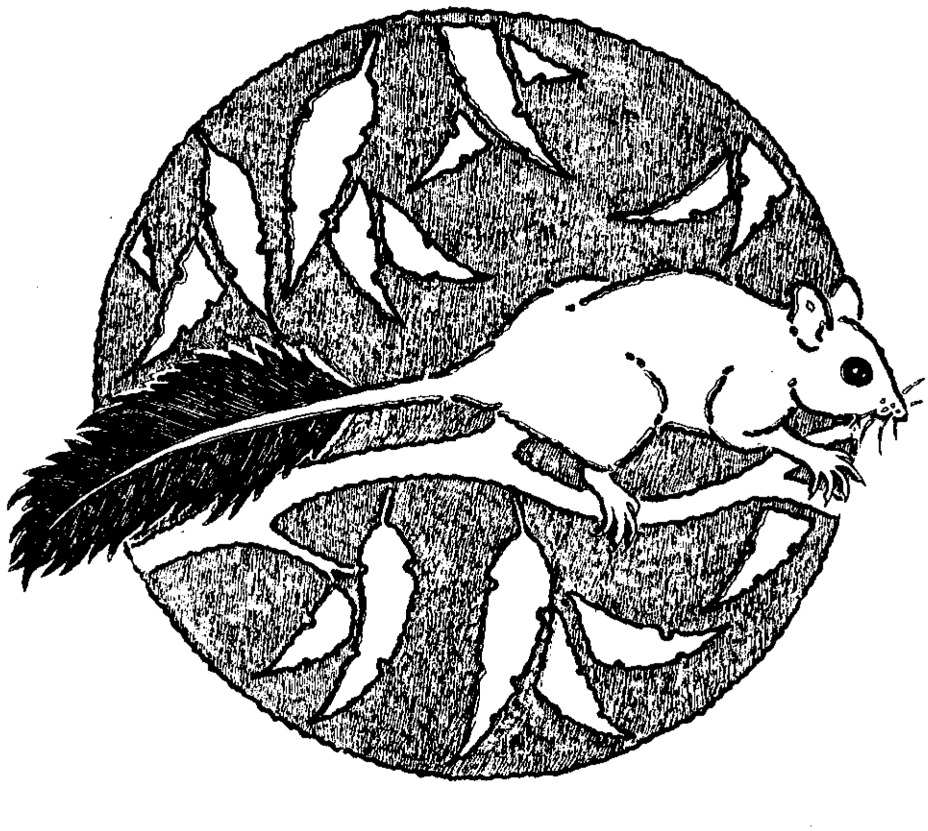
CONFERENCE ON REINTRODUCTION BIOLOGY OF AUSTRALASIAN FAUNA

19-21 APRIL 1993

HEALESVILLE SANCTUARY



ABSTRACTS

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CONFERENCE ON REINTRODUCTION BIOLOGY OF AUSTRALASIAN FAUNA

Healesville Sanctuary, 18-21 April 1993

PROGRAMME

SUNDAY, 18 APRIL

14:00 - 21:00	REGISTRATION open at Sanctuary Brolga Room
17:00 - 22:00	WINE TASTING at Sanctuary Brolga Room

MONDAY, 19 APRIL

07:30-08:30	REGISTRATION open at Badger Creek Primary School BREAKFAST available at Sanctuary Bistro
08:30-08:40	OFFICIAL WELCOME by Patricia E. Feilman (Chairman, Zoological Board of Victoria)
08:40-09:00	OPENING ADDRESS by Peter Bridgewater (Director, Australian National Parks and Wildlife Service)

SESSION 1

CHAIR:	P.B. Copley
09:00-09:20	M. Burgman, S. Ferson & D. Lindenmayer. The effect of the initial distribution on extinction risks: implications for the reintroduction of Leadbeater's possums.
09:20-09:40	H. McCallum & C. Moritz. Modelling translocation strategies.
09:40-10:00	T. Soderquist. The importance of hypothesis-testing in reintroductions.
10:00-10:20	D.B. Lindenmayer. Some ecological considerations for designing and planning re-introduction programs.
10:20-11:00	MORNING TEA

SESSION 2

Chair:	M. Serena
11:00- 11:20	M. McCarthy. Population viability of the helmeted honeyeater: risk assessment of captive management and reintroduction.
11:20-11:40	J.A. Friend. Re-introduction and the numbat recovery program.
11:40-12:00	K.A. Johnson, D.G. Langford, J.R. Cole, D.E. Clarke, D.F. Gibson & Willowra Community. The rufous hare-wallaby: a history of experimental reintroduction of the mala in the Tanami desert.
12:00-12:20	I. McLean & G. Lundie-Jenkins. Training captive mala to recognise predators.
12:20-12:40	P. Rismiller & M. McKelvey. Orientation and relocation of echidnas.

MONDAY, 19 APRIL (CONT.)

12:40-14:00	LUNCH

SESSION 3

Chair: B.D. Bell

14:00-14:20	A.J. Saunders. A review of New Zealand reintroductions.
14:20-14:40	C.R. Veitch. Habitat repair - a necessary pre-requisite to translocation.
14:40-15:00	M.P. Galbraith & C.R. Hayson. Tiritiri Matangi Island, New Zealand---public participation in species translocation to an open sanctuary.
15:00-15:20	D.G. Allen. Behavioural ecology of the communal whitehead (*Mohoua albicilla*) following transfer to Tiritiri Matangi Island, New Zealand.
15:20-16:00	AFTERNOON TEA

SESSION 4

Chair: P. Menkhorst

16:00-16:20	D.P Armstrong, T.G. Lovegrove, D. Allen & J.L. Craig. Composition of founder groups for bird translocations: does familiarity matter?
16:20-16:40	A. Graeme & B. Graeme. North Island weka - captive rearing and wild population restoration by a non-government organisation.
16:40-17:00	A. Danks. Translocation of noisy scrub-birds: 1983-1992.
17:00-17:20	P. Brown, M. Holdsworth & D. Rounsevell. Reintroducing captive-bred orange-bellied parrots into the wild.
17:20-17:40	K.L. Viggers, D.B. Lindenmayer & D.M. Spratt. The importance of disease in reintroduction programs.
18:00-21:30	BARBECUE outside Sanctuary Brolga Room
19:30-21:00	POSTER SESSION at Badger Creek Primary School

TUESDAY, 20 APRIL

07:30-09:00	BREAKFAST available at Sanctuary Bistro
08:00-09:00	REGISTRATION open at Badger Creek Primary School

SESSION 5

Chair: B. Male

09:00-09:20	R. Frankham. Genetic management of captive populations for reintroduction.
09:20-09:40	R. Lacy. Managing genetic variation in captive populations destined for reintroduction.
09:40-10:00	D. Driscoll, G. Wardell-Johnson & J.D. Roberts. Rare Western Australian frogs: genetic structuring and the implications for their conservation.
10:00-10:20	N.D. Murray, H.B. Allen, M.T. Ivanyi & D. Franklin. Helmeted honeyeater genetics: implications for reintroduction.
10:20-11:00	MORNING TEA

SESSION 6

Chair: J. Short

11:00-11:20	T.R. New. Needs and prospects for insect reintroductions for conservation in Australia.
11:20-11:40	M.J. Meads. Translocation of New Zealand's endangered insects: a tool for conservation.
11:40-12:00	G. Sherley. Translocations of endangered invertebrate species in New Zealand: successes and lessons learnt.
12:00-12:20	A. Yen. Some invertebrate issues in the reintroduction of threatened species of insectivores in Victoria.
12:20-13:45	LUNCH
14:00-18:00	CONFERENCE TOURS
19:30-22:00	CONFERENCE DINNER at Sanctuary Brolga Room

WEDNESDAY, 21 APRIL

07:30-09:00	BREAKFAST available at Sanctuary Bistro
"	WORKSHOP ON OUTBREEDING DEPRESSION (N. Murray, Convenor)
08:00-09:00	REGISTRATION open at Badger Creek Primary School

SESSION 7

Chair:	G. Backhouse
09:00-09:20	B.W. Thomas. Translocation of the Fiordland skink (*Leiolopisma acrinasum*) to Hawea Island and natural dispersal to Breaksea Island, Fiordland, New Zealand.
09:20-09:40	G. Wardell-Johnson, J.D. Roberts & D. Driscoll. The *Geocrinia rosea* complex: to where do we reintroduce the frogs?
09:40-10:00	P.L. Cadwallader. Rehabilitation of native fish stocks in the Murray-Darling River System.
10:00-10:20	P. Horwitz. An environmental critique of some freshwater re-introductions in Australia.
10:20-11:00	MORNING TEA

SESSION 8

Chair:	C.R. Veitch
11:00-11:20	B.D. Bell. Translocation of fluttering shearwaters: developing a method to re-establish seabird populations.
11:20-11:40	I. Castro, J. Alley & E.O. Minot. Translocation of hihi (*Notiomystis cincta*) to Kapiti Island, New Zealand: transfer techniques and comparison of release strategies.
11:40-12:00	I. Castro, J. Alley & E.O. Minot. Behavioural ecology of recently transferred hihi (*Notiomystis cincta*) to Kapiti Island, New Zealand, and possible management alternatives.
12:00-12:20	R. Pietsch. The fate of urban common brushtail possums translocated to sclerophyll forest.
12:20-12:40	B. Smith & M. Augee. Predation by introduced animals on hand-reared and relocated ringtail possums *Pseudocheirus peregrinus*.
12:40-14:00	LUNCH

WEDNESDAY, 21 APRIL (CONT.)

SESSION 9

Chair:	J.A. Friend
14:00-14:20	P.B. Copley. Translocations of vertebrates in South Australia: a review.
14:20-14:40	K.D. Morris & P. Orell. Reintroduction of the chuditch to Julimar Conservation Park.
14:40-15:00	J. Short, S. Parker & J. Twiss. Reintroductions to mainland Shark Bay - the Heirisson Prong Project.
15:00-15:20	P. Christensen & N. Burrows. Desert dreaming.
15:20-16:00	AFTERNOON TEA

SESSION 10

Chair:	P.L. Cadwallader
16:00-16:20	R. Southgate. Why should we reintroduce the bilby?
16:20-16:40	G.N. Backhouse, T.W. Clark & R.P. Reading. Re-introduction policy and planning for recovery of the eastern barred bandicoot.
16:40-17:00	J. Seebeck et al. Eastern barred bandicoot recovery - review of reintroduction experiments in Victoria.
17:00-17:20	T. Norton. Options for koala management in southeast Australia and the role of reintroduction biology.
17:20-17:30	CLOSING REMARKS by J.A. Friend (Regional Vice-Chairman, IUCN/SSC Re-introduction Specialist Group)

BEHAVIOURAL ECOLOGY OF THE COMMUNAL WHITEHEAD *(MOHOUA ALBICILLA)* FOLLOWING TRANSFER TO TIRITIRI MATANGI ISLAND, NEW ZEALAND

D.G. Allen
7A Abbeygate Street, Birkdale, Auckland 10, New Zealand

The incidence of helping behaviour in communal bird species has attracted considerable research effort. It has been variously postulated that such behaviour may result in some advantage to individuals within a group through the "inheritance" of a breeding territory and/or breeding access to the other sex within the group, which non-members are less likely to successfully acquire. Two transfers of the passerine whitehead which lives in relatively small flocks of 8 to 10, usually consisting of a breeding pair and non-breeding individuals, were made from a high density population to an island without whiteheads. Each transfer had flocks comprised of familiar and non-familiar birds which were released and subsequently monitored over at least two breeding seasons. Results indicate that given the opportunities of territory availability, several birds who traditionally acted as helpers or non-breeding non-helpers became independent of their founder groups. Additionally, although sample sizes were limited, it would appear that subsequent flock behavioural structure and breeding success were not dependant on familiarity of individuals making up founder flocks. The relative incidence of one year old individuals first breeding was also noted in the transferred population.

COMPOSITION OF FOUNDER GROUPS FOR BIRD TRANSLOCATIONS : DOES FAMILIARITY MATTER?

Doug P. Armstrong
Dept. of Ecology, Massey University, Palmerston North, New Zealand
Tim G. Lovegrove
Dept. of Conservation, Private Bag 68908, Auckland, New Zealand
David Allen
Ministry of Agriculture & Fisheries, PO Box 3437, Auckland, New Zealand
John L. Craig
School of Biological Sciences, University of Auckland, Auckland, New Zealand

Several studies have shown that (1) birds are much less aggressive to their neighbours than they are to unfamiliar birds, (2) birds with familiar neighbours have greater breeding success than those with new neighbours, and/or (3) established breeding pairs are more successful than newly-formed pairs. These results suggest that bird translocations are likely to be more successful if there is a high level of familiarity in a founder group. This has important implications for transfer strategies, particularly if genetic considerations suggest it is best to avoid taking several birds from the same location. Here we summarise experiments designed to test for effects of familiarity in translocations of 3 New Zealand birds: North Island Saddlebacks, North Island Robins, and Whiteheads. Our experiments compared (1) birds transferred in intact neighbourhoods vs those transferred with unfamiliar birds, (2) birds transferred with and without their mates or breeding groups, and (3) birds transferred with others from the same island or with birds from different islands. In all cases, our results suggest that familiarity had no effects on dispersal, survival, or reproduction of the translocated birds. Birds were effective at establishing new relationships and pair bonds with previously unfamiliar birds, and most existing breeding pairs and groups broke up after translocation. We conclude that familiarity is unlikely to affect the outcome of translocations, at least in these species.

REINTRODUCTION POLICY AND PLANNING FOR RECOVERY OF THE EASTERN BARRED BANDICOOT

Gary N. Backhouse
Dept. of Conservation & Natural Resources, Wildlife Management Section, PO Box 137, Heidelberg, Vic. 3084.
Tim W. Clark & Rich P. Reading
Yale University, School of Forestry & Environmental Studies, New Haven, Conneticut 06511 & Northern Rockies Conservation Co-operative, Box 2705 Jackson, Wyoming 83001 U.S.A.

The Eastern Barred Bandicoot *Perameles gunnii*, is Victoria's most endangered mammal species. Virtually extinct in the wild in Victoria, the species survives in captivity, in two small, confined semi-wild populations, and a very small, newly reintroduced free-ranging population. Reintroductions have occurred three times; twice into extensive fenced enclosure, and once as a free-ranging release. The establishment of the reintroduced, confined populations has been instrumental in preventing total extinction of the species in Victoria. An analysis of the factors leading to these reintroductions is described. The principal factors governing reintroductions have not been biological and technical, but rather a mixture of social, political and economic. The impact of this situation on reintroductions and implications for policy development are discussed, and lessons for this and other reintroduction programs described. Reintroduction programs need to consider the full array of biological and non-biological factors to be comprehensive, and offer improved chances of success.

TRANSLOCATION OF FLUTTERING SHEARWATER : DEVELOPING A METHOD TO RE-ESTABLISH SEABIRD POPULATIONS.

Brian D. Bell
Wildlife Management International, P.O. Box 14-492, Wellington, New Zealand.

Few people have attempted to translocate burrow nesting seabirds and these have had little success. Because of the threats to seabird habitats and the status of some species, the Ornithological Society of New Zealand is carrying out research into possible methods of translocating petrels and, for establishing guidelines for such programs, is using a common species the fluttering shearwater *Puffinus gavia*. Methods and progress to date are outlined and discussed.

REINTRODUCING CAPTIVE-BRED ORANGE-BELLIED PARROTS INTO THE WILD

Peter Brown, Mark Holdsworth & David Rounsevell
Dept. of Environment & Land Management, Tasmania

A captive breeding program for the endangered Orange-bellied Parrot was established in 1986. Following a difficult start, breeding has been successful with more than a hundred young reared to independence. To date 25 birds have been introduced to the wild in 1991 & 1992. Released birds have established well in S.W. Tasmania, with most birds breeding during their first summer in the wild. Those released in 1991 disappeared in the following April when the wild population departed on their northward migration to the mainland, however in the following summer of 1992/93, none of the released birds has to date been recorded back in S.W. Tasmania. A second group of 14 was released in the same area in October 1992. It was confirmed that at least 9 and probably several more young were reared from pairs made up of one or both captive-bred birds. Young were successfully fledged from four of a number of artificial nest boxes erected in the release area. Preliminary results from a banding program indicate that juvenile survival may be good, but less so in subsequent years.

THE EFFECTS OF THE INITIAL DISTRIBUTION ON EXTINCTION RISKS: IMPLICATIONS FOR THE REINTRODUCTION OF LEADBEATER'S POSSUMS

Mark Burgman
Forestry Section, University of Melbourne, Creswick.
Scott Ferson
Applied Biomathematics, Setauket, New York.
David Lindenmayer
Centre for Resource and Environmental Studies, ANU, Canberra.

The success of a release program may depend on the behaviour of individuals at small population sizes, on the number of individuals available for release, and on the demographic attributes of those individuals. If the initial distribution is unlike the stable age distribution, cycles of abundance may result , even in the absence of density dependence. Any cycle in total population abundance will bring a population regularly closer to extinction, resulting in elevated risks. Furthermore, the size and demography of the initial population could impact on risks through social dysfunction, and these factors may interact. Such considerations are relevant to questions of a release program. An example is provided by Leadbeater's possum. We investigate the effect of the initial population distribution and the number of animals released on extinction probabilities, using stage-based stochastic models.

REHABILITATION OF NATIVE FISH STOCKS IN THE MURRAY-DARLING RIVER SYSTEM

P.L. Cadwallader
Dept. of Conservation and Natural Resources, Private Bag 20, Alexandra, Victoria 3714

The range and abundance of many native fish species in the Murray-Darling River system have declined dramatically since European settlement in Australia. Reasons for the decline include flow regulation, altered temperature regimes, siltation, "river improvement", pollution, interaction with introduced species and overfishing. Over the last three decades, techniques for the artificial propagation of several of the larger fish species have been developed. However, stocking hatchery-bred fish will achieve very little in terms of conservation unless steps are taken to improve or better manage fish habitat. Aspects of the life histories of golden perch *Macquaria ambigua*, Macquarie perch *Macquaria australasica* and Murray cod *Maccullochella peeli* are discussed in relation to the roles of habitat improvement/manipulation, legislation and stocking in the conservation of these species.

BEHAVIOURAL ECOLOGY OF RECENTLY TRANSFERRED HIHI (*NOTIOMYSTIS CINCTA*) TO KAPITI ISLAND, NEW ZEALAND, AND POSSIBLE MANAGEMENT ALTERNATIVES.

Isabel Castro, Julienne Alley and Edward O. Minot.
Ecology Department, Massey University, Palmerston North, New Zealand

Hihi breeding and feeding behaviour differ between Little Barrier Island (source population) and Kapiti Island. These alternative behaviours reflect both environmental differences between the islands and the ability of the species to adapt to a new environment. These behavioural differences were not expected. Although Kapiti may be a suboptimal habitat for hihi, the behavioural plasticity of the species could be used, in combination with management, to establish a population on Kapiti.

TRANSLOCATION OF HIHI (*NOTIOMYSTIS CINCTA*) TO KAPITI ISLAND, NEW ZEALAND: TRANSFER TECHNIQUES AND COMPARISON OF RELEASE STRATEGIES.

Isabel Castro, Julienne Alley and Edward O. Minot
Ecology Department, Massey University, Palmerston North, New Zealand

Little Barrier Island has the only self-sustaining population of hihi. The Department of Conservation is trying to establish populations of this species elsewhere to ensure its survival. In 1991 and 1992 hihi transfers to Kapiti Island were approached in an experimental way. In 1991 four release strategies were tested: immediate, delayed, paired and clumped release. In 1992 we tested the effect of the presence or absence of conspecifics. Bird sightings and movements were used to compare the different strategies. Immediate release birds survived better and moved more than delayed release birds. There was no difference in survival of birds released in pairs or as a group. Birds released in the absence of conspecifics survived better than those released in their presence. Birds released in the absence of conspecifics appeared in an area with resident conspecifics about three days after being released.

DESERT DREAMING

P. Christensen and N. Burrows
Department of Conservation and Land Management, Research Centre, Como, Perth, Western Australia, 6152

The Central Australian deserts have suffered massive and sudden loss of mammal fauna unparalleled in any relatively undisturbed area anywhere else in the world. Some 90 per cent of mammal species with an adult body weight between 35 and 5500 grams are either extinct or endangered. These declines and extinctions occurred relatively recently, most species persisted until 30-50 years ago.

Several theories have been advanced for this sudden and massive loss of mammal fauna:

i) Change in the fire regime due to the depopulation of the deserts by Aborigines.
ii) Predation by introduced predators.
iii) Competition with introduced herbivores.
iv) Disease.

This project aims to test these hypothesis by experimental re-introduction and monitoring of two former inhabitants of the desert, the Golden Bandicoot *Isoodon auratus* and the Burrowing Bettong *Bettongia lesueur* from Barrow Island.

Animals have been taken from wild populations on Barrow Island to an area in the Gibson Desert in Western Australia where fire management and predator and rabbit *Oryctolagus cuniculus* control is being carried out.

Preliminary results are presented and discussed.

TRANSLOCATIONS OF VERTEBRATES IN SOUTH AUSTRALIA : A REVIEW

Peter B. Copley
South Australian Dept. of Environment and Land Management, PO Box 3034, Norwood, S.A. 5067

The history of translocations of native vertebrates in South Australia is a long and, until recently, a mostly sorry tale. Although all may have been well-intentioned, few translocations appear to have been carefully planned and considerations of consequences seem to have been minimal. Only a small percentage have been successful in terms of establishing self-perpetuating populations and even several of these have doubtful medium - to longer-term viabilities. Ecological data for "before" and "after" comparisons within release environments are not available for most translocation attempts. However, even without this information it is obvious that several translocations, especially those outside species' former known distributions, are having significant negative ecological impacts. Other aspects, such as the genetics of founding stock and the likely importance of proposed release sites for other priority species have seldom been taken into account. Examples of these potential and real failings will be given to add support to the Draft Policy for Translocations of Vertebrate Animals in Australia currently being promoted by the Endangered Species Advisory Committee.

TRANSLOCATION OF NOISY SCRUB-BIRDS : 1983-1992

Alan Danks
Dept. CALM, Two Peoples Bay Nature Reserve, RMB 8609, via Albany, W.A. 6330

Conservation of the endangered Noisy Scrub-bird *Atrichornis clamosus* requires both translocation and habitat management. Between 1983 and 1992 a total of 109 Noisy Scrub-birds were translocated from the population at Two Peoples Bay Nature Reserve to six new areas. Capture in the wild was followed by temporary holding near the capture site, transport to the new site and direct release into selected habitat. Initially the transfer of around 30 birds to each site was aimed for but in recent years the size of translocation groups has been reduced. Both the parent population and the release sites have been regularly monitored. At Mt. Manypeaks, 15km. east of Two Peoples Bay, 18 males and 16 females were released in 1983 and 1985. By 1992 there were 100 singing males in the Mt. Manypeaks subpopulation representing 31% of the total population index for the species. Translocations to areas 100-150km. west of Two Peoples Bay have been unsuccessful. Recent work has concentrated on building an inter-connected population in the area between Oyster Harbour and Cheyne Beach.

RARE WEST AUSTRALIAN FROGS : GENETIC STRUCTURING AND THE IMPLICATIONS FOR THEIR CONSERVATION.

Don Driscoll and Dale Roberts
Dept. of Zoology, University of Western Australia, Nedlands, W.A. 6009
Grant Wardell-Johnson
Dept. of Conservation and Land Management, Research Section, Brain St, Manjimup, W.A. 6258

The existence of spatial genetic variation within a species can reflect population structures and processes, and evolutionary trends which have important implications for conservation. Information about genetic structuring can provide a guide as to which populations are central to conserving the species and to where individuals could be relocated without the risk of reducing overall diversity. The frogs *Geocrinia alba* and *G. vitellina* only occur in a small area in south western Australia and are threatened with extinction. In order to help plan for their continued survival and evolution, an allozyme electrophoresis study is underway for all six populations of *G. vitellina* and 12 populations of *G. alba*. This paper reports on the initial findings and their implications for the conservation of the two frogs.

GENETIC MANAGEMENT OF CAPTIVE POPULATIONS FOR REINTRODUCTION

R. Frankham
School of Biological Sciences, Macquarie University, Sydney, N.S.W. 2109

Two major types of harmful genetic change can occur during captivity. One is change in allele frequencies and loss of genetic variation due to genetic drift, usually associated with inbreeding depression. The second is genetic adaptation to the captive environment through natural selection. Rapid genetic adaptation to the captive environment has been documented in *Drosophila* and fish and more anecdotal evidence exists for other species. The success of re-release programs is likely to be jeopardised by genetic adaptation to the captive environment. A framework for predicting the impact of factors on the rate of genetic adaptation to captivity is suggested. Equalisation of family sizes is predicted to approximately halve the rate of genetic adaptation. Introduction of genes from the wild, increasing the generation interval, using captive environments close to those in the wild and achieving low mortality rates are all expected to slow genetic adaptation to captivity. Many of these procedures are already recommended for other reasons.

RE-INTRODUCTION AND THE NUMBAT RECOVERY PROGRAM

J.A. Friend
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Only two significant numbat populations, at Dryandra and Perup, have survived the massive and widespread decline of the species. The numbat's recovery depends on the successful re-establishment of wild populations. A program of re-introduction has been in progress since 1985, first to an area of similar vegetation and then to other areas within the numbat's former range. Fox control has been implemented at each site. The first re-introduction was to the eastern block (2000ha) of Boyagin Nature Reserve, 20km north of Dryandra, where 37 numbats were released between 1985 and 1987. A population appears to have become established there, and numbats have now been recorded in the western block (3000ha), which is separated from the eastern block by 500m of farmland.

Since 1986, numbats have been translocated from the wild at Dryandra to three further sites. At a more arid site at Karroun Hill NR (300 000ha) rates of predation, due particularly to raptors and cats, are high. The re-introductions to Tutanning NR (2000ha) and the Batalling area (6000ha under fox control) are at an early stage, but have not suffered from the same rates of predation.

AGAINST THE ODDS - NORTH ISLAND WEKA. CAPTIVE REARING AND WILD POPULATION RESTORATION BY A NON-GOVERNMENT ORGANISATION

Ann and Basil Graeme
Royal Forest and Bird Protection Society of NZ, 53 Princess Road, Tauranga, New Zealand

Unlike many specialist species which decline in the face of changing habitat, competition, and predation, the weka is an apparently adaptable, opportunistic bird which looks like a survivor. But the once common North Island weka, *Gallirallis australis greyii* , has declined and was recently recognised as 'threatened'. This project aims to establish a new population using captive reared birds, within the original subspecies' range on the mainland.

Since the factors causing weka decline are still operating, and these factors remain unclear, how can we hope to establish a mainland population? The project is an exercise in detection, seeking to deduce the factors responsible for decline, to learn from past failed liberations, and to reintroduce the birds to a site, and in such a manner that anticipated hazards are obviated or minimised. Critical factors are thought to include a reliable food source, restitution of a territorial social structure, a tolerant human community, and minimal predation by dogs, poison, and traps.

This paper discusses the probable causes of weka decline, the pros and cons of captive breeding, the choice of a liberation site and method of liberation, and the first releases and monitoring results.

TIRITIRI MATANGI ISLAND, NEW ZEALAND - PUBLIC PARTICIPATION IN SPECIES TRANSLOCATION TO AN OPEN SANCTUARY

M.P. Galbraith and C.R. Hayson
Supporters of Tiritiri Matangi, PO Box 34-229, Birkenhead, Auckland 10, New Zealand

Tiritiri Matangi Island, 25km from the City of Auckland, New Zealand, is an 'open' sanctuary to which bird translocations have been successfully carried out. The open sanctuary classification offers high conservation protection while allowing open (but controlled) access for visitors.

Since 1983, volunteers have been involved in a restoration program to enhance the island's habitats and thus increase its conservation value. Especially significant has been the participation of volunteers and the general public in the translocation of birds (including a number with endangered status) to the island. Further translocations with public involvement are intended.

Volunteers founded the Supporters of Tiritiri Matangi (Inc) in 1988 to ensure the further development of this open sanctuary, which has already earned national and international recognition for its conservation and educational potential. The degree of lay participation in this project makes it unique within New Zealand and perhaps internationally.

AN ENVIRONMENTAL CRITIQUE OF SOME FRESHWATER REINTRODUCTIONS IN AUSTRALIA

Pierre Horwitz
Edith Cowan University, Joondalup Dr., Joondalup, W.A. 6027

The processes of captive-breeding and reintroduction for the recovery of threatened freshwater organisms are examined in the light of potential or real environmental impact. Three case studies are selected as examples of varying commitment to recovery, namely those of an undescribed sub-species of marron *Cherax tenuimanus*, the Murray River crayfish *Euastacus armatus* and the Pedder Galaxiid *Galaxias pedderensis*. For each case, knowledge of natural values in the areas of planned or executed reintroductions is assessed and potential environmental impact discussed. These issues are compared against data collected on the likelihood of the success of the reintroduction. It is proposed that the necessary imperative to preserve species should not over-ride other natural values particularly where such values may be threatened by the reintroduction. In addition, the control of threatening processes (the equally important second imperative in conservation biology) may not always receive the attention it should be given in recovery programs.

THE RUFOUS HARE-WALLABY : A HISTORY OF EXPERIMENTAL REINTRODUCTION OF THE MALA IN THE TANAMI DESERT

K.A. Johnson, D.G. Langford, D.E. Clarke, D.F. Gibson & Willowra Community
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Mala once occupied a third of the Australian continent primarily in hummock grass communities. By 1980 they were reduced to two small populations in the Tanami Desert of the N.T. and Bernier and Dorre Islands off W.A. Captive breeding was begun in 1980 and progeny were used to establish new colonies in the wild. The captive colony has been consistently maintained at about 50 animals and to date over 400 animals have been born. By November 1991, the two original wild populations were extinguished as a result of a drying climate, fox predation and wildfire. Captive bred Mala have been reintroduced to the Tanami Desert with the co-operation of Warlpiri Aborigines. An electric fence system built in 1986 has successfully retained mala and excluded predators. Survival and breeding within the enclosure has been high. A total of 78 Mala have been released into the surrounding bush in groups of about 12. Initial releases suffered high predation from feral cats. This has since declined as a result of cat trapping programs. Released Mala have successfully bred outside the enclosure. Aboriginal involvement is high, consisting of survey work, initial site selection, fence building and maintenance, fire management, predator control and knowledge dissemination. The 12 year program has a high profile in many Aboriginal communities. Unique characteristics of this reintroduction have been a long-term commitment by dedicated staff, recognition of the importance of Aboriginal and ranger involvement, and remoteness of location. The current problem centres on the difficulty in collecting data on survivorship of independent young outside the enclosure.

MANAGING GENETIC VARIATION IN CAPTIVE POPULATIONS DESTINED FOR REINTRODUCTION

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Genetic changes occurring in captivity can make captive-bred stock unsuitable for release. Altered natural selection can adapt a population to captivity and random genetic drift in small populations can deplete the variation needed for re-adaptation to a natural environment. Zoo biologists have developed techniques for managing the genetic diversity of captive populations, with the goal of minimising both random and selective changes. Although techniques are still evolving, several "rules" for more effective management have emerged. To give the opportunity for long-term viability, a captive population should be initiated with at least 20 founders. This founder stock should be expanded rapidly to the capacity of the captive habitat. If possible, 7 to 12 progeny should be produced from each founder, thereby reducing the probability of loss of any allele present in the founders to less than 1%. The captive population should be large enough to assure that no more than 10% of the original genetic variation is lost during the intended duration of the captive population. Priority should be given to breeding animals with the lowest mean kinships to the captive population. Additional emphasis should be placed on obtaining progeny from animals with a substantial portion of their genomes unrelated by descent to any other animals within the captive stock. The most genetically valuable animals should be mated to other genetically valuable animals, thereby preventing irreversible linkages of rare lineages with common lineages. The captive population should be spread over a number of facilities, diversifying the captive environment and isolating subpopulations to reduce the probability of catastrophic loss of the entire population. Movements of animals between subpopulations should be conducted when necessary to prevent close inbreeding. These rules can minimise genetic drift, minimise inbreeding, and minimise genetic response to selection for adaptations particular to the captive environment. Computer programs have been developed to assess the losses of heterozygosity and allelic diversity from a captive population, to define the above management criteria for the population, and to identify the genetically optimal animals for breeding.

SOME ECOLOGICAL CONSIDERATIONS FOR DESIGNING AND PLANNING RE-INTRODUCTION PROGRAMS

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One of the most important factors influencing the success of programs for the re-introduction of wildlife is the suitability of areas targeted for release. Site suitability must be considered at several ecological scales including the biogeographic, landscape, habitat patch and microhabitat levels of resolution. This highlights the need to couple the best available data and analytical approaches to identify suitable release sites and, in turn, maximise the probability of success of reintroduction and/or translocation programs.

MODELLING TRANSLOCATION STRATEGIES

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Most standard population viability analyses have modelled, under various sources of stochastic variation, the effect of remnant population size (usually carrying capacity or population ceiling) on the expected time to extinction. Translocations raise rather different problems: the translocated populations are unlikely to be near carrying capacity, and it is the size of the initial population propagule which is of importance. This paper reports very preliminary results of modelling directed towards translocation of bridled nail tail wallabies *Onychogalea fraenata* and northern hairy nosed wombats *Lasiorhinus krefftii*. Both these species are found only in single populations at present, so translocation is obviously a major conservation priority. The models examine the risk of extinction as a function of propagule size, propagule age structure and introduction frequency, under the influence of both demographic and environmental stochasticity. Genetic considerations will also be discussed briefly.

POPULATION VIABILITY ANALYSIS OF THE HELMETED HONEYEATER : RISK ASSESSMENT OF CAPTIVE MANAGEMENT AND REINTRODUCTION

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Popularity viability analysis can be used to assess the costs and benefits of reintroduction and captive management. A model, based on the behaviour and ecology of helmeted honeyeaters *Lichenostomus melanops cassidix*, was used to predict the probability of success of reintroducing these birds to the wild. The risk of population decline within fifty years was predicted for an isolated colony of helmeted honeyeaters. The results indicated that reintroduction of at least thirteen pairs in a single area would be necessary to ensure a risk of extinction of less than ten percent within the next fifty years.

The model was also used to predict the costs of removing birds from the wild population for reintroduction or captive management purposes. These costs can be expressed in terms of the increased risk of population decline. General implications for reintroduction are discussed.

TRAINING CAPTIVE MALA TO RECOGNISE PREDATORS

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Re-release into the wild is the ultimate objective of virtually all programs for captive-rearing of endangered species. Unfortunately, captive-reared animals necessarily have limited skills for survival at the release site, primarily because of lack of experience with local conditions. While techniques such as acclimation, soft-release and supplementary feeding can be used to hone important foraging and nesting skills there is no equivalent means for developing skills to recognise and respond to predators.

Here we describe an attempt to condition captive-reared Rufous Hare-wallabies (Mala) to recognise two predators, the Fox and Feral Cat, that they will encounter on release into the wild. We take the view that improved recognition abilities will give otherwise naive animals a preliminary advantage when they first encounter the predator. Our results provide strong support for the effectiveness of such conditioning techniques. Implications for future research and management are discussed.

TRANSLOCATION OF NEW ZEALAND'S ENDANGERED INSECTS : A TOOL FOR CONSERVATION

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Before human settlement bats were the only mammalian predator in New Zealand. Many insects became flightless and defenceless and grew to huge proportions. Introduced mammals modified the habitats, and predators almost eliminated the giant insects from the mainland. A four-stage model is useful to guide translocation work.

1. Original site : status, biology.
2. Maintenance in captivity.
3. Breeding in captivity.
4. Receiving site : conditions, management of new site.

For example, giant wetas have been translocated with an understanding only of stages 1 and 4; giant flightless weevils have been translocated by adding stage 2. The most difficult issues are those where the life history and even the basic aspects of diet and feeding behaviour are largely unknown. Not only do all four stages of the model have to be invoked, but the target location (stage 4) location may first have to be restored (Mercury tusked weta). Conflicts of interest with other conservational values may have to be resolved.

REINTRODUCTION OF THE CHUDITCH TO JULIMAR CONSERVATION PARK

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The establishment of Chuditch *Dasyurus geoffroii*, (Marsupialia: Dasyuridae) populations outside their present range is one of the objectives of the Recovery Plan for this species. In September 1992, 24 captive bred Chuditch (19 radiocollared) were reintroduced to Julimar Conservation Park, in the northern Jarrah forest. These were subsequently monitored by radiotracking and trapping. Another 19 captive bred Chuditch (10 radiocollared) were released at Julimar in March 1993. Ages of the animals released ranged from 9 months to 4.5 years. Chuditch initially lost about 9% of their bodyweight but then regained weight. All of the radiocollared Chuditch released in September, except one, have survived. Half of the animals have established home ranges within 2 km of their release point. The maximum movement from release point in this time has been 6.3 km. Dispersal distance does not appear to be related to either sex or age. One female which had 4 pouch young when released has successfully raised these and in January 1993 these were dispersing away from the mother's home range. The quality of diurnal refuge site increased with time after release. Arboreal sites were used by 3 animals. Preliminary dietary analysis suggests that large invertebrates are an important food source as they are in other parts of the Jarrah forest. It appears at this stage that this trial reintroduction has been successful, although the true measure of this will be this winter when breeding should occur. This study has, and will continue to provide valuable information necessary for undertaking a reintroduction to a semi-arid location in 1995.

HELMETED HONEYEATER GENETICS : IMPLICATIONS FOR REINTRODUCTION

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We have used DNA fingerprinting to characterise genetically the surviving population of Helmeted Honeyeaters (*Lichenostomus melanops cassidix*) at Yellingbo, Victoria. By combining DNA results with field observations on bird relationships we have been able to show that:

1. One system of variation (the per/Taq I combination) is attributable to a single locus with twelve alleles;

2. Some infidelities occur in the natural population; and

3. There is a highly significant non-random genetic structure in the natural population in spite of the obligate dispersal by pre-breeding females. The ways that social structure might lead to such local inbreeding are discussed, as is the unorthodox suggestion that reintroduction of this taxon could be designed to incorporate some local inbreeding.

NEEDS AND PROSPECTS FOR INSECT REINTRODUCTIONS FOR CONSERVATION IN AUSTRALIA

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Reintroductions of insects for conservation are novel in Australia, but a number of cases (especially involving butterflies) are well-documented in Europe and North America, and general protocols for translocation, captive breeding and post-release monitoring are being developed. Field translocation and release from captive-bred stock have been anticipated in some management plans for Australian insects. Selected examples are discussed, to evaluate the prospects of reintroduction becoming an important facet of their conservation management.

OPTIONS FOR KOALA MANAGEMENT IN SOUTH EAST AUSTRALIA AND THE ROLE OF REINTRODUCTION BIOLOGY

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The future of the Koala *Phascolarctos cinereus* in the wild is problematic. The species has experienced a significant reduction in geographic range and almost certainly population size, largely as a result of habitat clearance and degradation in eastern Australia since European settlement. Unfortunately, habitat clearance and degradation continues unabated in many parts of the remaining range of the species. In south east Australia the management of the Koala is particularly controversial. For example, in south east New South Wales the species is threatened by intensive forestry practices while in Victoria the protection of habitat and the management of island populations is controversial. This paper considers the potential role of reintroduction biology in the conservation of the Koala and identifies several ecological issues that need to be resolved before the efficacy of reintroduction biology can be adequately determined.

THE FATE OF URBAN COMMON BRUSHTAIL POSSUMS TRANSLOCATED TO SCLEROPHYLL FOREST

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In Australia the Common Brushtail Possum *Trichosurus vulpecula*, has adapted to life in urban areas, often conflicting with human interests. Live trapping and subsequent translocation to outlying native bushland has been used to alleviate these conflicts. This study investigated the fate of translocated urban Common Brushtail Possums.

A total of 74 urban caught possums were released over a 3 month period into the sclerophyll forest study site. All released possums were fitted with reflective ear tags and 12 were fitted with radio transmitters. Of the radio-collared possums, 5 were killed by wild canids, 2 died of stress related trauma, 1 was killed by a vehicle, 2 survived for up to 10 weeks and the fate of the remaining 2 was uncertain. Spotlighting revealed that translocated possums rapidly disappeared from the study area following release, probably due to dispersal and predation. The high mortality and low rate of establishment within the study area appeared to be related to unfamiliarity with the release site and the naivety of the urban possums to the forest environment. Released possums denned frequently on the ground, spent a higher percentage of time on the ground, spent a higher percentage of time in transit and appeared to be less responsive to disturbance than resident possums.

ORIENTATION AND RELOCATION OF ECHIDNAS

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The life range or familiar area of a short-beaked echidna may extend over several kilometres outside of its home range. Echidnas demonstrate good short distance orientation, returning to established burrows or foraging areas directly or shortly after release anywhere within their home range. Home range size for an individual may vary throughout the year.

There is some evidence that echidnas are also capable of long distance orientation when removed outside of their familiar area. Success of homing may depend primarily on distance of displacement. Age, habitat at release site and other factors influencing orientation and homing or establishment of a new home site are also discussed.

A REVIEW OF NEW ZEALAND REINTRODUCTIONS

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The endemic fauna of New Zealand evolved in the absence of mammalian predators, including humans, and with fire as a rare natural event. The recent arrival of humans, who brought with them fire and predatory mammals, has significantly changed the abundance and distribution of endemic and indigenous taxa. Since the 1880's translocation has been seen as a realistic means of saving species from extinction. Some 40 taxa have been involved in more than 400 moves. The majority of these have been from naturally occurring healthy populations to islands or habitat which have been restored by the removal of introduced predators or activity to regenerate forest. Reintroductions to mainland sites, where introduced predators remain but other environmental factors have been restored, have been less successful. Reintroduction from captive reared stock has been used for few species.

EASTERN BARRED BANDICOOT RECOVERY - REVIEW OF REINTRODUCTION EXPERIMENTS IN VICTORIA

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The Management Plan for the conservation of the Eastern Barred Bandicoot, *Perameles gunnii* in Victoria calls for the reintroduction of captive-bred animals into appropriate habitat at a number of sites within the species' former range as a major strategy. Bandicoots have been experimentally released at three sites at which they formerly occurred - Gellibrand Hill Park, adjacent to Melbourne Airport; Hamilton Community Parklands; and "Mooramong", a National Trust property near Skipton, in the Western District. Gellibrand Hill Park and Hamilton Community Parklands have predator-proof fencing, "Mooramong" does not. At all sites free-ranging populations have been established, but with differing levels of ease and success. Predation appears to be a major determinant of bandicoot population numbers.

TRANSLOCATIONS OF ENDANGERED INVERTEBRATE SPECIES IN NEW ZEALAND : SUCCESSES AND LESSONS LEARNT

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Formally recorded attempts at translocating rare species of New Zealand invertebrates are described. One translocation of a giant weta *Deinacrida rugosa* has resulted in an expanding population while two translocations of another *Deinacrida n. sp.* has resulted in transferees successfully breeding. Three translocations of a giant land snail *Bulimulidae : Placostylus* have resulted in one case of successful breeding and 2 uncertain results. Some problems with methodology are identified including determining the previous existence of the transferee species at the new site; identifying suitable new sites within the previous distribution of the species; deciding on the optimum number of 'secure' populations; difficulties monitoring invertebrates at low density and hence determining "success"; how often to restock founder populations to enhance abundance and genetic diversity; transferred animals dispersing into suboptimal habitat and dying; biological features of translocation species including relatively low fecundicity, long life and susceptibility to predation from introduced predators; enhancing the establishment of founder populations.

Translocations must be carried out under the umbrella of a recovery plan and dove-tailed with captive rearing - which in turn should be integrated with research. Future plans for giant weta and *Placostylus* include using captive reared sub-adults as transferees (*Placostylus and Deinacrida*) and placing paired adult *Deinacrida* in exclosures on the new site until they have laid. Planning the recovery of endangered invertebrate species has been enhanced with a national priority plan which ranks all threatened species conservation and a central co-ordinating body (the Threatened Species Unit, Department of Conservation).

REINTRODUCTIONS TO MAINLAND SHARK BAY - THE HEIRISSON PRONG PROJECT

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Local community, mining company, and government departments have combined to create a unique conservation project at Shark Bay that is centred on the reintroduction and husbandry of endangered fauna. They aim to create a secure reserve for up to half a dozen endangered species that is buffered from introduced predators by a barrier fence and a zone of multiple land use (mining, pastoralism, recreation, and conservation) where predator control is a primary activity. Burrowing bettongs were reintroduced to the site in May 1992 from Dorre Island. The initial group of 12 animals has now doubled in size and a further reintroduction of 30 animals from Dorre is scheduled for May 1993. Continued success is critically dependent on ongoing and effective control of foxes and feral cats. Fundamental components of the Project are the testing of hypotheses about species decline and extinction; development of improved techniques for the control of foxes, feral cats, and rabbits; refinement of reintroduction techniques; and extending our knowledge of the ecology of endangered species.

PREDATION BY INTRODUCED ANIMALS ON HAND-REARED AND RELOCATED RINGTAIL POSSUMS PSEUDOCHEIRUS PEREGRINUS

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Since we presented a preliminary report to the Australian Mammal Society in 1991, we completed a radio-tracking study of 82 Common Ringtail Possums released into Ku-ring-gai Chase National Park. The fate of those animals was:

Fox	38
Cat	27
Python	5
Goanna	6
Unknown predator	4
Goshawk	2

We conclude that the presence of foxes, and to a lesser extent cats, must be a major consideration in the release of native animals.

THE IMPORTANCE OF HYPOTHESIS-TESTING IN REINTRODUCTIONS

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Many reintroductions are conducted without specific objectives beyond the initial release. Such unfocussed experimental designs commonly produce imprecise or even flawed interpretations of results. If subsequent reintroductions are to be improved, reliable field information is essential. Observation and indication can extract general patterns from the success or failure of reintroductions, but field tests of hypotheses are more likely to provide reliable knowledge. Beginning with sound ecological studies of a species, researchers should frame and validate hypotheses as improved information becomes available. This process demands flexibility and creativity. For instance, hypotheses can be tested with small numbers of animals derived from surplus genetic stock of captive breeding programs, with the results from these preliminary trials helping to ensure the successful implementation of the reintroduction. As an example of this process, the design and results of the Brush-tailed Phascogale Reintroduction Program will be presented.

WHY SHOULD WE REINTRODUCE THE BILBY?

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Reintroduction provides one of the most powerful tools to learn about factors which limit a species. However, information relevant to the ecology or management of threatened species is commonly not produced by reintroduction programs. Goals are often overly ambitious when little is known about the ecological requirements of the species or the condition of the recipient environment; program resources and objectives are frequently mismatched; and, objectivity is sometimes clouded by emotional issues. A strategy for the reintroduction of the Bilby is proposed which hopefully will avoid such problems.

The Bilby reintroduction strategy stresses that an experimental approach should be taken whenever individuals are released; the characteristics of an organism's home range and generation time should be used to set the minimum duration and size of an experiment; and, assessment of environmental conditions and population survival and fecundity is critical. Monitoring should be adjusted in relation to environmental variability and ideally continue until the range of environmental extremes have been experienced by the population. Hypotheses are presented which focus on the perceived problems influencing the survival of reintroduced population. The essential components of an experiment unit are outlined and the possibilities to begin testing the hypotheses are discussed. It is argued that reintroduction of the Bilby will contribute little to the conservation of the species unless an approach along these lines is adopted.

TRANSLOCATION OF THE FIORDLAND SKINK (*LEIOLOPISMA ACRINASUM*) TO HAWEA ISLAND AND NATURAL DISPERSAL TO BREAKSEA ISLAND, FIORDLAND, NEW ZEALAND

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Following successful eradication of Norway rats in 1986, 20 male and 20 female Fiordland skinks (a littoral species), were reintroduced to Hawea Island in 1988. Mark-resight studies indicate a minimum population of 200 dispersed 300 m along the coast from the release site. Fiordland skinks, probably aided by a westerly gale, dispersed to Breaksea Island from a nearby islet sometime in 1990. In the absence of rats, which were eradicated from Breaksea Island in 1988, this natural founder population also appears to be well established.

HABITAT REPAIR - A NECESSARY PRE-REQUISITE TO TRANSLOCATION

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New species may establish in an area if there is a naturally vacant niche or some event has changed the habitat or removed competing or predatory species from the habitat. If species are to be reintroduced then the original cause of their extirpation from that locality must be removed or other repair activity undertaken to a point where the reintroduced species can survive. Four major aspects of the lifestyle of a species - food, water, breeding and sleeping - are considered and examples of repair activities given. It is noted that many threatened species no longer survive in their preferred habitat and thus predicted habitat requirements need to be considered carefully. The notion that naive species can be 'trained' to survive in a modified habitat is also considered.

THE IMPORTANCE OF DISEASE IN REINTRODUCTION PROGRAMS

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Disease has played an important role in the decline of several endangered animal species and has contributed to the failure of a number of captive-bred animal reintroductions. Despite this, the potential impacts of disease have been largely neglected in reintroduction programs. Co-introduced diseases or diseases present in the resident animal populations may jeopardise the success of a reintroduction program. A number of steps are outlined to minimise risk and to reduce the probability of disease compromising the success of an attempted reintroduction.

THE *GEOCRINIA ROSEA* COMPLEX : TO WHERE DO WE REINTRODUCE THE FROGS?

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Geocrinia alba and *G. vitellina* are two of Australia's most restricted vertebrates, breeding sites of the latter occurring in less than 20ha within a narrow range. The former is more widespread but over 80% of its range is private land. Less than 9km separates the distributions of the two species. Developing awareness by landholders for *G. alba* is a critical first step in its conservation. In the meantime, populations are becoming extinct due to the deterioration or clearing of its riparian breeding sites. Reintroduction programs are required but must focus on rehabilitation of habitat, landholder co-operation and the historic distributions of both species.

Increasing human activity and the likely spread of feral pigs into its habitat increase the vulnerability of *G. vitellina* and suggest a need for translocation. Defining suitable sites and focussing on historic distribution patterns are critical issues in the translocation of this species.

SOME INVERTEBRATE ISSUES IN THE REINTRODUCTION OF THREATENED SPECIES OF INSECTIVORES IN VICTORIA

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Reintroduction biology has generally involved species of threatened vertebrates. In Victoria, nearly 40% of threatened vertebrate species are entirely insectivorous, and over 35% include invertebrates as an important component of their diets. Some of the issues involving invertebrates in the reintroduction of insectivores, whether it involves reintroduction into new or former habitats, supplementing remnant populations, or even maintaining captive bred populations, are outlined. It is suggested that a greater emphasis on invertebrate conservation will benefit vertebrate reintroductions.

RE-INTRODUCTION OF THE SWAMP ANTECHINUS (*ANTECHINUS MINIMUS*) TO ANGLESEA HEATHLANDS, VICTORIA

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The Swamp Antechinus is a carnivorous dasyurid which, in southern Victoria, is restricted to wet areas of predominantly coastal habitat. Before the 1983 Ash Wednesday fires the species was present near Anglesea. Although captured after the fires, subsequent extensive trapping indicates the species has become locally extinct. An aim of this study was to re-introduce *A. minimus* and monitor subsequent behaviour. Observation of a population at Port Campbell revealed diurnal activity, the use of extensive underground burrows and daily movements within areas of approximately 0.3 ha.

In December, a time when dispersal normally occurs, 10 juvenile animals were translocated from Port Campbell to Anglesea. Six radio collared animals were released into artificial burrows. Animals were readily retrapped and released again with supplementary food at the artificial nest. After 5 days 3 animals died, having lost up to 30% of initial body weight. Two healthy females remain resident at the site.

BREEDING MANAGEMENT OF CAPTIVE MALA FOR REINTRODUCTION AND CONSERVATION

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A prerequisite for the successful reintroduction of captive-reared specimens of a rare or endangered species is a viable, well managed, self-sustaining captive population with broad genetic representation. The captive population must be able to endure the loss of many animals over a long period while reintroduction techniques are developed and perfected.

Here we describe and analyse 12 years of studbook records from a captive population of the Rufous Hare-wallaby or Mala maintained at the Arid Zone Research Institute in Alice Springs. This information is examined with respect to theoretical models for self-sustaining populations and to investigate the effects of inbreeding on fecundity and juvenile survival.

Despite originating from a small number of founder stock the captive Mala population appears to be self-sustaining and there were no detectable effects on fecundity and juvenile survival associated with the levels of inbreeding currently present in the population. Future options for management of the captive Mala population are discussed.

THE FAT-TAILED DUNNART (*SMINTHOPSIS CRASSICAUDATA*) : POTENTIAL FOR REINTRODUCTION STUDIES

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The Dasyurid genus, *Sminthopsis*, contains about 18 species many of which gave a limited geographic distribution and relatively small population size. *S. crassicaudata* is one of two species having a distribution that almost spans the continent. The Genetics Department's colony of *S. crassicaudata* was established in 1965. In the period 1968 to 1974, additional animals were obtained from widespread sources within and around South Australia. No further additions have been made over the last 18 years, the colony being maintained as a closed, disease-free population.

Dasyurid marsupials are subject to predation by introduced species such as foxes and cats, and also experience reductions in habitat quality and area. For example, two species of *Sminthopsis, S. crassicaudata* and *S. murina* are very rare and possibly extinct on the Adelaide Plain where they were thought to have been patchily distributed, but common, in the early days of settlement.

It is proposed to use the Genetics Department's colony as a supply source for reintroduction experiments. These experiments will involve the release of a limited number of genetically defined, and physically tagged animals into controlled areas free from feral predators (e.g. cats, foxes and dogs), but with controlled exposure to natural predators (e.g. owls, hawks and snakes). The experiences gained from these planned reintroductions, and from the successful establishment of an expanding laboratory colony of *S. crassicaudata*, are expected to have application to rarer species of *Sminthopsis* and possibly other Dasyurids.

THE BRUSH-TAILED ROCK WALLABY IN EAST GIPPSLAND : CHROMOSOME AND ALLOZYME COMPARISON WITH CONSPECIFICS

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Although chromosomes of *Petrogale penicillata* from Grampians and Jenolan Caves populations are similar, Gippsland animals carry a unique X-chromosome. These are larger than Grampians animals and have a different blood enzyme. Such differences demonstrate the potential of *Petrogale* to survive in small, genetically divergent groups.

Although the different X's are unlikely to cause infertility, results would be unpredictable if the different populations interbred. That is, the increase in genetic variation might benefit some populations, while breakdown of co-adapted gene complexes might harm others.

The only captive source of Brush-tails derive most recently from Kawau Island (N.Z.). These animals have the typical X-chromosome but also a unique blood enzyme. Translocations of these animals would be unwise unless the site is isolated and all local populations extinct.

REINTRODUCTIONS OF THE GREATER STICK-NEST RAT, *LEPORILLUS CONDITOR*

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During 1990 and 1991, 101 captive-bred stick-nest rats *Leporillus conditor* (51M:50F) were reintroduced to 344ha Reevesby Island (S.A.) Survival, dispersal and reproduction were monitored using radio-tracking, and pitfall and Elliott trapping. Radio-tracking provided by far the most reliable and complete data-set for each animal monitored. Released rats had a high survival rate. They quickly established relatively fixed home ranges and regained lost body condition. Females occupied core areas of about 1ha; males ranged further with regular movements of 800m plus. Up to five litters per female were recorded within the first 9 months (mean litter = 1.5) and at least 57 young were found of an estimated 100 produced in this period. Predation by owls was detected, but minimal, probably due to the abundant dense vegetation cover present. Forty *Leporillus* (18M;22F) were also released on 160ha Salutation Island, Shark Bay (W.A.) in July 1990. Monitoring revealed similar behavioural and reproductive patterns to those on Reevesby, although there was a significant initial mortality of released rats due to the long and varied transit conditions. Two releases at Yookamurra Sanctuary on the S.A. mainland in 1991 and 1992 failed primarily due to high levels of predation by a fox or foxes and by birds of prey.

REINTRODUCING THE RED-NECKED WALLABY, *MACROPUS RUFOGRISEUS*, TO THE SMELTER IN THE PARK

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A large buffer zone surrounds the smelter operated by Portland Aluminium on the outskirts of Portland, western Victoria. The buffer is progressively being developed as a conservation park under a project called the 'Smelter in the Park'. The goal of the project is to integrate the large smelter complex into a semi-natural setting, providing a biologically-diverse and aesthetically-pleasing environment which will be accessible by smelter staff and the wider community for recreation and education purposes. The project entails extensive habitat rehabilitation and progressive reintroduction of flora and fauna. Red-necked Wallabies, *Macropus rufogriseus*, were once common in the area and may still occur there at a low density. A population reinforcement trial was conducted in 1991, using four adults (2 males, 2 females) originating from the nearby Cobboboonee State Forest. On release in the park they dispersed rapidly; at least two died shortly after, and none established themselves in the park. In the light of this experience a cautious reinforcement program commenced in 1993. A 7.5 ha predator-proof enclosure is under construction, incorporating an area of remnant coastal heathland and shrubland, some former pasture and a permanent wetland. A founder group of 8 radio-collared animals will be released into the enclosure, and their survival and reproduction monitored to gauge the appropriate time for release in 1994/95. Prior to their release, a program for control of exotic predators throughout the park has begun, together with a program of habitat enhancement by revegetation and control of environmental weeds.

ACCLIMATISATION OF BUSH THICK-KNEES (*BURHINUS MAGNIROSTRIS*) FOR MONITORED RELEASE TO YOOKAMURRA SANCTUARY

Mark Craig and Christina MacDonald
Adelaide Zoo, Frome Road, Adelaide, S.A. 5000

Dr John Wamsley, creator and Director of Earth Sanctuaries has shown that by excluding feral species from an area by means of a specially designed fence, it is possible the native wildlife and vegetation within the enclosure have a better chance of survival.

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The Adelaide Zoo contributed to this project by undertaking a release to the sanctuary of six captive-bred Bush Thick-knees *Burhinus magnirostris*.

The poster presentation will outline the procedures taken to reintroduce this species to Yookamurra Sanctuary.

1. The function, design and fitting of radio transmitters.
2. The acclimatisation process in an eight hectare compound.
3. Methods of monitoring their acclimatisation to the area.
4. Results of the project.

THE USE OF FAECAL PELLET ANALYSIS FOR THE ELUCIDATION OF MACROPOD DIETS IN NATURAL HABITATS USING CONFOCAL SCANNING LASER MICROSCOPY.

Fred G. de Munk
Department of Applied Chemistry, Faculty of Applied Science, Royal Melbourne Institute of Technology, Plenty Road, Bundoora, Vic. Aust. 3083

This study has sought to improve the accuracy of determining the diets of wild animals from faecal analysis by the addition of Confocal Scanning Laser Microscopy (CSLM) and the use of a database compared with the use of transmission microscopical examination alone. Two hundred and twenty eight species of native and introduced plants which were thought to be possible components of herbivorous diets were collected from various lowland habitats of Macropus giganteus (Eastern Grey Kangaroo) and the abaxial, adaxial and where appropriate, stem epidermis were digested stained with Gentian Violet and mounted for CLSM and transmission microscopy.

M. giganteus faecal pellets were collected from the same habitats on a weekly basis for twelve months and prepared for similar epidermal examination. It was possible to positively identify epidermal fragments in the macropod faecal pellets much more efficiently and accurately using the transmission, CLSM and database tools in combination when compared to the use of transmission light microscopy alone as has been used in the past.

The elucidation of macropod diets in natural habitats provides important baseline data for the proper reintroduction of native animals into their habitats.

REINTRODUCTION OF THE QUENDA (*ISOODON OBESULUS FUSCIVENTER*) TO THE WHEATBELT OF WESTERN AUSTRALIA

J.A. Friend, G. Collis and N.D. Thomas
W.A. Wildlife Research Centre, CALM, PO Box 51, Wanneroo, W.A., 6065

A group of 40 quendas was translocated in October 1991 from dense shrubland on a highway development site in an outer suburb of Perth to Tutanning Nature Reserve (2000ha), where the species became extinct between 1972 and 1980. Fox control using 1080 in meat baits has been carried out on the reserve since 1984. Twenty of the quendas were fitted with radio transmitters. The quendas were released at four shrubland sites. The translocated animals were monitored by radio-tracking and by trapping at the release sites.

All but three of the radio-tagged quendas established home ranges near their release sites. In the first five months, only three mortalities were recorded amongst the radio-tagged individuals, none due to predation. On all trapping occasions, more than 50% of females were carrying pouch young. The first capture of a newly independent juvenile occurred in April 1992. In October 1992, seven out of 16 animals captured had been recruited at Tutanning. A further 38 quendas from the same source were released at Tutanning in November 1992

TIRITIRI MATANGI ISLAND, NEW ZEALAND - OPEN SANCTUARY

M.P. Galbraith and C.R. Hayson
Supporters of Tiritiri Matangi, PO Box 34-229, Birkenhead, Auckland 10, New Zealand.

Tiritiri Matangi Island, 25 km from the City of Auckland, New Zealand, is an 'open' sanctuary to which bird translocations have been successfully carried out. The open sanctuary classification offers high conservation protection while allowing open (but controlled) access for visitors.

In co-operation with Department of Conservation, volunteers have been involved in projects over the past decade to increase the island's conservation value. These projects have included revegetation, habitat enhancement, boardwalk construction, purchase of equipment, and assistance with bird translocations.

Especially significant has been the participation of volunteers and the general public in the translocation of birds (including a number with endangered status) to the island. These have attracted media attention, and stimulated an on-going public interest in the project. This public participation has shown the value of the open sanctuary concept for effective conservation education, and Tiritiri Matangi has earned national and international recognition for its conservation and educational potential.

ACCLIMATISATION OF BUSH THICK-KNEES (*BURHINUS MAGNIROSTRIS*) FOR MONITORED RELEASE TO YOOKAMURRA SANCTUARY

Mark Craig and Christina MacDonald
Adelaide Zoo, Frome Road, Adelaide, S.A. 5000

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A HEALTH MONITORING PROGRAM FOR CAPTIVE, TRANSLOCATED AND WILD CHUDITCH (*DASYURUS GEOFFROII*)

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K. Morris
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To date a total of 40 captive chuditch *Dasyurus geoffroii* have been sampled prior to their release at Julimar Conservation Park and subsequently 15 have been recaptured for testing. Blood was collected for complete blood counts, serum biochemistry and serum protein electrophoresis. Serum was stored for *Chlamydia, Toxoplasma, Leptospira,* and *Listeria* antibody titres. Faeces was examined for parasites and to review bacterial flora. A wild population of chuditch at Batalling block (50 km east of Collie) was used as a control population and the same protocol followed. Reference intervals for haematological and biochemical parameters were established from 15 animals to allow comparison with captive and translocated animals. The implementation of the program and logistical considerations are discussed.

It is anticipated that haematology, serum biochemistry and serum protein electrophoresis may be useful tools in assessing the health, progress, nutrition and level of stress in wild and translocated animals, and several preliminary findings support this. Results to date suggest that wild animals may carry parasitic and bacterial infections without apparent clinical disease in the short term. Results will be critically analysed when there is sufficient data.

GENETIC MANAGEMENT OF CAPTIVE STOCKS FOR RE-INTRODUCTION : THE WESTERN AUSTRALIAN EXPERIENCE

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G. Kuchling
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K. Morris
W.A. Wildlife Research Centre, PO Box 51, Wanneroo. W.A. 6065

The Western Swamp Tortoise (WST) and the Chuditch are being bred in collaborative programs at Perth Zoo for translocation to managed sites in the wild. The genetic management of each species is very different. Most of the entire WST population has been DNA profiled, which revealed that the animals are genetically uniform. However, the captive chuditch are a subset of a larger population, and show greater genetic variation. The management of these very different gene pools will be discussed.

REINTRODUCTION OF WESTERN SWAMP TORTOISES : WHY, HOW, WHEN, WHERE

G. Kuchling
Department of Zoology, The University of Western Australia
A.A. Burbidge
Western Australian Department of Conservation and Land Management

Only one wild population of about 30 Western Swamp Tortoises *Pseudemydura umbrina* (WST's) exists at Ellen Brook Nature Reserve (EBNR) near Perth. A goal of the ten-year Recovery Plan, being implemented by the WST Recovery Team, is to create a second wild population at nearby Twin Swamps Nature Reserve (TSNR). During 1993-94 a predator-proof fence will be constructed around TSNR and a bore and pumps will be installed to pump groundwater to supplement some of the ephemeral swamps in order to extend, during dry years, the period of swamp life. These measures should eliminate the causal factors for the local extinction of the species at TSNR during the 1980's. During the past four years a captive breeding project at Perth Zoo has produced 44 WST's. All captive-bred tortoises are DNA fingerprinted and genetic management will ensure that, in the long term, all available founders (including wild animals) will contribute genetically to the translocated population. Re-introductions are planned to commence in the winter of 1994. when captives of sufficient size are available. Five to ten WST's will be released and closely monitored by radio-tracking, which will extend through the summer, when wild animals aestivate, to ensure that the captive-bred animals can cope with the somewhat harsher natural conditions. Further releases are planned from 1994 onwards, with releases numbers depending on the continuing success of captive breeding.

THE NUTRITIONAL IMPORTANCE OF ACACIA GUM EXUDATES IN RELATION TO THE DISTRIBUTION OF THE LEADBEATER'S POSSUM

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The Leadbeater's Possum, *Gymnobelideus leadbeateri* is a small arboreal marsupial found in temperate forests dominated by *Eucalyptus regnans* in the Victorian Central Highlands. This 'rare and vulnerable' species chews V-shaped notches into the trunks of certain Acacia trees (*A. dealbata, A. frigescens* and *A. obliquinervia*) in order to obtain the gum which exudes from these wound sites.

Acacia gums consist primarily of complex uronic acid-containing polysaccharides (not all of which are digested by non-ruminants), up to 59% protein, and large quantities of tannins which may interfere with the digestion of certain amino acids and carbohydrates. While the Leadbeater's Possum obtains most of its protein from seasonal invertebrates these gums may be a source of certain essential amino acids and the bulk of the possum's energy is probably supplied by Acacia gum exudates.

A detailed study of the nutritional components of these exudates will determine the extent of any intraspecific variation in the nutrients due to environmental parameters, as well as any interspecific variation in the gum exudates. Results will also indicate the degree of dependence the Leadbeater's Possum may have on these exudates as a seasonal source of food. Should these exudates prove to be related to the distribution of the Leadbeater's Possum in the wild, it may be necessary to incorporate these parameters into the design of reintroduction programs for this species.

GENETIC MANAGEMENT OF CAPTIVE AND WILD EASTERN BARRED BANDICOOTS

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The original Victorian wild population of the Eastern Barred Bandicoot *Perameles gunnii* is nearing extinction. Although the species exists in Tasmania, mitochondrial DNA data suggests that the Tasmanian and Victorian populations are genetically distinct (based on nucleotide sequence divergence of 2.5%). Compared to Tasmania, genetic variability within Victoria is very high, and there are genetic differences between the east and the west of the Victorian population. Therefore, the captive propagation program is designed to preserve high levels of genetic diversity originally present in the wild caught founders. Both "ranching" and "isolated pair" approaches have been taken in the management of the captive colonies, and their relative merits are evaluated. The management challenge is to manage the captive and wild metapopulations to ensure long-term survival and genetic fitness. This has been aided by the identification of molecular markers, which should be useful in directing the choice of animals for reintroduction.

SHOULD CAPTIVE BREEDING BE PART OF A MALLEEFOWL CONSERVATION PROGRAM IN WESTERN AUSTRALIA?

Jean-Paul Orsini
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In any attempt to establish a captive breeding program to preserve an endangered species, an analysis should be conducted comparing the likely benefit of such a program with the benefits of a program aimed at conserving existing wild populations and their habitat. In the case of the Malleefowl in Western Australia, more information is needed on the species' current distribution, density and preferred habitat, chick and adult mortality, effect of fire, predation, fragmentation of habitat and food availability in drought time.

However, it might take many years to obtain even a small fraction of the information listed above and most people would agree that we cannot wait until the species is on the brink of extinction to implement a suitable recovery plan. A captive breeding program within a carefully planned Malleefowl sanctuary would boost public interest, promote education in Malleefowl preservation and provide revenue from touristic visitation, as well as aim to reverse the species current decline through a reintroduction program modelled on the one in the process of being implemented in New South Wales.

EAGLES HERITAGE RAPTOR WILDLIFE CENTRE

Phillip Robert Pain
PO Box 262, Margaret River. W.A. 6285

The Eagles Heritage was opened to the public in January 1988. This specialised Centre was developed in response to an overwhelming need to provide a suitable facility to treat, rehab and release displaced birds of prey back into the wild. A successful proven method of re-introduction of treated birds back into the wild is applied to birds on an individual needs basis. A special program is designed for each individual bird. Captive breeding has been quite successful using permanently disabled birds. This program is helping us to develop and evaluate the most suitable and practical method of release and re-introduction back into the wild. Using our most common species of raptor to form a solid proven basis that will be applied when we progress to breeding and releasing our rare and vulnerable birds of prey. Sadly, the controlled captive breeding and releasing of birds of prey back into the wild is virtually non existent in Australia even though a number of our raptor species is rare, vulnerable or threatened. All wildlife, not just mammals, deserve to be carefully studied and monitored. This will give us a clear picture to base our captive breeding programs on with the aim of this program to prevent problems in the wild and in captivity rather than try and cure these problems after th birds are in trouble, i.e. before it is too late.

HABITAT SELECTION BY THE HELMETED HONEYEATER *LICHENOSTOMUS MELANOPS CASSIDIX* AND ITS IMPLICATIONS FOR REINTRODUCTION

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The decline of the Helmeted Honeyeater over the last century has been attributed to loss of habitat. However, the loss of individual colonies, or the species' failure to expand into apparently suitable habitat is not so easily explained. Using logistic regression analysis, habitat models for the Helmeted Honeyeater were constructed using both current and historical presence/absence data. Several structural variables were identified to be of importance within two floristic communities. Within the *Eucalyptus camphora* community these were the number of stems per hectare, teatree height and the interactions, teatree height x canopy depth and bark index x water cover, and within the *E. viminalis community*, canopy depth and dieback index. These models could be used to predict the suitability of a site for reintroduction of birds, or to determine the extent of available habitat within the reserve. Possible reasons for the decline of the bird in the wild and options for future management of Helmeted Honeyeater habitat are also discussed.

FROGS OF THE *GEOCRINIA ROSEA* COMPLEX : CONSERVATION ISSUES AND PROSPECTS FOR REINTRODUCTION

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Grant Wardell-Johnson
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Don Driscoll
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The *Geocrinia rosea* complex contains four frog species found across the far south-west corner of W.A. : *G. lutea* around Walpole; *G. rosea* from the drainages of the Deep to Shannon Rivers; *G. vitellina* in Spearwood Creek and four unnamed seepage systems, and, *G. alba*, between Witchclife and Karridale, west of the Blackwood River. All are spring-summer breeders with direct developing eggs. There are no threats to the long-term persistence of either *G. rosea* or *G. lutea*. *G. vitellina* has approximately 0.2 km^2 of breeding habitat and disturbance, e.g. by pig foraging, at any of the five known breeding sites could cause local extinction. Captive breeding, or, introduction to sites outside the natural range coupled with reintroduction programs may be warranted to replace unnatural loss of *G. vitellina* populations. *G. alba* has lost about 70% of suitable breeding sites to clearing within a total range of 101 km^2 with 1.9 km^2 of breeding habitat left. Local extinctions have occurred at monitored sites within the last ten years, some correlated with intense fires. Reintroduction of *G. alba* to cope with loss of populations caused by disturbance or to sites where vegetation has been rehabilitated may be warranted as long-term, conservation measures.

RE-INTRODUCTION OF A REHABILITATED WEDGE-TAILED EAGLE TO THE WILD

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'Bilyarra', a two-year-old male wedge-tailed eagle, was donated to Healesville Sanctuary after being found in the Gunbower State Forest in December 1991. The bird had fractured its right carpometacarpal joint and was unable to fly. Following an intensive rehabilitation program, the eagle was released in suitable habitat near Heyfield, Victoria in January, 1993. In order to monitor post-release movements and activity levels, the bird was fitted with a satellite radio transmitter tag. Major post-release findings include the following: 1) The eagle remained in the general release area, consistently roosting for the night within 3 km of the point of release. 2) A 2-4 day cycle of activity peaks and troughs was observed, suggesting that the bird was feeding regularly (followed by loafing). 3) The eagle's body was recovered 39 days after release. Activity data indicated the bird had died 12-14 days earlier; possible causes of death include agonistic interactions with a resident pair of wild eagles.

THE DEVELOPMENT OF CAPTIVE-RELEASE TECHNIQUES FOR HELMETED HONEYEATERS *LICHENOSTOMUS MELANOPS CASSIDIX*

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There is potential for two distinct phases, requiring quite different approaches, to proposed reintroductions of Helmeted Honeyeaters.

i) Supplementation of the existing relict wild population;
ii) Establishment of new colonies at sites where the subspecies has become extinct.

Some experimentation aimed at achieving the first objective has been undertaken. Survival of captive-released passerines is believed most likely to succeed if the majority of their learning experience occurs in the wild. With this in mind, trials of the adoption of extra eggs, nestlings and fledglings, re-adoption following periods of separation, and adoption of young of varying ages, by both wild and captive adult birds have been undertaken. Most of the trials have succeeded and they illustrate methods by which captive-laid Helmeted Honeyeaters might be used to augment the existing wild population. The techniques and limitations of the trials are outlined.

GENETIC VARIATION IN THE GREATER BILBY

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Mark Adams
Evolutionary Biology Unit, South Australian Museum, North Terrace, Adelaide, S.A.

The taxonomic status of and genetic diversity amongst extant populations of the Greater Bilby, *Macrotis lagotis*, were assessed using allozyme electrophoresis. A total of 47 Bilbies sampled from three geographic areas and two captive colonies were screened for 42 loci, six of which were polymorphic. The results are consistent with the view that all extant populations represent a single biological species. All population were genetically very similar (Nei D's 0.000 to 0.004) and overall levels of within-population genetic variability were low (H_0 0.004 $\pm$ 0.004 to 0.0026 $\pm$ 0.017). The allozyme data support the hypothesis that there has been no significant loss of variability in the captive colonies when compared to the species as a whole.

ISLAND RESTORATION RESEARCH, BREAKSEA SOUND, FIORDLAND, NZ.

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Stemming from ecological surveys in the 1970's and successful trials on neighbouring Hawea Island in 1986, an ambitious, ground-based poison campaign to eradicate rats from large (170 ha), and rugged Breaksea Island was successfully achieved in 1988. Translocations of invertebrates, lizards and birds and monitoring recovery of native flora and fauna are an integral part of this island restoration program, jointly undertaken by Manaaki Whenua and Department of Conservation.