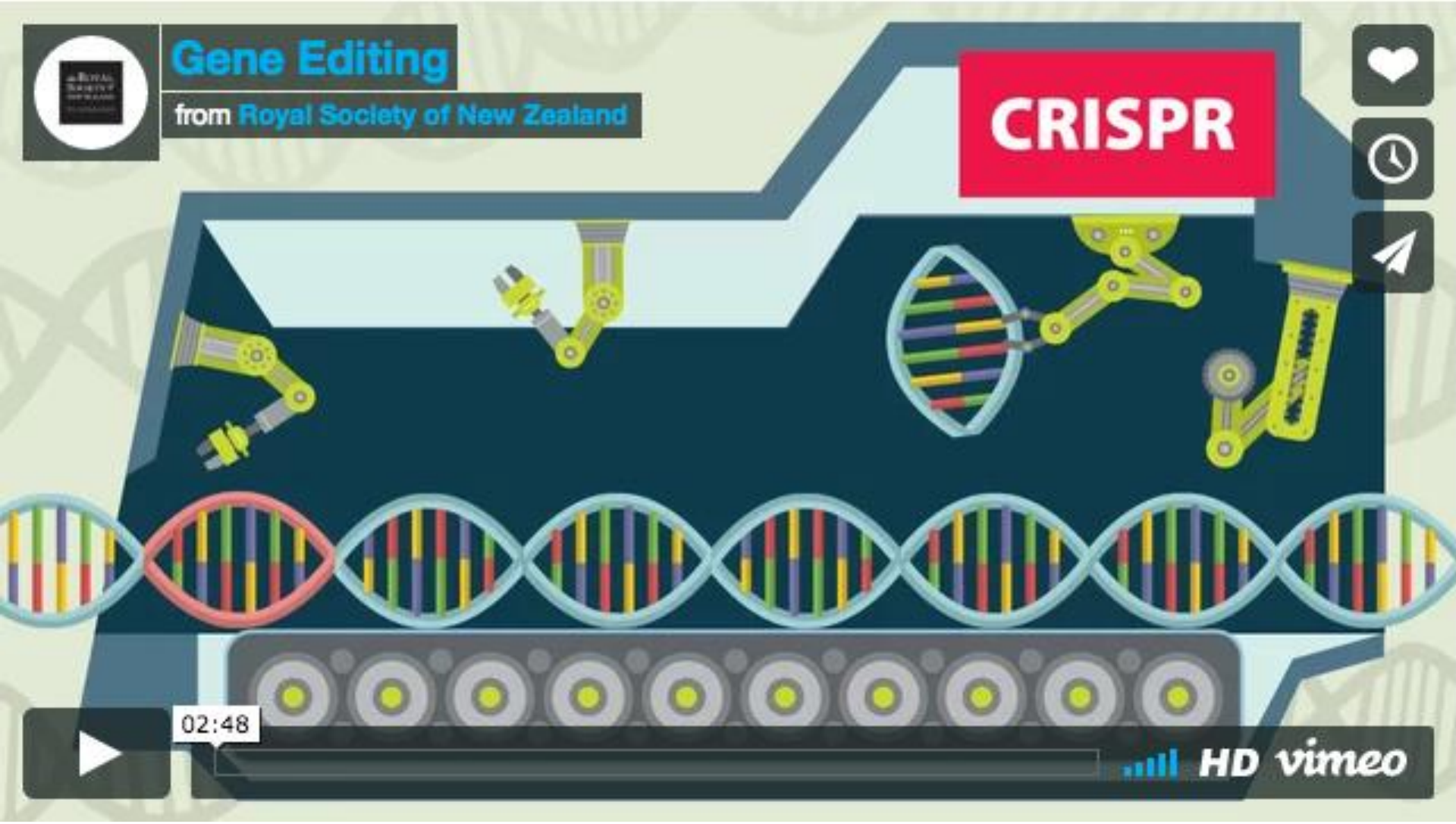
Gene Editing
from Royal Society of New Zealand
CRISPR
02:48
HD vimeo

SCIENCE / ENVIRONMENT

We need to talk about gene drives and gene editing

From Our Changing World, 9:06 pm on 27 April 2017

Alison Ballance, Senior Producer
@alisonballance alison.ballance@radionz.co.nz

Imagine a New Zealand without introduced wasps, rats and possums, and a world where diseases such as malaria and heritable blindness have been eliminated.

This is a future that recent genetic breakthroughs could soon make possible – and scientists say we should be having a national conversation now about how willing we are to go there.

This brave new world will be possible through gene editing and gene drives – so what are they, how do they work, and what do they make possible?

Questions?

@HelenTaylorCG

http://helentaylorscience.weebly.com/

http://sciblogs.co.nz/wild-science/