

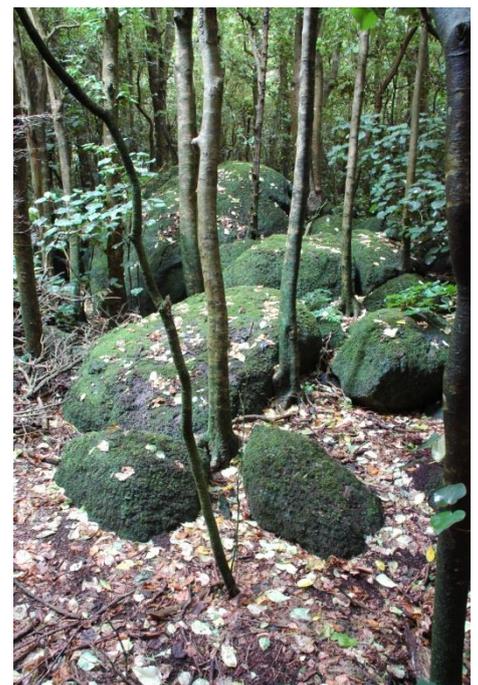
Differential effects of exotic predator-control on nest success of native and introduced birds in New Zealand.

Amanda Startling-Windhof, Melanie Massaro, James V Briskie

(Following are extracts and graphs from this published article):

Introduced mammalian predators have been one of the main causes of bird extinctions on isolated islands (Blackburn et al. 2005). At least 42 species of native birds have become extinct in New Zealand since the arrival of humans, with most of these extinctions being attributed to the introduction of exotic mammals (Holdaway 1999).

Predatory mammals were not the only introductions to New Zealand; beginning in the nineteenth century at least 30 species of mostly European birds became established through the actions of acclimatisation societies (Long 1981; Thomson 1922). In contrast to native birds, introduced European birds co-evolved with mammalian predators in their native ranges (King 1984). As a result, these continental species display a variety of life history traits that minimise the risk of predation (Briskie et al. 1999; Martin 1995; Martin et al. 2000). For example, birds subject to high predation pressure have more rapid chick development (Harfenist and Ydenberg 1995), subdued chick begging (Briskie et al. 1999), and reduced nest visitation rates (Fontaine and Martin 2006; Massaro et al. 2008). As many of the introduced predatory mammals are the same species European birds co-evolved with in their native range, it has been suggested that introduced birds should be able to cope with the pressures of high predation from mammals, and would possibly suffer less nest predation than native birds (Moors 1983). However, there is little information available at present to test this idea.



Pristine New Zealand forest

The study was conducted from 2002 to 2009 at Kowhai Bush and from 2004 to 2009 at Waimangarara Bush near Kaikoura, New Zealand. Kowhai Bush is 240 ha of native woodland that we used as a non-treatment site as it has little mammalian predator-control, except for some poisoning of possums around the eastern edges where the forest is adjacent to farmland. Waimangarara Bush is 65 ha of native woodland which has been subject to continual predator-control since 2003 for possums, feral cats, mustelids, and rodents. The two sites are separated by five kilometres and experience similar climate and have similar native vegetation. The forest canopy in both sites consists mainly of kanuka (*Leptospermum ericoides*), and manuka (*L. scoparium*), with lesser abundances of *Pittosporum tenuifolium*, *Coriaria arborea*, *Phymatosorus diversifolius*, *Cytisus monspessulanus*, *Dodonaea viscosa*, *Melicactus ramiflorus*, *Clematis vitalba*, *Ribes sanguineum*, *Olearia paniculata* and *Pseudopanax arboreus* (Gill 1980). Both forests lie on the coastal plain about seven km inland, and range from 10 to 50 m above sea level.

Nests were located by watching adults and by searching vegetation. Nests were tagged nearby with flagging tape and then visited at intervals of three to four days until they fledged or failed. A nest was considered successful if young were observed leaving the nest or if the young were ready to fledge on the previous visit (e.g., pin feathers unsheathed several centimetres). A nest was considered depredated if all eggs or young were missing (before being capable of fledging), if there were egg-shells in the nest, or if the nest was destroyed. We assumed that mammals were the main predators. Avian predators (e.g., falcons (*Falco novaeseelandiae*), moreporks (*Ninox novaeseelandiae*) and long-tailed cuckoos (*Eudynamis taitensis*)) were rare at the study sites and are more likely to prey on adults and mammals than on nests



Bellbird female feeding her chicks
(a native New Zealand bird)



Blackbird
(an introduced species)

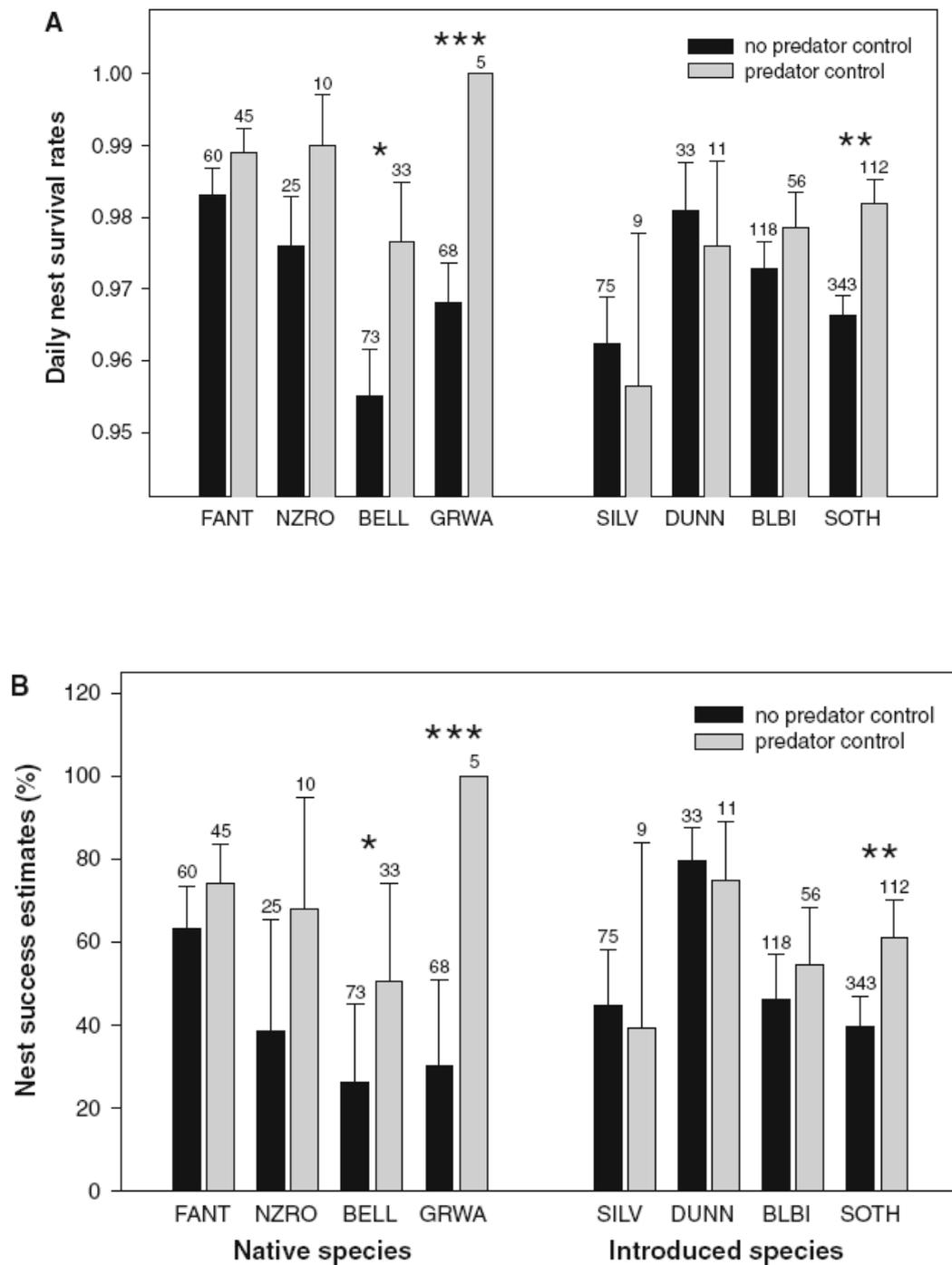


Fig. 1 Daily nest survival rates (a) and overall nest success estimates (b) of native and introduced species of New Zealand birds in a site with no predator-control and a site with predator-control. FANT = fantail, NZRO = New Zealand robin, BELL = bellbird, GRWA = grey warbler, SILV = silvereeye,

DUNN = dunnock, BLBI = blackbird, and SOTH = song thrush. Sample sizes of nests that were monitored are above the bars. Stars indicate level of significance of differences within species ($P < 0.05 = *$, $P < 0.001 = **$, $P < 0.0001 = ***$)

Q	Achievement	Achievement with Merit	Achievement with Excellence
1	<p>Kowhai Bush has no predator control and Waimangarara Bush has predator control.</p> <p>Or</p> <p>One site has no predator control and the other has predator control.</p>	<p>The two sites have similar climates, altitude and vegetation so the only difference is the level of predator control.</p> <p>Or</p> <p>The two sites have all other variables such as climate / vegetation / altitude controlled.</p> <p>(plus ACHEIVED)</p>	
2	<p>Native birds benefit more.</p>	<p>The daily nest survival rate is greater for all the native birds in the area with predator control;</p> <p>but not all the introduced birds had higher survival rates in the predator control area.</p> <p>Or</p> <p>2 of the native bird species had significantly higher survival rates but only 1 of the introduced bird species had a significantly higher survival rate.</p> <p>(plus ACHIEVED)</p>	<p>(Merit)</p> <p>And</p> <p>Introduced European birds co-evolved with mammalian predators and have survival strategies such as subdued begging / quicker chick development / reduced nest visitation rates so they would cope better than the native birds when predators are present.</p> <p>Or</p> <p>When predators are removed the native birds would have better survival rates as they do not have the survival strategies to deal with mammalian predators as they did not co-evolve with mammalian predators like the introduced European birds.</p>

Q	Achievement	Achievement with Merit	Achievement with Excellence
3	Bellbirds had a higher survival rate when predators were controlled.	Bellbirds had a significantly higher survival rate when predators were controlled. After seeing the results of this study, conservationists can be confident that predator control is an effective method for saving Bellbirds.	Bellbirds had a significantly higher survival rate when predators were controlled. After seeing the results of this study, conservationists can be confident that predator control is an effective method for saving Bellbirds. And They could use this study to justify money/resources spent on predator control.