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Spending limited resources on de-extinction could lead to net biodiversity loss

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Supplementary Table 1: Extinct species, analogues, number of extant species sharing at least one action, and estimated Year 1 conservation costs used in the prioritization protocol to determine whether species can be funded within a specified budget.

a) NZ

Extinct Species	Taxonomic Group	Extant Analogue	Number of extant species sharing at least one action	Year 1 Conservation cost in NZD (USD in brackets)
<i>Anthornis melanocephala</i> - Chatham bellbird	Bird	<i>Gerygone albofrontata</i> - Chatham Island warbler	10	\$535,770 (\$358,966)
<i>Coenocorypha iredalei</i> - South Island snipe	Bird	<i>Philesturnus carunculatus</i> - South Island saddleback	7	\$913,770 (\$612,226)
<i>Heteralocha acutirostris</i> - Huia	Bird	<i>Callaeas wilsoni</i> - North Island kōkako	32	\$375,900 (\$251,853)
<i>Ixobrychus novaezealandiae</i> - New Zealand bittern	Bird	<i>Botaurus poiciloptilus</i> - Australasian bittern	1	\$2,460,630 (\$1,648,622)
<i>Sceloglaux albifacies</i> - Laughing owl	Bird	<i>Falco novaeseelandiae</i> - New Zealand falcon	4	\$459,590 (\$307,925)
<i>Leiopelma waitomoensis</i> - Waitomo frog	Frog	<i>Leiopelma hochstetteri</i> - Hochstetter's frog	1	\$369,180 (\$247,351)
<i>Myosotis traversii</i> var. <i>cinerascens</i> (no common name)	Plant	<i>Myosotis colensoi</i> - Colenso's forget-me-not	2	\$118,400 (\$79,328)
<i>Stellaria elatinoides</i> – (no common name)	Plant	<i>Raoulia monroi</i> - fan-leaved mat daisy	1	\$42,560 (\$28,515)
<i>Anomalopteryx didiformis</i> - little bush moa	Bird	<i>Apteryx rowi</i> - rowi	19	\$359,560 (\$240,905)
<i>Coenocorypha chathamica</i> - Forbes' snipe	Bird	<i>Coenocorypha pusilla</i> - Chatham snipe	39	\$138,530 (\$92,815)
<i>Dendroscansor decurvirostris</i> - long-billed wren	Bird	<i>Xenicus gilviventris</i> - New Zealand rock wren	4	\$789,830 (\$529,186)

b) NSW

Extinct Species	Taxonomic Group	Extant Analogue	Number of extant species sharing at least one action	Year 1 Conservation cost in AUD (USD in brackets)
<i>Columba vitiensis godmanae</i> - Lord Howe pigeon	Bird	<i>Gallirallus sylvestris</i> - Lord Howe woodhen	21	\$10,397,520* (\$7,486,214)
<i>Zosterops strenuus</i> - robust white-eye	Bird	<i>Zosterops lateralis tephroleurus</i> - Lord Howe silveryeye	21	\$10,693,440* (\$7,699,277)
<i>Bettongia gaimardi gaimardi</i> - eastern bettong (mainland subspecies)	Marsupial	<i>Potorous tridactylus</i> - long-nosed potoroo	2	\$451,080 (\$324,778)
<i>Persoonia laxa</i> – (no common name)	Plant	<i>Persoonia hirsute</i> - hairy persoonia	1	\$252,520 (\$181,814)
<i>Euphrasia rupture</i> – (no common name)	Plant	<i>Euphrasia ciliolata</i> - Polblue Eyebright	1	\$50,130 (\$36,094)

*This cost includes a \$10M AUD rodent eradication program on Lord Howe Island. The proposed program is prescribed for 21 extant species.

Supplementary Table 2: Impact of de-extinction focal species on number of extant species prioritized with our baseline budgets

(\$30M NZD for NZ; \$4.65M AUD for NSW).

a) NZ

Resurrected species	Year 1 Conservation cost in NZD (USD in brackets)	Scenario 1 – Resurrected species funding is burden of government	Difference in number of species funded from standard prioritization	Scenario 2 – Full costs of resurrected species sponsored by external agency	Difference in number of species funded from standard prioritization	Number of species prioritized if funding used for de-extinction is applied instead extant species	Difference in number of species funded from normal standard prioritization (Scenario 2 opportunity cost)
<i>Anthornis melanoccephala</i>	\$535,770 (\$358,966)	296	0	298	2	299	3
<i>Coenocorypha iredalei</i>	\$913,770 (\$612,226)	292	-4	297	1	300	4
<i>Heteralocha acutirostris</i>	\$375,900 (\$251,853)	296	0	297	1	299	3
<i>Ixobrychus novaezelandiae</i>	\$2,460,630 (\$1,648,622)	282	-14	297	1	303	7
<i>Sceloglaux albifacies</i>	\$459,590 (\$307,925)	296	0	297	1	299	3
<i>Leiopelma waitomoensis</i>	\$369,180 (\$247,351)	296	0	298	2	299	3
<i>Myosotis traversii</i> var. <i>cinerascens</i>	\$118,400 (\$79,328)	296	0	296	0	296	0
<i>Stellaria elatinoidea</i>	\$42,560 (\$28,515)	296	0	296	0	296	0
<i>Anomalopteryx didiformis</i>	\$359,560 (\$240,905)	296	0	297	1	299	3
<i>Coenocorypha chathamica</i>	\$138,530 (\$92,815)	299	3	300	4	296	0
<i>Dendroscansor decurvirostris</i>	\$789,830 (\$529,186)	295	-1	297	1	300	4

All extinct species	\$6,424,530 (\$4,304,430)*	265	-31	307	11	328	32
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b) NSW

Resurrected species	Year 1 Conservation budget in AUD (USD in brackets)	Scenario 1 – Resurrected species funding is burden of government	Difference in number of species funded from standard prioritization	Scenario 2 – Full costs of resurrected species sponsored by external agency	Difference in number of species funded from standard prioritization	Number of species prioritized if funding used for de-extinction is applied instead extant species	Difference in number of species funded from normal standard prioritization (Scenario 2 opportunity cost)
Columba vitiensis godmanae	\$10,397,520 (\$7,486,214)	Zero – budget insufficient to fund any species	N/A	168	-3	176	5
Zosterops strenuus	\$10,693,440 (\$7,699,277)	Zero – budget insufficient to fund any species	N/A	173	2	178	7
Bettongia gaimardi	\$451,080 (\$324,778)	157	-14	172	1	174	3
Persoonia laxa	\$252,520 (\$181,814)	164	-7	172	1	174	3
Euphrasia ruptura	\$50,130 (\$36,094)	170	-1	172	1	171	0
All extinct species	16,796,950 (\$12,093,940)*	Zero – budget insufficient to fund any species	N/A	182	11	213	42

*Assumes costs are shared among resurrected species where identical actions are prescribed

1 Supplementary Discussion

2 Note that for several NZ resurrected species, the number of species that could be prioritized, if
3 the government were obliged to fund the resurrected species (Scenario 1), is the same as in a
4 standard prioritization (Extended Data Table 2). This is due to cost sharing between analogue
5 extant and resurrected extinct species; costs of the analogue extant species are halved if the
6 actions for the resurrected species are funded because we assumed that the species would be
7 managed in the same way at the same sites. In the case of *Coenocorypha chathamica*, the
8 number of species that could be prioritized if the government were obliged to work on this
9 species is higher than in a baseline prioritization with extant species only. This is because the
10 conservation program for *Coenocorypha chathamica* contained shared actions with 39 additional
11 species that inhabit its former habitat on Chatham Island. This number of shared actions is higher
12 than for any of the other extinct species in either NZ or NSW.

13 Conversely, for two species in NSW (*Columba vitiensis godmanae* and *Zosterops strenuus*),
14 initial costs were higher than total budget. It could be argued that these contrasting results
15 suggest that de-extinction for some individual species may produce net benefit, and that de-
16 extinction candidates could be chosen on the basis of potential benefit to other species. However,
17 the fact that our analysis does not consider up-front costs of producing viable populations, and
18 also assumes actions can be perfectly shared between analogue species, suggests extreme caution
19 in using such an approach. Indeed, our general results show that net biodiversity benefits are
20 likely to be far higher when spending additional conservation funds on extant species.

21 Note also that for the NSW species *Columba vitiensis godmanae*, the number of extant species
22 that could be prioritized in Scenario 2 where this species was externally sponsored is lower than

23 for a standard prioritization, despite the cost of shared actions being set to zero. *Columba*
24 *vitiensis godmanae* shared a \$10M AUD rodent eradication action with 21 extant species.
25 Species that shared this cost with *Columba vitiensis godmanae* were boosted in rankings in
26 Scenario 2 (due to their shared actions being externally funded), such that nine new species were
27 prioritized. However, even with the eradication program being funded, these species had
28 generally higher year 1 costs than the species they displaced, leading to three fewer species
29 fitting within the set budget.