Native and invasive: the changing fate of the spur-winged plover in New Zealand

Photo: Ralph Green 2011

D. L. Fraser, M Galbraith, N. Adams, D. Blanchon

Biology: *Vanellus miles novaehollandia*

Characteristic morphology

- Characteristic plumage + wattle
- Yellow wing ‘spur’
- Noisy, bold demeanour

(Photo: JJ Harrison, 2009)

(Photo: ozplasmic, 2008)

Reproduction

- NZ: mid June–late November
- Highly reproductive
- Can produce several clutches/breeding season
- Aggressively defend eggs & chicks

(Photo: D. Annandale, 2002)

(Photo: Denis Wilson, 2008)

(Photo: Benjamint444, 2010)

Habitat

- Open wetland & marshland
- Stony or sandy edges of rivers, beaches or estuaries
- Human developed areas: agricultural land, sports grounds, golf courses and air fields

(Photo: D. Fraser, 2014)

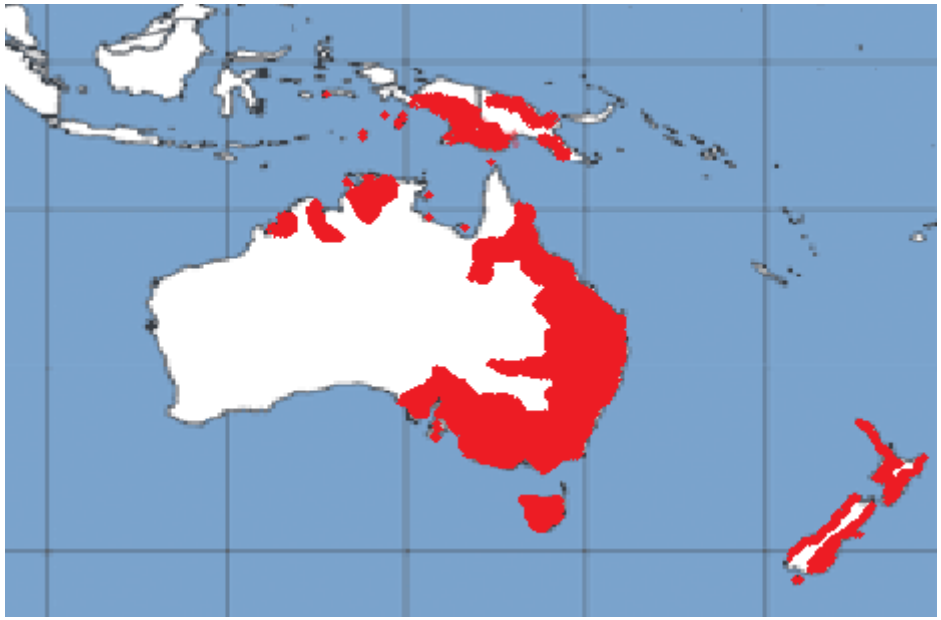
(Photo: Te Ara Encyclopaedia of New Zealand, 2013)

Vanellus miles range

Range:

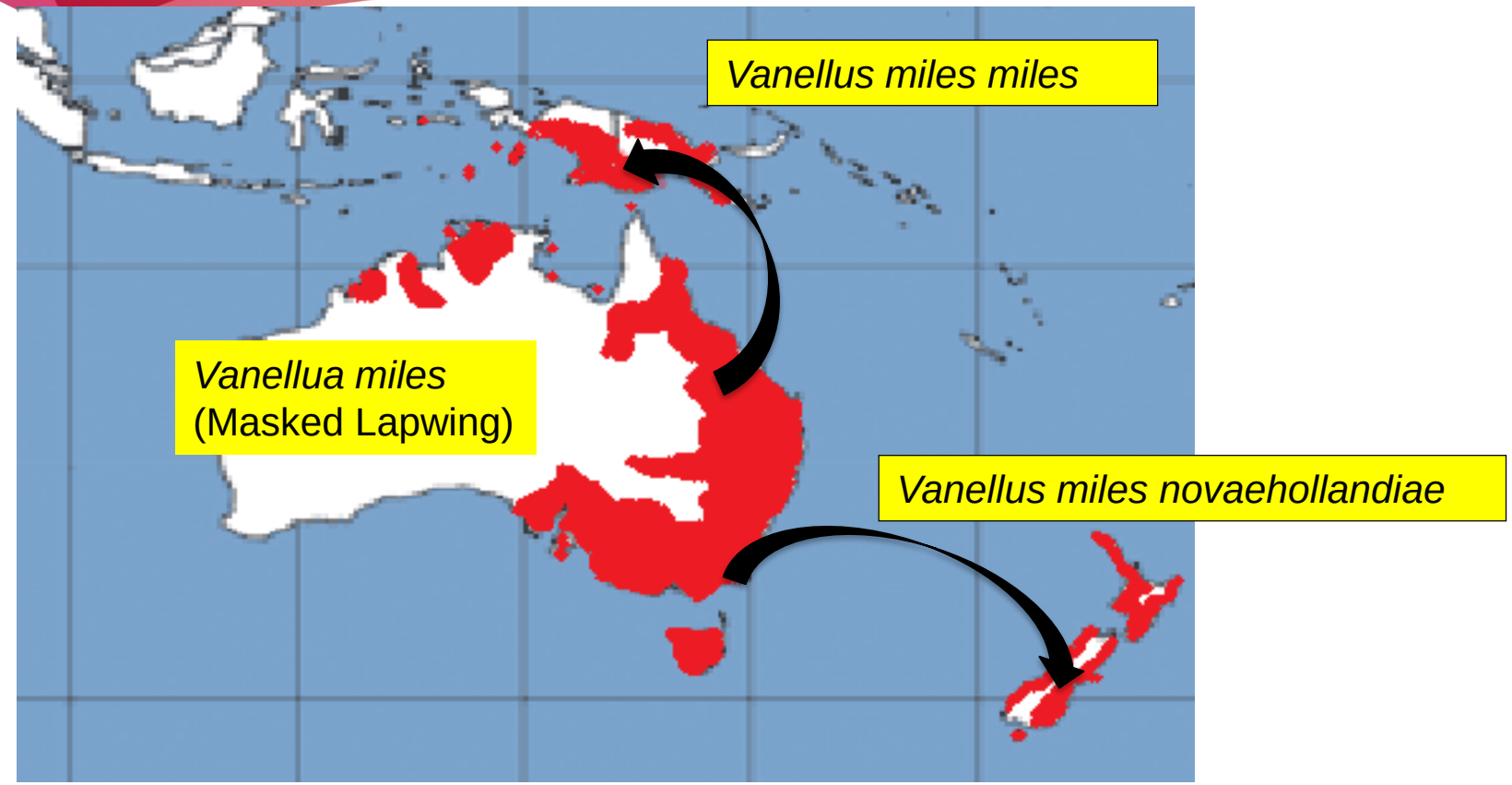
- Native: Australia, Indonesia, New Zealand, Papua New Guinea, Timor-Leste
- Introduced: Singapore
- Now breeding: Stewart, the Chatham and Pitt Islands
- Vagrant: Norfolk, Kermadec, Snares, Antipodes and Campbell Islands, Christmas Island, Fiji and New Caledonia

(RUCN Red List, 2012)



(Map: adapted from TEFL, 2009 & Birdlife International & Natureserve, 2012)

Sub-species distribution



New Zealand: Spur-winged plover (*Vanellus miles novaehollandiae)*

(Map: adapted from TEFL, 2009 & Birdlife International & Natureserve, 2012)

Sub- species differences

Vanellus miles miles
(Masked lapwing, Northern sub-species, Aus)

Aviceda, 2008, www.flickr.com

Vanellus miles novaehollandiae
(Masked lapwing, Southern sub-species, Aus; spur-winged plover, NZ)

(Photo: JJ Harrison, 2009)

Arrival in New Zealand

- Self-introduced
- First recorded in 1886
- First breeding pair 1932

Technically classed as 'Native' – arrived before establishment of the Wildlife Act 1953

(Plover photo: Benjamint444, 2010)

Protection status prior 2010

Prior to 2010:

As a self-introduced 'Native' not listed on any schedule of NZ Wildlife Act 1953

⇒***Provided full protection***

(Photo: JJ Harrison, 2009)

Impacts in New Zealand

(Photo: Danny Masson)

Avian airstrike risk:

- 1999-2004: Air NZ 37% of actual air strike incidents due to SWP

Agriculture/horticulture:

- Limited info, crops such as cauliflower, broccoli & lettuce affected (DOC, 2006)
- Aggressive defence behaviour towards livestock

(Photo: D Fraser, 2009)

Public Nuisance:

- School playgrounds and playing fields

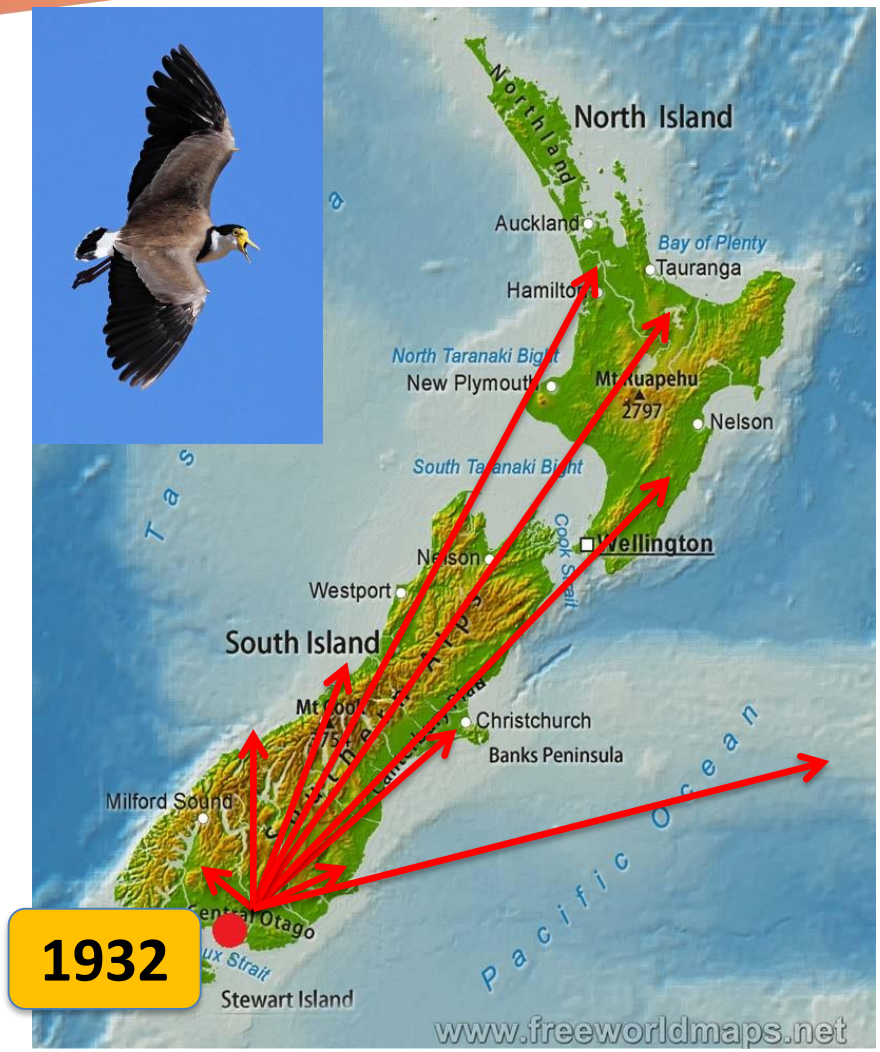
Native birds:

- Some evidence; NZ dotterel

(Photo: D Fraser, 2014)

Spread since introduction

- Over last 70-80 years the SWP has spread across whole of NZ.
- First recorded in North Island in 1974 and Firth of Thames by 1977.
- How does spread compare with an invasive species?

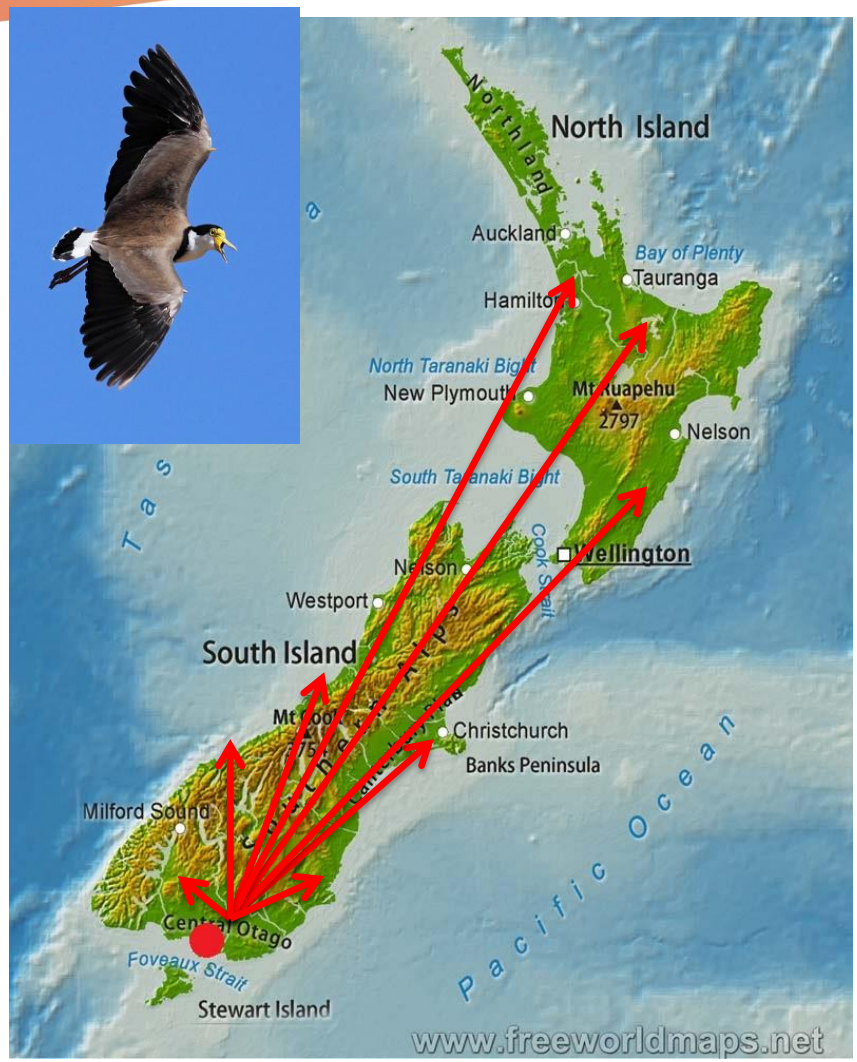


(Plover photo: Benjamint444, 2010)

Aim of this study

Study Aims:

- Describe the pattern of spread across new Zealand
- Identify possible factors associated with the spread
- Relate this to the spread of invasive species

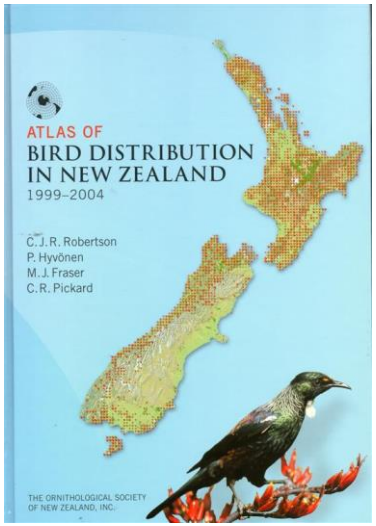


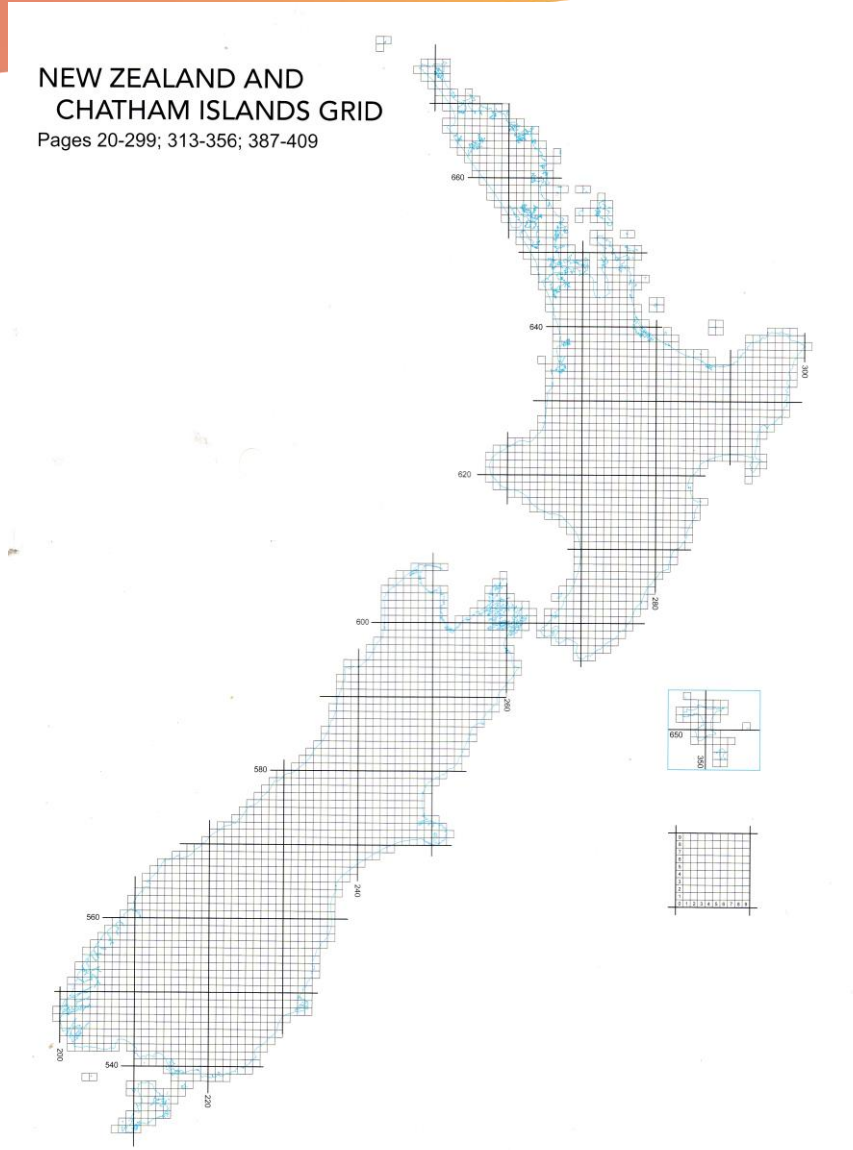
(Plover photo: Benjamint444, 2010)

Assessment of spread

Method:

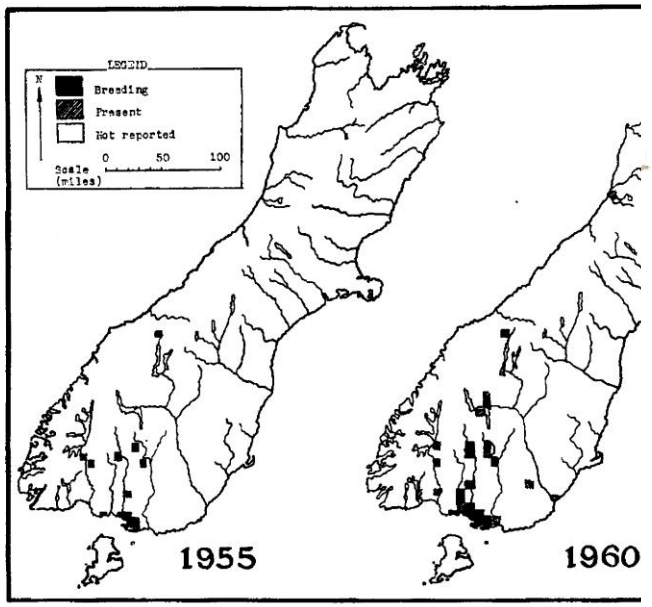
- Used OSNZ member reports from 1930-2004.
- Presence or absence of birds on country wide grid

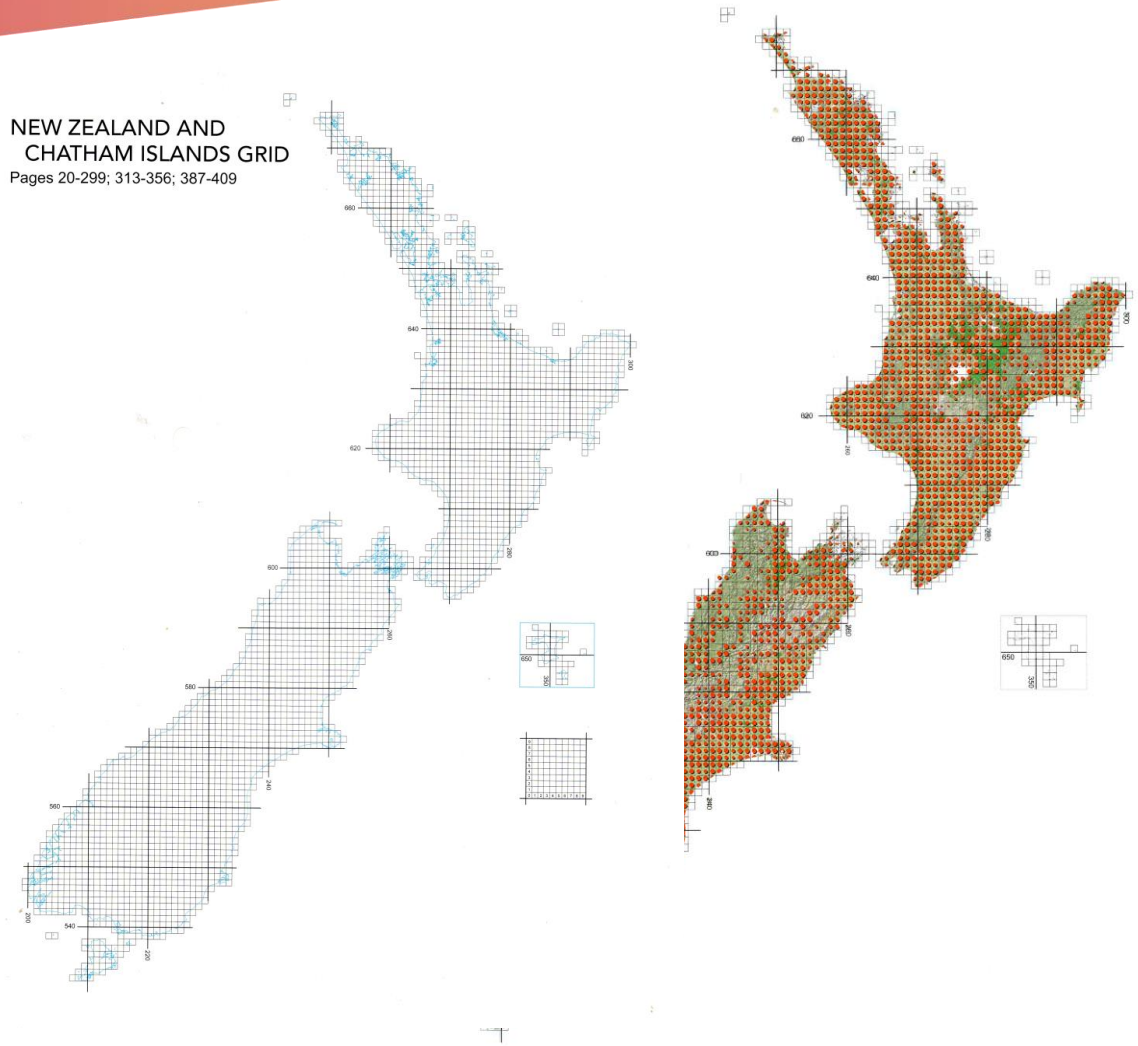




Presence/absence

- Barlow, 1972
- Robertson et al. 2007





Data

- Increasing presence across South Island
- Introduction to North Island
- Increasing presence across North Island
- Increased spread across the whole of the country

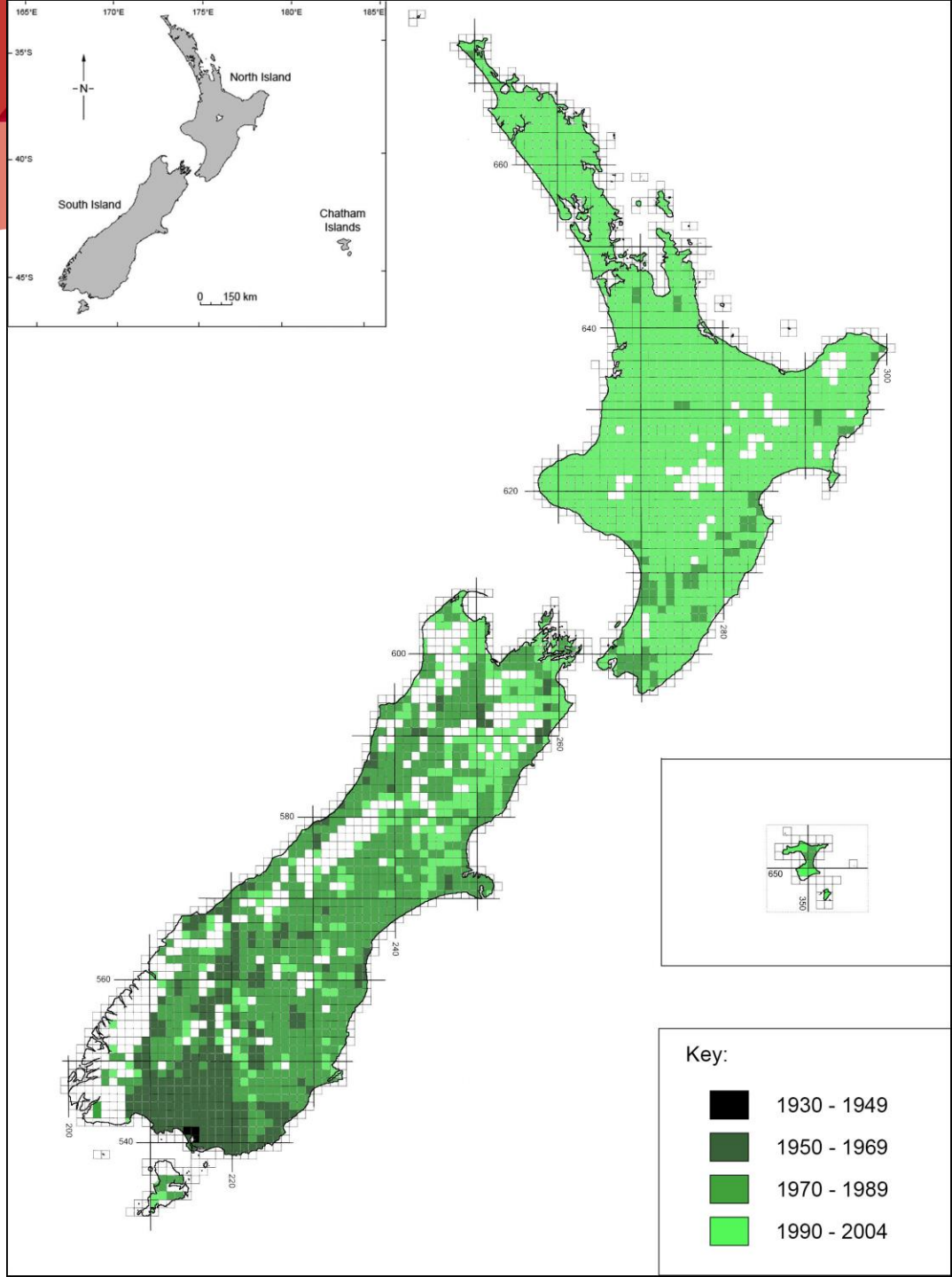
Year Period	South Island	North Island	All NZ
1999-2004	1191	1313	2504
1995-1999	-	-	-
1990-1994	-	-	-
1985-1989	-	-	-
1980-1984	-	-	-
1975-1979	699	47	746
1969-1974	452	9	461
1965-1969	131	-	131
1960-1964	32	-	32
1955-1959	14	-	14
1950-1954	-	-	-
1945-1949	-	-	-
1940-1944	-	-	-
1935-1939	-	-	-
1930-1934	1	-	1

Map of spread

Data collated into 4 time periods:

- 1930-1949
- 1950-1969
- 1970-1989
- 1990-2004

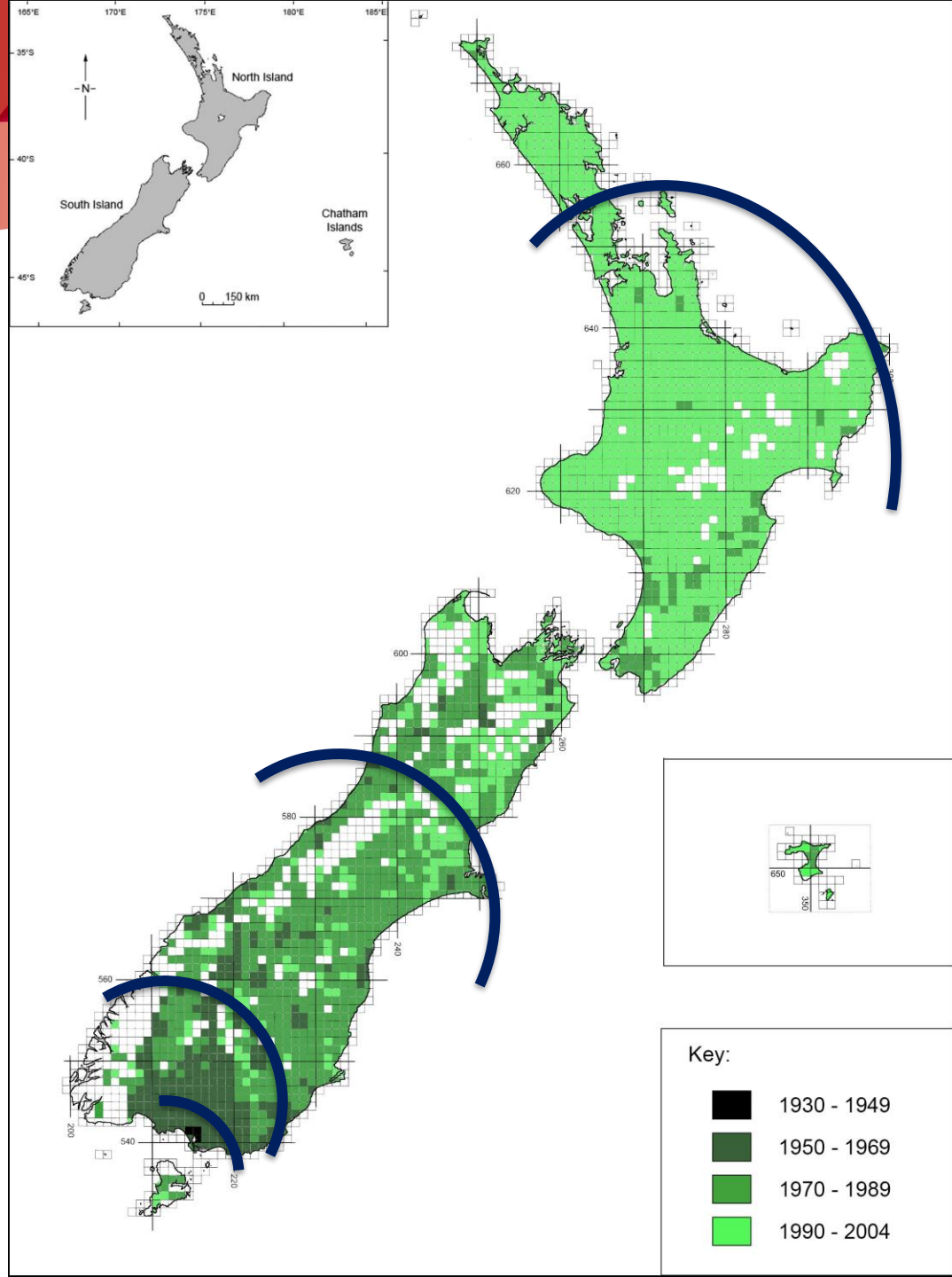
Create distribution map for 1930-2004.



Pattern of Range Expansion

Pattern of spread is consistent with:

- Regular concentric ring range expansion pattern similar to invasive species (Elton, 1958)

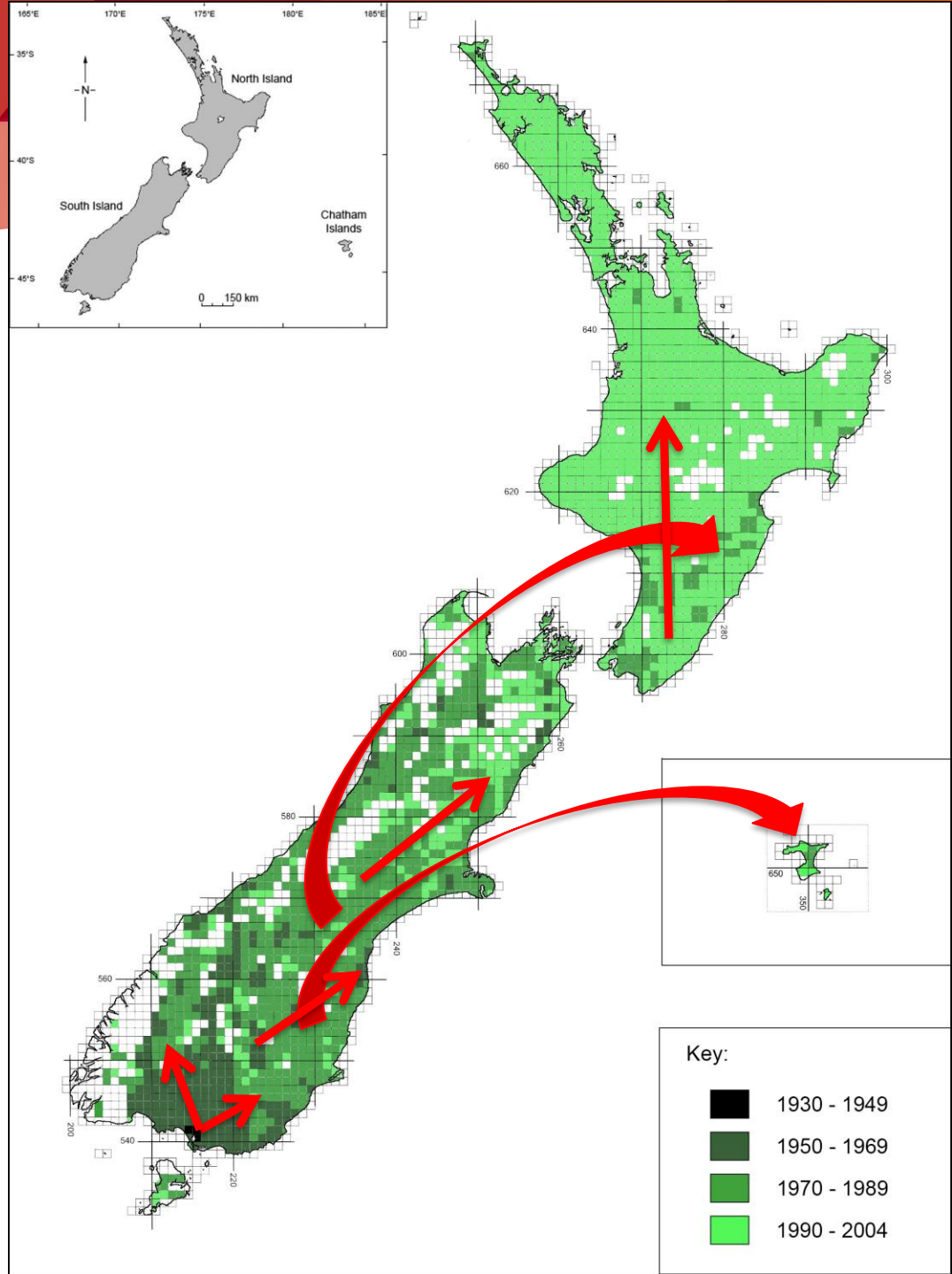


Pattern of Spread

Pattern of spread is consistent with:

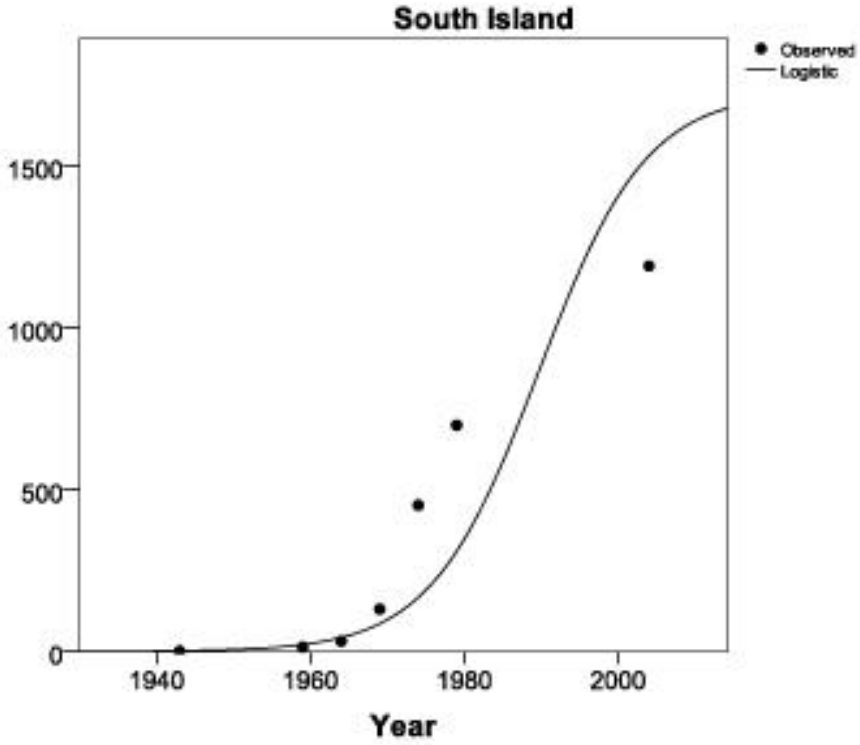
Stratified dispersal model;

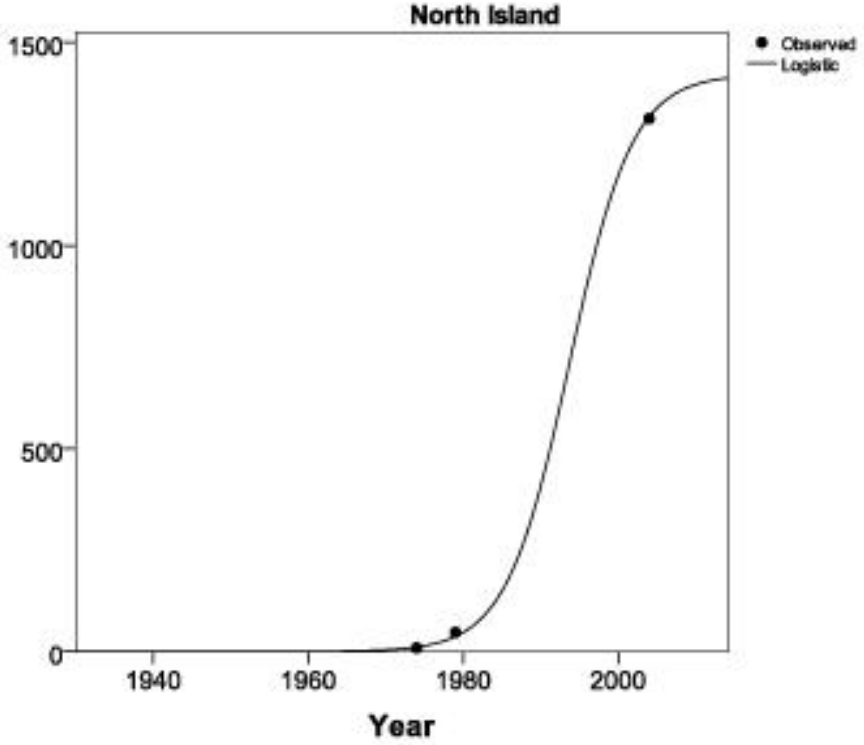
- short distance
- long distance 'jump' dispersal similar to invasive species.
  (Shigesada & Kawasaki, 1997)



Range Expansion

Grid occupancy over time (1930-2004)





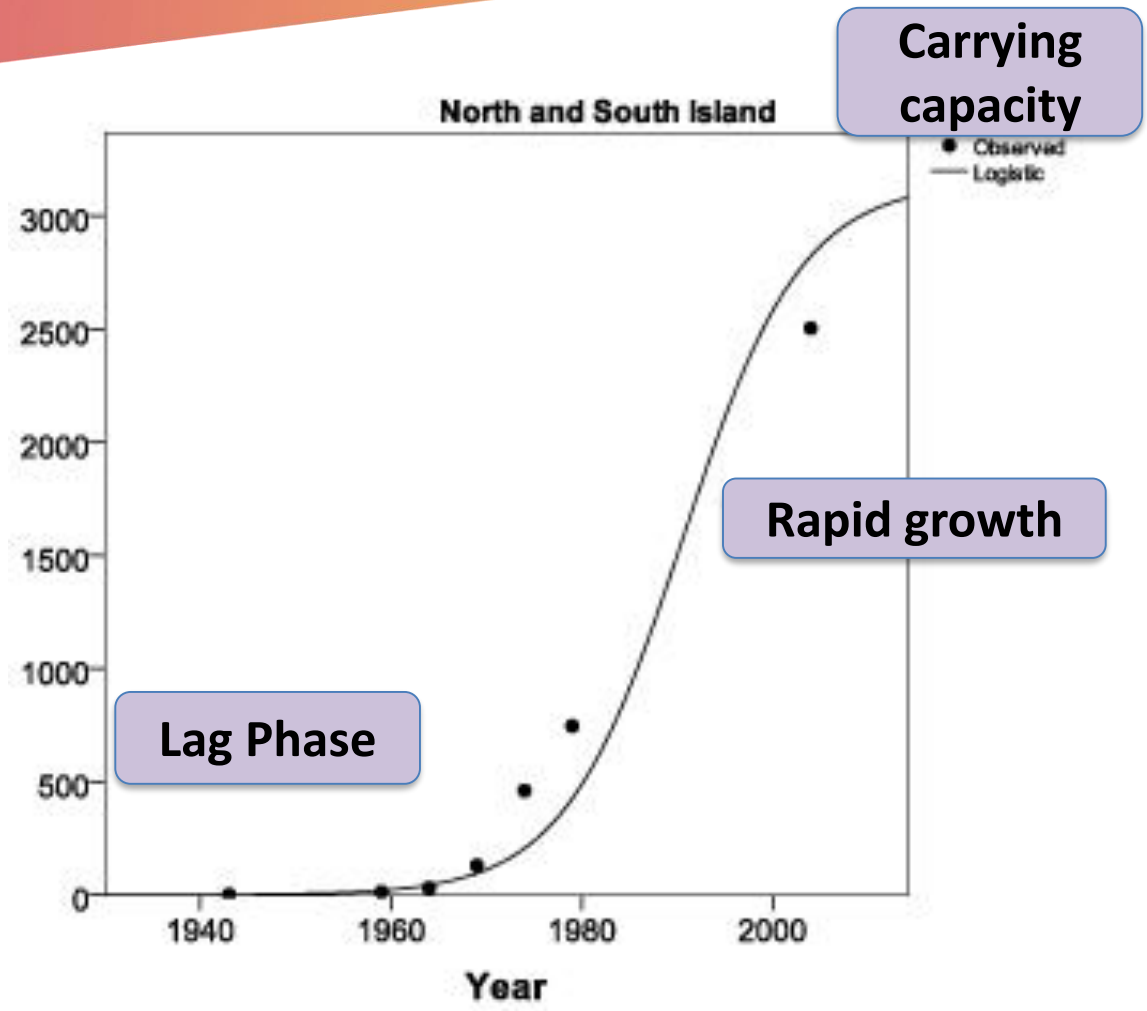
South Island (r=0.943, P=0.001)

North Island (r=0.998, P<0.05)

Range Expansion

Grid occupancy over time
All New Zealand
(1930-2004)
(r=0.979, P<0.001)

Similar to population growth pattern shown by invasive species
(Lockwood, et al. 2007)



Factors affecting invasion success

- Life history traits
- Climate matching
- Propagule pressure
- Habitat suitability & vacant niche
- Affiliation with humans

(Photo: D. Fraser, 2014)

Life History traits: (*V.m.novaehollandiae)*

- High dispersal ability
- High reproductive rate
- Generalist feeder
- Aggressive behaviour
- Good health status on introduction

(Photo: Tony Rodd, 2009)

(D. Jenkins, 2013)

(Denis Wilson, 2008)

Climate matching

Similarity in climate matching aids introduction & invasion success
(Duncan, et al. 2003)

(Photo: Ralph Green, 2011)

(Google maps, 2009)

Introduction effort (Propagule pressure)

Introduction effort = propagule number + propagule size
(Lockwood et al. 2005; Veltman et al. 1996)

First sighting 1886,
First breeding pair 1932.
Ongoing introduction?

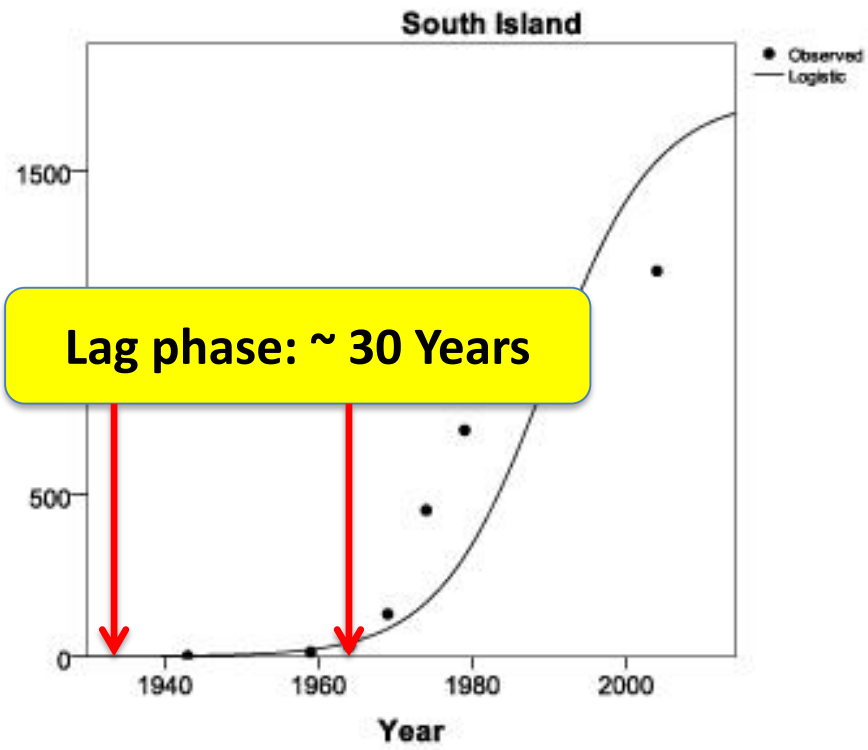
Success of invasion:

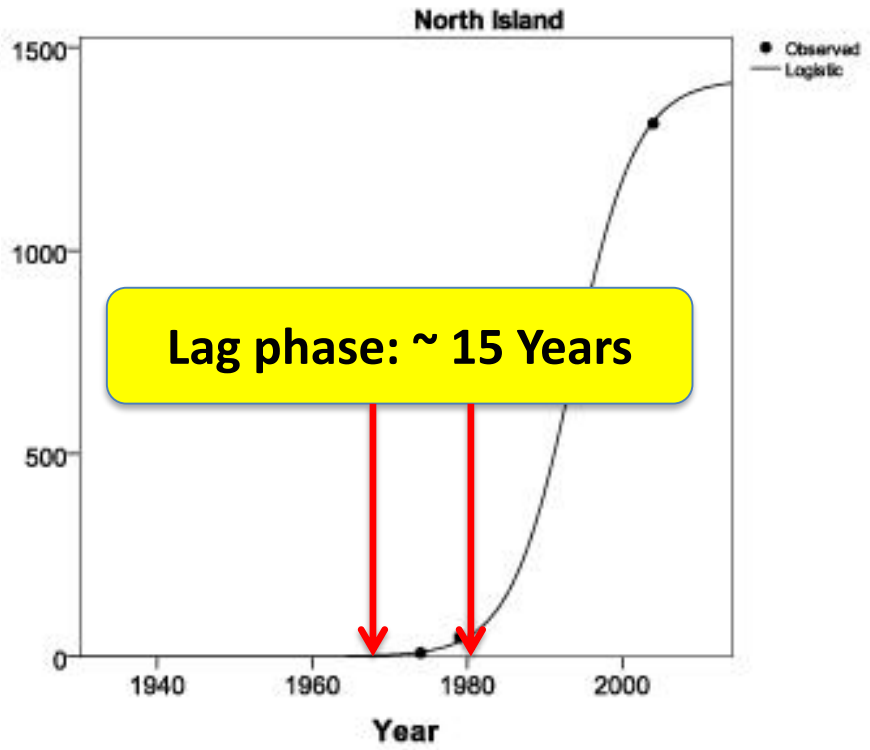
1. Proximity to novel environment
2. Propagule pressure

(Photo: Single Benjamint444, 2010, double David Jenkins 2013; Map Google maps 2009)

Lag Phase

Grid occupancy over time (1930-2004)





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Introduction effort (Propagule pressure)

1. Proximity to novel environment
2. Propagule pressure

(Photo: Plover: Ralph Green, 2011; Map Google maps 2009)

Habitat and vacant niche

Habitat suitability/adaptability:

- Natural vs human-modified

(Photo: Jon Sullivan, 2005)

Vacant niche

(Photos: Pasture-Winam, 2007; Golf course-Photos_by_Angela 2010)

Human affiliation

Human affiliation promotes invasion success
(Jeschke & Strayer 2006)

(Photo: Denni Schnapp, 2005)

Is the introduction & spread similar to invasive species?

(Photos: Tony Rodd, 2009)

Spur-winged plover *(V.m. novaehollandiae):*

Self-introduced to NZ

Characteristic of an invasive species	Spur-winged plover (V. m. novaehollandiae)
Elton's concentric ring range expansion	√
Stratified dispersal model	√
Population growth	√
Life history characteristics	√
Climate matching	√
Proximity of novel environment	√
Propagule pressure	√
Utilization of a vacant niche	√
Affiliation with humans	√

Protection status in New Zealand

Wildlife Act 1953: Amendment 8 July 2010

- SWP reclassified on Schedule 5
- ***'not protected'***
- Free to control

(Photo: Ralph Green, 2011)

Future Research

- Population dynamics and carrying capacity
- Impacts, particularly on native ground nesting birds
- Genetic structure of NZ populations in Australia and NZ to determine propagule pressure

(Photos: Ralph Green, 2011)

Thanks to my co-authors (Mel Galbraith, Nigel Adams & Dan Blanchon) and Drs Margaret Standley & Imogen Bassett, (University of Auckland)

Thank you

(Photos: D. Fraser, 2014)