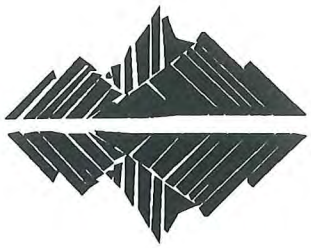

# NEW ZEALAND ECOLOGICAL SOCIETY

# ANNUAL CONFERENCE 1993

# AUCKLAND UNIVERSITY

**and**

# A JOINT SYMPOSIUM WITH

# SYSTANZ

**on**

# SYSTEMATICS, BIODIVERSITY AND CONSERVATION

**ORGANISED BY**

**ENVIRONMENTAL SCIENCE**

**and**

**THE CENTRE FOR CONSERVATION BIOLOGY**

**AUCKLAND UNIVERSITY**

**IN ASSOCIATION WITH**

**THE DEPARTMENT OF CONSERVATION, AUCKLAND**

**Sunday 22nd August**
2-5pm Registration & Student session

**Monday 23rd August**
8:30 Registration
Human Sciences Building
Level 3

10:30 Tea

11:00 Official opening
Christine Fletcher MP
Graeme Campbell
DoC, Auckland

12:00 Lunch

**Session 1**
1:30 John Innes
1:50 Kath Dickinson
2:10 Peter Espie
2:30 Bill Lee
2:50 Alison Franklin

3:10 Tea

**Session 2**
3:40 Shane Wright
4:00 Dave Kelly
4:20 Gill Rapson
4:40 Bob Webster

**Session 3**
Wayne Fraser
Gary Bramley
Steve Wratten
Mike Fitzgerald

**Tuesday 24th August**

**Session 4**
9:00 Simon Thrush
9:20 Graeme Hickling
9:40 Jenny Brown

10:00 Tea

10:30 Panel Discussion
Collections &
databases
FORST, MORST
and users

12:00 Lunch
Poster Session

**Symposium**
**SESSION S1**
1:30 Peter Wardle
1:50 John Craig
2:10 Allen Rodrigo
2:30 Philip Simpson
2:50 Russell Gray

3:10 Tea

**SESSION S2**
3:40 C Scott Baker
4:00 John Ogden
4:20 Richard Allibone
4:40 Phil Garnock-Jones

**Wednesday 25th August**

**Session 5**
9:00 E G White
9:20 Sandra Anderson
9:40 Chris Ward
10:10 Ross Beever

10:30 Tea

**Session 6**
11:00 Cathy Shave
11:20 Dale Towers
11:40 Martyn Kennedy
12:00 Colin Townsend

12:20 Lunch

**Session 8**
1:30 John Parkes
2:00 LLoyd Robbins
2:20 Ian Payton
2:40 Ian MacFaddan
3:00 Mick Clout

3:20 Tea

**Session 9**
3:50 Sibilla Girardet
4:10 Richard Harris
4:30 Craig Miller

**Session 7**
Hamish Maule
Mitchell Andrews
Kristin Svavarsdottir
R Bungard

**Thursday 26th August**

Field trip to Rangitoto & Motutapu Islands
Departs 9.00am Marsden Wharf
Returns to town by 4pm

**N.B.**
Most sessions will be in lecture theatre HSB1
Sessions 3 & 7 will be in HSB2
Sunday registration is in the Biology Building
Posters will be in the cafe on Level 4

SYSTANZ papers will run concurrently
with our sessions 5,8,9 in HSB2

**Monday 23rd August**

**11am Official opening of the 1993 conference**

**Christine Fletcher MP for Eden**
**Graeme Campbell, Regional Conservator,**
**Department of Conservation, Auckland**

Conference Organisers: Neil Mitchell, Environmental Science; John Craig, School of Biological Sciences

**SESSION 1 Lecture Theatre HSB1, Human Sciences Building Level 3**

1:30

**Fates of nesting attempts of North Island kokako on the mainland, as revealed by time-lapse photography**

John Innes, Rachel Shorten, Kerry Brown, Dale Williams, Manaaki Whenua, Landcare Research Ltd., Private Bag 3052, Palmerston North.

Since 1989/90, 49 nesting attempts of N.I. kokako have been monitored at Rotoehu forest in the Bay of Plenty. Of these, only 8 (16%) have successfully fledged young. Of the 28 explained failures, 22 were predations and 6 were desertions. Thirteen known failures were unexplained since we couldn't find or reach the nests.

So who were the predators? Time-lapse, 24-hour video surveillance provides a break-through technique which allows direct observation of predation events. Filming at 11 nests has so far revealed that predators were ship rats, kahu (harriers) and possums. Ship rats (frequently) and possums (rarely) also visited nests without preying on their contents. Ship rats were confirmed scavengers after predation by other species; therefore sign left at nests may be that of scavengers, not predators. We filmed a rat causing a late-stage chick to leap prematurely from a nest; we label this "disturbance". Such non-fatal (at the time) interactions between birds and rats or possums may be common in podocarp-broadleaved forests.

1:50

**Ecotone stability or dynamic processes? A study of Holocene dune-wetland systems in coastal South Westland**

K.J.M. Dickinson[1] and A.F. Mark[2],
1. School of Biological Sciences, Victoria University, Box 600, Wellington;
2. Botany Department, Otago University, Box 56, Dunedin.

A sequence of six alternating Holocene dune-slack features are characterised in terms of surface profile, vegetation pattern and associated environmental parameters for the outer 2.3 km strip of coastal plain in the Haast Ecological District, South Westland. Climatic conditions are strongly perhumid and mesothermal.

Restricted random sampling and multivariate analyses of quantitative and floristic data from up to seven structural tiers at 54 sites along the sequence have revealed 12 quadrat groups (communities) and 12 generally related floristic groups from among the 110 vascular species and more important bryophytes of the 84 taxa recorded.

Mixed podocarp-*Nothofagus* - broadleaved rain forest, up to 33m tall, dominates the crests and the upper slopes of the beach ridges. Swales comprise mostly herbaceous wetlands. The communities within each of these two major vegetation types relate to distance from the coast and hence age, the intervening fringe (ecotonal) vegetation constitutes another five communities.

Drainage is established as the major determinant of vegetation distribution. Environmental conditions highly favourable to paludification prevail and account for the considerable and increasing peat depth (to 6.7m) with distance from the coast, as well as the gradual replacement of forest vegetation along its fringes, thereby suggesting a dynamic process rather than ecotone stability. Slight doming of the wetlands, marginal lagg streams and local development of string pools indicative of patterned aapa mires are special features.

Changes at various scales are operating. At the macro-scale, active progradation is occurring with three major and three smaller sediment-laden rivers discharging *c.* 50 million tonnes annually on to the coast of the District. A soil chronosequence is demonstrated by soil aging with increasing distance from the coast, associated with low nutrients, high organics, high acidity and podzolisation of adequately drained sites under a forest cover. At the meso-scale, conditions at the pronounced ecotone between predominantly wooded vegetation and wetland are probably favouring the latter through paludification processes.

Very high ecological and nature conservation values of this dune-slack sequence and associated vegetation pattern justify the highest status of protection.

2:10

**A new interpretation of ecological processes in *Hieracium* invasion**

Peter Espie, AgResearch, Private Bag 50034, Invermay

Hawkweeds, species of *Hieracium* are one of the greatest biological challenges facing conservation and pastoral farming in New Zealand's montane grasslands. Introduced from Europe around the 1880's, they have dramatically increased since the 1960's, reducing stocking capacity and threaten native flora.

Hawkweed density in Waimakariri unimproved fescue tussock grassland increased from 1 plant/64 $m^2$ in 1980 to 1 plant/0.25-4 $m^2$ in 1992. Mean ground cover of *H. pilosella* increased from 0.04% to 1%. Three additional species, *H. lepidulum, H. ceaspitosum* and *H.* x *stoloniferum* invaded the site.

Hawkweed established in bare ground was not significantly greater than in fescue grassland. Nor did enhanced fertility increase establishment. Grazing significantly altered the relative abundance of hawkweed species.

The processes of hawkweed invasion are discussed in relation to these results.

2:30

**Dispersal traits: do they really matter? Fruit features in relation to the ecology and distribution of *Acaena* (Rosaceae) species in New Zealand**

William G. Lee, B.H. MacMillan and T.R. Partridge, Manaaki Whenua - Landcare Research, Private Bag 1930, Dunedin

Plant fruits exhibit a range of accessory structure which are considered to assist the dispersal of seeds. Some plant species have specialised morphological extensions such as hooks of barbs that enable fruits to adhere to passing animals (epizoochory). In this study we investigate fruit features and ecological relations of 17 *Acaena* species in New Zealand, in an attempt to determine the habitat, distribution and seed differences between species with barbed fruits and those lacking barbs.

The results show that morphological features facilitating adhesion to animals are associated with a distinctive set of fruit features and habitats. We identify those habitats in New Zealand which appear to favour the development of epizoochory and speculate on the impact of human settlement and changes in the type of dispersers currently available.

2:50

**Reproduction in Kaimanawa Feral Horses**

Alison Franklin, Department of Ecology, Massey University, Private Bag Palmerston North.

Observational and post mortem data were collected from March to July 1993 to measure reproduction in feral horses in five ecological zones of the Kaimanawa horse range. Working on foot over 30 field days, I counted horse bands and recorded where possible the age classes and sexes of band members. 217 bands were observed. In a widely publicised round-up between the 7th and 9th of June 1993, 231 horses were removed from two ecological zones. Of these animals, 151/231 (65%) were aged from visual examination of tooth wear and had blood samples taken and post mortem data were gained from 67 adults. Field observations showed that the foal to adult ratio of 0.3 did not vary significantly between ecological areas. Post mortem data showed that mares ranged in age from 2 to 11 years and 20/26 (76%) of the mares were pregnant. Of these, 18/26 (69%) were also lactating. These results and those of Rogers (1991, NZ J Ecol, 15(1)49-64) suggest that mares have not experienced social or nutritional challenges to reproduction. Immunocontraception is a feasible management option, given the absence of any differences in fecundity between ecological zones and age groups discovered in this study.

**SESSION 2 Lecture Theatre HSB1, Human Sciences Building Level 3**

3:40

**Dendrocentric sampling - a plant 's eye view**

Shane Wright and John Ogden, School of Biological Sciences, University of Auckland

Vegetation sampling which uses individual plants rather than defined areas (plots) as the foci of information gathering has been termed the dendrocentric approach. Dendrocentric sampling concentrates interest on the immediate environs of a chosen (eg. juvenile) individual. A 'plot' may still be used to define the area of search for that individual but it is no longer the determinant area for information acquisition. That area is instead defined using the selected individual as the central locum for sampling. This paper describes two recently applied dendrocentric sampling regimes in New Zealand forest. These were used to examine the regeneration environments respectively to taraire (*Beilschmiedia tarairi*) at Waipoua Forest and of tree ferns in the Kauaeranga Valley. Using the two investigations as working models the particular advantages of this approach are discussed.

4:00

**Towards a numerical definition of divaricate shrubs**

Dave Kelly, Dept of Plant and Microbial Sciences, University of Canterbury, Christchurch.

Different authors have stressed various morphological features of divaricate shrubs, but the two most commonly mentioned are numerous interlaced branches and small widely- spaced leaves. However Atkinson's (1992) divarication index considers only branch attributes. I measured shoot architecture (leaf size, shape and arrangement; branch frequency, length and angles; number of apices) on 24 species of divaricate and non-divaricate shrub from Canterbury. A clustering program created two different groups for the divaricate species, and a third group for small-leaved shrubs with non-interlaced branches. The variables which best separated divaricate and non-divaricate species were leaf width, internode size relative to leaf width, and branch angles. A new index which uses these variables is easy to use and correlates well with perceived degree of divarication. The definition of divaricate plants should include small leaf size and relatively large spaces between leaves in addition to branching characteristics. All this may suggest which selective forces have favoured divarication.

4:20

**Ecological variation within a population of *Agrostis capillaris***

Jill Rapson, Department of Ecology, Massey University

High levels of variation within populations have been reported for various species and characters. Here I investigate the nature and organisation of variation with a lawn population of browntop, a common grass.

Using a 10 x 10 m grid, 400 individual tillers were sampled and cloned for experimental measurement of a range of morphological characters and growth analysis variates.

The frequency distribution of variates within the population ranged from normal to skewed or biomodal. For any characteristic the spatial pattern of classes of values over the sampled area is complex. When characteristics are clustered, groups of genotypes in adjacent areas of the lawn have similar packages of strategies. The extent to which this reflects clonal spread is being investigated.

In conclusion, levels of ecological variation within even uniform populations is extremely high and appears to be organised rather than random.

4:40

**High Country vegetation database development and some initial observations on patterns and relationships.**

Bob Webster and Caroline Mason, Landcorp Property Ltd., P.O. Box 142, Christchurch.

Landcorp Property Ltd maintains a South Island high country vegetation monitoring programme initiated in the mid 1970's. The steadily increasing data set from this programme now includes 145 different surveys, ranging from Marlborough to Southland. Detailed species abundance information has been recorded at the majority of sites. Older data are stored as hard copy only, while more recent data have been entered on computer spreadsheets. The procedure by which this extensive, varied, and previously disjoint data set has been transferred to a PC based relational database is described. An initial exploration is made of the range of vegetation communities and corresponding environmental gradients represented in the database. Detrended Correspondence Analysis is used as a means of revealing the predominant trends in vegetation, and related variables, using a sample of 494 sites with directly comparable species abundance data.

SESSION 3 Small Lecture Theatre (HSB2), Human Sciences Building Level 3

3:40

**Comparative study of the diet and rumen morphology of sika deer and red deer in the central north island, new zealand**

Wayne Fraser, Landcare Research New Zealand Ltd, PO Box 31 011, Christchurch

Sika deer and red deer are sympatric over much of the central North Island. Sika deer are steadily replacing red deer and are also continuing to disperse into areas where red deer are already present. Information on diet and rumen morphology may help to explain why these changes are occurring. Nearly 340 samples of rumen contents (>280 from sika deer; >50 from red deer) have been collected and analysed. Almost 200 plant species have been identified from these rumen samples. Despite an overall similarity between the diets of the two species, both frequency of occurrence and % dry weight results show significant differences for several items in the diet. Sika deer consume greater quantities of poor quality forage, including plant stems and leaf-fall from the main forest canopy species (*Nothofagus*). Plant species consumed in greater quantities by red deer are typically more palatable, higher quality forage species. Several factors, including greater selectivity for palatable species and the greater effective height of the browse zone for red deer may contribute to this pattern. Samples of rumen wall tissue were obtained from 14 sika deer and 11 red deer. The density and average size of rumen papillae were consistently greater in red deer. The surface enlargement factor (SEF), a measure of the absorptive surface within the rumen, was significantly greater in red deer ($SEF_{SIKA}$=4.7; $SEF_{RED}$=7.2). Higher SEF values are associated with greater dietary selectivity, higher fermentation rates, and more constant stimulation of papillary development. Since all the samples were obtained within a 2-week period from the same area, potential variation from seasonal and habitat effects was avoided. Although the study is still in progress, the preliminary results confirm previous research on the digestive physiology of cervids that indicates sika deer are better adapted to poorer quality, high fibre forage. Where sika deer and red deer are sympatric, the greater 'digestive flexibility' of sika deer provides them with a competitive advantage over red deer, particularly in habitats where previous modification by herbivores has substantially reduced the diversity and availability of forage species.

4:00

**Conserving a rare pest - movements and survival of radio-tagged weka with and without translocation.**

Gary Bramley, Department of Ecology, Massey University, Private Bag 11-222, Palmerston North.

Of the 107 translocations of North Island weka (*Gallirallus australis greyii*) between 1960 and 1988 98% failed to establish new populations. Release of captive-reared weka into the Karangahake Gorge by the RFBPS from November 1992 provided an opportunity to compare movements and survival of translocated weka (n=10), with weka captured and released back into their own home ranges at Rakauroa (n=13). It was predicted that weka released in unfamiliar areas would exhibit larger home ranges than weka with local knowledge because of greater movement. The point locations of weka wearing back-mounted radio transmitters were obtained at randomly chosen times of day for a series of up to 23 days. Home range size estimates were calculated using the minimum convex polygon method. The median "survival" of radios fitted to weka at Karangahake Gorge was 13 days (range 2-128). This was significantly lower than radio "survival" at Rakauroa (median=110 days, range= 15-202 days, Mann-Whitney P=.0039). Wekas in Karangahake used an average of 2.68 hectares (s.d.=2.91). The mean range size in Rakauroa was 8.94 hectares (s.d.=7.52). This difference was significant (Mann-Whitney, P=.0143). At Karangahake nine weka died (survival range from 2-128, median 37) and one lost its' radio(after 7 days). At Rakauroa three died (at 15, 68 and 131 days), seven lost their radios (range 46-202, median 116.5) and three were still alive.

4:20

**Permeability of field boundaries to insects**

S.D. Wratten[1], K M.H. Bowie and G. Lovei[2],
1. Department of Entomology and Animal Ecology, Lincoln University;
2. Flock House Agricultural Centre, Private Bag 1900, Bulls 5452.

Adults of the hoverfly *Melanostroma fasciatum* were captured in yellow pan traps on either side of field boundaries comprising fences, 'gappy' poplars and 'dense' poplars. Control sites were cultivated land with no boundary feature. On one side of each boundary, and along the centre of control plots, a strip of *Phacelia tanacetifolia* (Hydrophyllaceae) provided pollen for the hoverflies. On dissection of the trapped flies, up to 30% of individuals contained this morphologically unique pollen. Its presence in flies on both sides of the barriers was used to show that all three boundary types restricted the movement of the hoverflies. Work by collaborators in Europe on carabid beetles and butterflies also points to 'mobile' invertebrates being restricted by 'viscous' boundaries. The implications of this restriction for predator foraging and for their recovery from pesticide-induced population reductions are discussed.

4:40

**More on the beech seed — mouse relationship**

B.M. Fitzgerald, Landcare Research, Private Bag 31-902, Lower Hutt.

At Ecological Society Conference two years ago I suggested from studies in the Orongorongo Valley, that the numbers of mice in beech forest after a heavy seeding might be determined by the abundance of litter-feeding Lepidoptera, rather than by the beech seed itself.

Results of further work since then reveal more details of the system. This report will concentrate on the contribution of arthropods to the diet of mice, with emphasis on the major foods (caterpillars and spiders), and their seasonal availability in both hard beech forest at low elevation and silver beech forest at higher elevation. Litterfeeding arthropods may be influenced by the differences in the timing of leaf-fall of hard beech and silver beech. The beech seeding events appear increasingly complex as we learn more about them.

**Evening functions in the Biology Building**

**5.30 Council Meeting**
**7.30 AGM**
**9.00 Wine & Cheese**

**Tuesday 24th August**

**SESSION 4 Lecture Theatre HSB1, Human Sciences Building Level 3**

9:00

**The seasonal effects of shorebird and eagle ray predation on sandflat communities**

Simon F. Thrush, Rick D. Pridmore, Judi E. Hewitt and Vonda J.Cummings, Ecosystems Division, National Institute of Water and Atmospheric Research, Hamilton.

The experiment consisted of bird exclusion,m ray and bird exclusion and reference plots. Samples were collected from each plot on two occasions: 6 months after the initiation of the experiment, when rays were absent and common bivalve densities were high following recruitment, and 8 months later when rays were present and bivalve population structure was not dominated by new recruits. Community level differences on both occasions were driven by effects on common taxa. The seasonality of effects in our experiment precluded direct comparison of the two predators. However, the 6 month results indicated that bird predation resulted in indirect effects due to adult-juvenile interactions amongst the dominant bivalve *Macomona liliana*. At the end of the experiment, 14 months after its initiation, analysis of common taxa generally revealed direct negative effects of predation, with significantly high densities in the ray and bird exclusion treatment. Infaunal density changes in response to the exclusion of shore birds and rays did not indicate the presence of multiple trophic levels in this infaunal assemblage. This edge effect emphasises the importance of infaunal mobility and its potential to swamp predator effects. The results of this experiment highlight the importance of considering the role of predators within an appropriate spatial and temporal context.

9:20

**Principles of vertebrate pest management : a computer-aided learning approach for tertiary students**

Graham Hickling & Russel McAuliffe, Department of Entomology & Animal Ecology, PO Box 84, Lincoln University

New Zealand faces economic and conservation threats from a wide range of introduced mammal pests, including possums, deer, rodents and mustelids. Except on islands, eradication of these species is rarely an option, so managers must develop effective, sustainable control programmes. However, the technical and economic constraints on such programmes are often poorly understood by the public, who readily advocate ineffective or unsustainable control practices for high-profile species such as possums.

As a method of conveying the basic principles of sustainable pest management to third-year Wildlife Management students we have developed *Possum Pak*, an

interactive computer programme running on the Lincoln University PC-network. The core of the programme is a stochastic plant/herbivore model of possum population dynamics in indigenous forest, which allows students to investigate the effect of different types of resource limitation (den sites, food), control strategy (aerial and ground poisoning, shooting, trapping, etc.), and pest behavioural response (bait shyness, immigration). As an independent study tutorial, students are assigned the goal of holding the modelled population below a designated ecological damage threshold (relating to forest dynamics or bovine Tb spread) through a cost-effective combination of available control options.

In this paper we discuss the ecological basis for the various components of the possum model, and the tutorial's effect on student perceptions of New Zealand's "possum problem".

9:40

**Sampling in ecology - what is the best way to sample a spatially aggregated population?**

Jenny Brown, Department of Mathematics and Statistics, University of Otago, P.O. Box 56, Dunedin

Many studies in ecology involve sampling and estimation of density. This study considered populations where the individuals were "spatially aggregated", that is, the individuals tended to be found in patches rather than in a random distribution.

Using a range of realistic spatial distributions, adaptive cluster sampling was compared to simple random and systematic sampling. For a population that is spatially aggregated, adaptive sampling is efficient and the gain in efficiency over more traditional sampling increases with more aggregated populations. The cost of sampling also varies between sampling strategies.

The estimate of density from adaptive cluster sampling is derived from the distribution of networks sampled, from which the distribution of patches in the population may be estimated. Used in monitoring, adaptive cluster sampling is an efficient sampling strategy; it provides an estimate of density and an estimate of changes in patch size and patch frequency.

SYSTANZ AND THE NEW ZEALAND ECOLOGICAL SOCIETY

JOINT SYMPOSIUM

'SYSTEMATICS, BIODIVERSITY AND CONSERVATION'

**Lecture Theatre HSB1, Human Sciences Building Level 3**

**10:30 Panel Discussion - The maintenance of databases and collections**

Basil Walker, MoRST; Malcolm Crawley, FoRST; Wendy Nelson, Museum of New Zealand; Colin Webb, Landcare; Roger Blakely, Ministry for the Environment.

Chair: David Penny

**SESSION S1 Lecture Theatre HSB1, Human Sciences Building Level 3**

1.30

**Whipcord *Hebe* a study in biogeography, evolution and conservation**

Peter Wardle, Landcare Research, P.O. Box 69, Lincoln.

Whipcord *Hebe* are small subalpine to alpine shrubs. Their seedlings establish on bare ground, but mature plants persist in closed grass, shrub and wetland communities, as well as on rocky slopes. Allan's flora recognises 14 species. Five are in the "tetragona" complex, which extends from Mt Hikurangi to Stewart Island but is absent from a 180 km wide stretch of the central South Island. This discontinuity, which is shared by *Raoulia* "vegetable sheep" and other mountain plants, coincides with the "Westland beech gap".

The "lycopodioides" complex, with 3 recognised species, extends the length of the South Island on the drier eastern ranges, but overlaps broadly with taxa in the tetragona complex. Taxonomic boundaries within each complex are uncertain, especially in southern Otago and Southland where the distinct and uniform *Hebe propinqua* also grows.

In all the above 2n=40. *H. ochracea*, with 2n=124, grows on marble outcrops in northwest Nelson. In remaining species 2n=42; *H. cupressoides* and *H. salicornioides* (including *H. annulata*?) occur sporadically in the eastern mountains of the South Island and *H. armstrongii* is currently known only from the Waimakariri catchment. These may have relict distributions, and cladistic analysis show that they retain ancestral characters.

Uncertain taxonomic boundaries, together with the rarity or localised occurrence of some taxa, pose questions as to evolutionary directions among the whipcord hebes, and in respect of their conservation status.

1.50

**Taxonomy and conservation: ad hoc classification and management?**

John L Craig, Centre for Conservation Biology, School of Biological Sciences, University of Auckland

In New Zealand taxonomic status is used as one criterion in priority setting and is a prominent basis of conservation planning through species recovery plans. As a consequence, the way taxonomic categorisation is achieved can have a marked effect on conservation outcomes. Two problems associated with taxonomy and conservation require further debate to ensure effective conservation.

1. Taxonomy appears not objective and is often inconsistent. There are no universally accepted criteria for the definition of a species and different techniques and different researchers are providing different recommendations. Genetic distance is increasingly used as a guide but there are no accepted criteria for separating taxa. Other techniques appear similarly variable in their use.

2. The use of taxonomy as the basis for planning puts major emphasis on the symptoms of conservation rather than dealing directly with the cause. Hence the current subdivision of the problem by species recovery plans is inappropriate without broader ecosystem planning and has allowed ad hoc management. Examples of these issues will be given along with suggestions for future action. One of these is increased debate especially among those involved in systematics and conservation.

2.10

**Conserving biological diversity - conserving biological information?**

Allen Rodrigo, Experimental Biology Research Group, School of Biological Sciences, Auckland University

It is not coincidental that one of the measures of ecological diversity is based on a measure of information; diversity and information are intimately linked. At present, the conservation of biodiversity appears to be restricted to the conservation of species. If, instead, one views biodiversity as biological information, then one is forced to focus not only on the components of biological systems (e.g. species) but also on the interactions of these components and the dynamics of the system as a whole. This is because biological information in its purest form relates to statements that can be made about properties (i.e., components), patterns (i.e., interaction between and within components), and processes (i.e. dynamics of the entire system). I will argue that by shifting the focus from a simplistic approach of species enumeration to one that takes account of the interactions of the species and the dynamics of larger systems, conservation management will move closer to its ideal aim: the perpetuation of natural systems.

2.30

**The importance of intraspecific variation in identifying, maintaining and restoring biodiversity in New Zealand plants**

P.G. Simpson, Department of Conservation, Science & Research, Wellington

The occurrence of local, regional or habitat provenances or ecotypes in many species of New Zealand plants is well recognised. There is now widespread scientific agreement that these genetic provenances should be used when species, habitat or ecosystem restoration is carried out. In fact, using plants of local origin, whether identifiable as physically distinct provenances or not, is now an established conservation principle. This reflects the understanding that plants adapt to local physical conditions as they migrate and establish ecological linkages with other plants and animals in an ecosystem. Ignoring this interlinking by introducing non-local forms may lead to a loss of biodiversity. It is important to transfer existing scientific understanding to the community at large, in particular plant growers, and planters.

2.50

**Partitioning biodiversity with confidence**

Russell Gray[1], Adrian Paterson[2] and Graham Wallis[2]
1. Psychology Department, Auckland University
2. Department of Zoology, University of Otago, P.O. Box 56, Dunedin

It has been argued that historical (phylogenetic) classifications of biological diversity have the greatest information content and predictive value. It has also been claimed that phylogeny provides the logical basis for ranking conservation priorities. However, all phylogenetic trees are estimates of the true relationships that are open to error. In this paper we will outline these sources of error and the statistical methods that can be used to estimate them using our molecular and behavioural/ecological datasets for New Zealand seabirds. We will then examine phylogenies published for other New Zealand organisms and evaluate the degree of confidence that can be placed in them.

SESSION S2 Lecture Theatre HSB1, Human Sciences Building Level 3

3.40

**Abundant microbiological DNA variation and worldwide population structure in humpback whales.**

C. Scott Baker[1] and S R Palumbi[2]
1. School of Biological Sciences, Auckland University
2. Department of Zoology, University of Hawaii, Honolulu, HI 96822, U.S.A.

Commercial hunting during the last two hundred years has reduced many populations of mysticete whales to near extinction. Large, stable populations that are reduced to low numbers may suffer from inbreeding depression as a result of mating between closely related individuals and subsequent loss of genetic variation. To evaluate potential genetic bottlenecks in these exploited populations, we examined mitochondrial DNA control region sequences from 90 individual humpback whales (*Megaptera movaeangliae*) representing six subpopulations distributed across three ocean basins. Tissue samples for genetic analysis were collected by biopsy darting in collaboration with scientists from New Zealand, Australia, Tonga, Mexico, Canada, the Dominican Republic and the United States. Comparisons of relative nucleotide and nucleotype diversity reveal an abundance of genetic variation in all but one of the oceanic subpopulations. Phylogenetic reconstruction of nucleotypes and cladistic analysis of gene flow show that current genetic variation is not due to postexploitation migration between oceans but is a relic of past population variability. Calibration of the rate of control region evolution in six baleen whale species suggests that existing humpback whale lineages are of ancient origin. Preservation of pre-exploitation variation in most humpback whales may be attributed to their long life span and overlapping generations, and to an effective, though perhaps not timely, international prohibition against hunting.

4.00

**Plant biodiversity in New Zealand forests - what do we really know?**

John Ogden, School of Biological Sciences, Auckland University.

The broad patterns of forest diversity in New Zealand are known in a general sense, but quatitative data allowing rigorous comparisons between different forest types are few. The paper will address: (1) the broad geographical trends in biodiversity within New Zealand (gamma diversity); (2) the main regional gradients associated with altitude, topography and soil (beta diversity); (3) within community (alpha ) diversity. A quantitative comparison between kauri and beech forest ecosystems will be used to address diversity patterns at all levels. I conclude that if biodiversity is to be used as a criterion in conservation decisions we urgently need a standardised methodology for it's description.

4.20

**Systematics of non-migratory Galaxiids: implications for conservation management**

Richard M. Allibone and Colin R. Townsend, Department of Zoology, University of Otago, PO Box 56, Dunedin.

An isozyme study of several galaxiid species from the South Island and Stewart Island, revealed that non-migratory galaxiids (*Galaxias vulgaris* and *G. divergens)* had particularly high levels of genetic divergence among river systems. A further investigation of within-river divergence of twenty populations of *G. vulgaris* in the Taieri River, comparing them with holotype specimens of *G. vulgaris* and *G. anomalus*, has revealed the presence of four distinct galaxiid types - *G. anomalus*, a previously unrecognised species, a type genetically similar to *G. vulgaris* but morphologically distinct, and another of undetermined status. The data indicates that the species "*Galaxias vulgaris*" may in fact be a cluster of similar but distinct species. Ecological studies of demographic traits, habitat associations, diets and relationships with introduced trout, indicate that the galaxiid types vary in ways that are likely to prove of relevance when planning their conservation management.

4.40

**Diversity and disparity in the New Zealand flora: examples from the *Hebe* complex.**

Phil Garnock-Jones, Manaaki Whenua - Landcare Research, P.O. Box 69, Lincoln.

For a given flora, estimates of diversity (variation within a phyletic lineage) *versus* disparity (number of such lineages represented) at generic level may be heavily dependent on phylogenetic content of the classification adopted. I will argue that, using current classification of our large generic complexes, estimates of diversity and disparity are likely to be misleading. Acceptance of polyphyletic genera causes underestimation of disparity, whereas acceptance of paraphyletic genera causes underestimation of both diversity and disparity.

Phylogenetic analysis indicates that *Hebe* is polyphyletic, *Parahebe* is paraphyletic, and *Chionohebe* is monophyletic but more diverse than previously thought, due to the need to include some alpine species of *Parahebe*. Using a phylogenetic classification, the *Hebe* complex in Northland and Central North Island is seen to be somewhat diverse but hardly disparate, whereas in Nelson and Marlborough it is both disparate and diverse, and in Fiordland it is disparate but moderately diverse. By this measure, Marlborough has more disparity in the *Hebe* complex than all the National Parks combined.

**7pm for 7.30 Annual Dinner at the Hyatt Hotel**

**Wednesday 25th August**

**SESSION 5 Lecture Theatre HSB1, Human Sciences Building Level 3**

9:00

**A question of scale: what in the world are you measuring!**

E.G. White, 74 Toorak Ave, Christchurch 4

The acumen of understanding scale in ecology is in essence the ability to recognise and comprehend the relevance of boundaries. Boundaries occur where there is a steep transition in process rates; and the recognition of transition is only possible by choosing appropriately scaled windows for experimental observation. In a holistic X, ecosystems need to be studied with specific spatial and temporal scales in mind, and stepwise variation in sample and universe size is a powerful tool for identifying the scaling of ecological phenomena. Ecologists need to go beyond their intuitive perceptual levels in conceptualising ecosystems. Some phenomena contain counter-intuitive elements that arise because of wide differences in the processing rates operative within an ecosystem. The hierarchical structuring of any dynamic system follows with mathematical necessity from this range of process rates. Despite the insights of 40 years of Hierarchy Theory literature, biologists (unlike physicists) have by and large seriously failed to comprehend holism.

9:20

**Bellbird breeding and sub-speciation**

Sandra Anderson & John Craig, Centre for Conservation Biology, School of Biological Sciences, University of Auckland

The bellbird of the Poor Knights are regarded as a distinct sub-species. The distinction was based on size and plumage differences, as well as timing and pattern of breeding, and timing of moult into adult plumage. Detailed studies of bellbird breeding behaviour on Tiritiri Matangi provide a basis for questioning this distinction.

On both islands, peaks in breeding coincide with pohutukawa flowering, and there is considerable competition for resources among pairs.

The presence of other competitors (tui) and predators (ruru & kiore) on Tiritiri coincides with higher mortality, lower densities, no ground nesting, larger clutch size, more frequent renesting, and earlier moult into adult plumage than found on the Poor Knights.

Social organization also differs between the islands. On Tiritiri, bellbirds have a variable social system that relates to the distribution of food, especially nectar. Males move considerable distances to nectar whereas females are more sedentary and

flocks like those found on Poor Knights are short lived and do not involve adults. Tiri males do less feeding of nestlings, visit neighbours nests and attack neighbouring fledglings. These differences may be a reflection of the availability and distribution of food in different habitats.

The results suggest that factors distinguishing the bellbird populations may be seasonal flowering, occurrence of predators and competitors, and availability and distribution of food, rather than any sub-specific differences. Hence it is expected that on the mainland or more southerly islands breeding will be later and, in the presence of more predators, densities and breeding success will be lower, while the frequency of renesting will be higher. Social organisation will also vary with differing distributions of resources. In the absence of comparable data from other areas in New Zealand, this awaits testing.

9:40

**Kokako, possums and ecosystem management/research in the northern Urewera**

Chris Ward, Department of Conservation, P.O. Box 668, Gisborne

Recent surveys indicate that the kokako population of the northern Urewera is 800-1000, probably comprising about half the total population. In this area there is a close relation between current kokako population density and the history of possums - the lateness of possum arrival and the degree of control subsequently achieved by commercial possuming until 1988. After considering other ecological factors relevant to kokako, it is inferred that possums have been the main cause of kokako decline in the northern Urewera, and pose the main threat to the surviving high density kokako areas.

In the expectation of a crises stemming from non-control of possums, East Coast Conservancy proposed a management trial using a matched pair of study areas, to test directly the hypothesis that non-treatment would lead to a decline in kokako productivity relative to possum treatment by conventional ground trapping and cyanide poisoning.

This proposal proved controversial, and it has now been essentially superseded by a larger programme of possum control in the northern Urewera. It is appropriate then to broaden the focus to include the potential for while ecosystem management/research. The area is a prime candidate for a programme of large scale ecological research and management for mainland biodiversity conservation. We invite wide participation in the design and implementation of a suitable programme.

10:10

**Truffle-like fungi: fruit of the forest floor**

Ross E. Beever, Manaaki Whenua, Landcare Research, Private Bag 92-170, Auckland

Truffle-like fungi are defined as those macrofungal species in which active spore release is absent and the fruit body remains closed, even at maturity. Most are hypogenous, producing fruit bodies underground. Several agents have been implicated in their dispersal including, in particular, small placental mammals and marsupials. Prior to human contact, New Zealand lacked terrestrial mammals except for species of bat. Nevertheless, New Zealand has a distinct albeit poorly known, flora of truffle-like fungi. This includes species of Ascomycotina (*Dingleya, Elephomyces, Labyrinthomyces, Paurocotylis*), Basidiomycotina (*Claustula, Gallacea, Hysterangium, Macowanites, Notholepiota, Phallobata, Protubera, Stephanospora, Thaxterogaster*) and Zygomycotina (*Glomus*) The flora will be briefly surveyed, with emphasis on fruit body features that may reflect adaptation to dispersal by indigenous animals such as ground-feeding birds, bats, lizards, and insects. Features putatively associated with dispersal the these animals include purple, red, orange, and pure white coloration; epigeous as well as hypogeous habit; development of visual 'flags'; ease of fruit body detachment; and distinctive odour. Most of the species and some of the genera are endemic, indicating that these features may have evolved in New Zealand in response to the ecology of indigenous dispersers.

**SESSION 6 Small Lecture Theatre (HSB2), Human Sciences Building Level 3**

11:00

**Genetic diversity and ecology of native freshwater bullies (Family Eleotridae).**

Cathy Shave, Department of Zoology, University of Otago, P.O. Box 56, Dunedin

Several species of native freshwater bully can often be found breeding together in the same area, with no obvious temporal or spatial separation. One possible reason for the lack of hybridisation between different species is isolation through sexual selection. Work is currently being undertaken to examine the possibility of mate choice by female bullies for bright colouration in their male counterparts. This colouration, in the form of a band on the first dorsal fin, varies between the different species and could be a trait involved in maintaining separation of species through descrimination against heterospecifics.

11:20

**Invertebrate responses to environmental manipulation of trout in Tongariro river.**

Dale Towers, Ecology Department, Massey University, Private Bag, Palmerston North.

To test the hypotheses that trout alter benthic invertebrate community structure and lower invertebrate densities in a small braid of the Tongariro River, an enclosure experiment was conducted in April 1993. Nine triangular enclosures, arranged in a 3 by 3 configuration were erected immediately upstream of the Pillars of Hecules. Each enclosure enveloped $6m^2$ of substrate. In three enclosures trout were introduced at a biomass equal to that naturally occurring in the study section of the river. Three "enclosures" had no attached netting which allowed normal trout activity. There were no trout in the remaining three enclosures. Drifting invertebrates were sampled using two drift collection tubes behind each enclosure. Two $0.1m^2$ Surber samples of benthic invertebrates were collected at randomly chosen locations in each enclosure. These drift and Surber samples were collected at 0, 24, 72 and 144 hours after completion of the enclosures. Trout were removed from the enclosures at the end of the experiment and their stomach contents examined. The drift density was significantly lower from enclosures that contained no trout and there were no differences between the two trout treatments. There were no significant differences in benthic invertebrate numbers among the three treatments. However, enclosures without trout were found to contain significantly richer benthic insect communities and more stoneflies and mayflies.

11:40

**Quantifying the effect of predation risk on foraging bullies: no need to assume an Ideal Free Distribution.**

Martyn Kennedy[1], Cathy R. Shave[1], Hamish G. Spencer[1] and Russell D. Gray[2].
1. Department of Zoology, University of Otago, P.O. Box 56, Dunedin, New Zealand.
2. Department of Psychology, University of Auckland, Private Bag 92019, Auckland, New Zealand.

Previous studies of the effects of predation risk on patch choice have assumed the distribution of foragers to be Ideal Free. However, recent investigations have revealed systematic departures from the Ideal Free Distribution. In this study we do not assume that the distribution of foragers fits an Ideal Free Distribution. Instead we use a method that separates the effects on patch choice of predator avoidance (site bias) from effects due to the resource ratio. Our experiment examines the distribution of foraging upland bullies (*Gobiomorphus breviceps*) between two resource sites over a series of five different food input ratios. We had two conditions, a predator-free and a predator condition. The bullies exhibited a strong bias (preference) towards Site 1 when there was no predator (quinnat salmon, *Oncorhynchus tshawytscha*). When a salmon was present at Site 1 they exhibited a strong bias towards the alternative resource site (Site 2). By allowing that the distribution of foragers may deviate from Ideal Free, we demonstrate that it is possible to separate the effects of predator avoidance from a change in their ability to discriminate between resource sites caused by the presence of a predator.

12:00

**Multi-trophic level effects of introduced trout**

Colin R. Townsend, Department of Zoology, University of Otago, PO Box 56, Dunedin, and Alexander S. Flecker, Department of Entomology, Cornell University, Ithaca, New York 14853, USA

Three experimental treatments were established in a series of in situ channels containing either: 1) native galaxiid fishes, 2) exotic brown trout, or 3) no fish. We found large differences in the insect assemblages colonizing experimental channels depending on the fish species present. In general, insect densities and biomass were lowest in channels containing trout compared to either galaxiid or no fish treatments. The influence of fishes was manifested through multiple trophic levels, and algal standing crop increased dramatically in treatments where fish strongly affected insect assemblages. Impacts of fish on algal standing crop were also species dependent; the presence of trout resulted in greater algal biomass than native galaxiids. The mechanism for strong fish effects appears to be at least twofold, through modifying the composition of grazing insect assemblages, as well as constraining invertebrate foraging behaviours. These results suggest that the consequences of trout may extend beyond the replacement of native fish species.

**SESSION 7 Small Lecture Theatre (HSB2), Human Sciences Building Level 3**

11:00

**Shade acclimation of *Tradescantia fluminensis* in a New Zealand native forest remnant.**

H.G. Maule, J.D. Morton, A.V. Jones and M. Andrews, Dept of Plant Sciences, University of Lincoln

Mean monthly growth rate of individual *Tradescantia fluminensis* plants in a N.Z. mixed mahoe (*Melicytus ramiflorus*) coastal forest remnant was positively correlated with monthly mean values for air temperature. Over the study period, growth at the shoot apex was balanced by death at the shoot base. In pot experiments in a glasshouse or outdoors, total plant dry weight increased with increased relative irradiance (open ground PAR = 100% relative irradiance) from 1 to 26% then changed little or decreased with increased irradiance thereafter. Changes in specific leaf area and leaf chlorophyll, carotenoid and protein content associated with decreased irradiance from 26 to 1 % were similar to those associated with increased distance into the forest remnant. It is concluded that irradiance level is the primary factor limiting the extent of colonisation of the forest remnant by *T. fluminensis.*

11:20

**Environmental effects on the partitioning of dry matter between root and shoot of higher plants: the importance of tissue nitrogen content.**

M. Andrews, G.T. Daly, J.I. Sprent and J.A. Raven, Dept of Plant Sciences, University of Lincoln.

Often, when a root acquired resource such as nitrogen (N) becomes limiting, shoot growth rate (rate of dry matter accumulation) will decrease more than root growth rate and hence shoot to root dry weight ratio (S:R) will decrease. Similarly, if a shoot acquired resource such as light decreases then S:R often increases. This paper reviews the literature on environmental effects on S:R. It is argued that in many cases, environmental effects on S:R are mediated through their effects on tissue N content. A mechanism for the N effect on S:R is proposed.

11:40

**Some affects of soil fertility on different *Hieracium* spp.**

Kristin Svavarsdottir, Dept of Plant Sciences, P.O. Box 84, University of Lincoln

This presentation describes Hieracium spp. abundance in a degraded short tussock grassland experiment. The site is located at Mt. Possession Station, Mid-Canterbury (700m asl).The experiment was originally set up in 1979 to compare the performance of overdrilled legumes at different levels of superphosphate. Plots have been excluded from grazing since establishment.

Results of cover abundance assessment showed that the current species composition was affected by the original treatments of legumes and superphosphate fertilizer. In particular, the three *Hieracium* species occurring in the experimental site had developed a pattern in response to added fertility. The distribution of these species overlapped each other along the fertility gradient, however, their relative abundances differed. When ranked along the gradient the order of the species was: *H. caespitosum* > *H. praealtum* > *H. pilosella*. In the more fertile areas *H. caespitosum* was common, whereas *H. pilosella* was abundant towards the least fertile sites.

The patterns described are thought to be still dynamic (i.e. species abundance/composition continuing to change) even though this can be regarded as an "old" experiment. This emphasises and demonstrates the importance of long term experiments.

12:00

**The effect of chilling, nitrogen form and nitrogen concentration on germination of *Cematis vitalba* l. (Old man's beard)**

R.A. Bundard, M. Andrews, and G.T. Daly, Dept of Plant Sciences, University of Lincoln

The effect of a range of chilling periods (0, 4, 8 and 12 weeks at 4°C) with different applied nitrogen (N) concentrations (0 - 50.0 mol $m^{-3}$) either as nitrate ($NO_3^-$) or ammonium ($NH_4^+$) on seed dormancy (germination %) and days to 50% germination (T 50%) were examined in *Clematis vitalba*. Without N, germination increased with increased chilling period from around 6% at 0 chilling to 75% - 82% at 8 - 12 weeks chilling. At 0 and 4 weeks chilling, germination increased substantially with increased applied $NO_3^-$ or $NH_4^+$ concentration in the range 0.5 - 2.5 mol $m^{-3}$. For example, at 0 chilling, germination increased from 6% to 50%. Without N, T 50% decreased with increased chilling from 16 - 22 days at 0 chilling to around 5 days at 8 - 12 weeks chilling. In general, T 50% decreased with increased $NO_3^-$ or $NH_4^+$ concentration in the range 0.5 to 5.0 mol $m^{-3}$ then increased with additional N thereafter. However, the magnitude of the N effect was small in comparison with that of chilling.

Possible mechanisms of germination stimulation by chilling and N were tested and are discussed. Findings are related to the distribution of *C. vitalba* in a New Zealand native podocarp forest remnant.

**SESSION 8 Lecture Theatre HSB1, Human Sciences Building Level 3**

1:30 **Presidential address**

**National goat control plans - some lessons from New Zealand and Australia**

John Parkes, Manaaki Whenua, Landcare Research, P.O. Box 31-011, Christchurch

Feral goats are pests in New Zealand and Australia. An estimated population of 0.5 million occurring over about 30 000 $km^2$ in NZ and an estimated 2.3 million in about 1 120 000 $km^2$ in Australia. Both countries are in the process of developing national plans to manage the impacts of feral goats (and other pests). These plans are structured to ensure that the management response takes account of the "rules" imposed by the ecological, sociological and economic relationships in the goat - resource - people systems. For example, feral goats in NZ are naturally limited by food and have reached carrying capacities of 1000/$km^2$. In Australia, they are limited by dingoes, perhaps by toxic plants (species with 1080), and of course by water and never reach such huge densities.

In New Zealand, feral goats are primarily pests in indigenous habitats so control is organised and driven by the main "beneficiary" the Department of Conservation. In Australia, feral goats are primarily pests on semi-arid pastoral lands that, although still basically indigenous, are used for grazing sheep (with which goats compete) as well as to protect native flora and fauna. Here, control is driven by the individual landowners (including State Conservation agencies). Both countries have had difficulty in sustaining control action; NZ because of the fickleness of central Government funding, and Australia because of the changing perceptions of goats as pests and resources. One significant aim of the plans is to ensure stability in funding.

Common features include: the need to distinguish between ends (protection of resources) and means (controlling pests), the need for organisational structures capable of sustaining action, and the need for operational and performance monitoring of control to improve efficiency and effectiveness.

2:00

**Bait aversion in brushtail possums**

Lloyd Robbins & Graham Hickling, Department of Entomology & Animal Ecology, PO Box 84, Lincoln University

There is growing evidence for behavioural resistance among some brushtail possum (*Trichosurus vulpecula*) populations to standard poison-baiting techniques. However, the relative importance of various potential behavioural mechanisms for such resistance remains unclear.

Field trials were undertaken during May 1993 in a plantation forest in Canterbury to examine toxic bait aversion among individually-marked possums. These were presented with 2 g each of three pelleted cereal baits: i) non-toxic RS5 bait, ii) non-toxic RS5 bait coated with regular green dye, and iii) RS5 bait with dye and 0.08% 1080 toxin. While only 7% of possums avoided the non-toxic bait, 42% and 73% of possums avoided the dyed non-toxic bait and dyed toxic bait, respectively. Since these possums had not been previously exposed to toxic bait, this suggests that loading dye onto the bait decreases its acceptability to possums in the field. This result was unexpected, and challenges the commonly-held assumption that toxic bait aversion is due solely to detection of the 1080 toxin. Trials to further test this assumption are in progress.

2:20

**Vegetation change after possum control, Waipoua Forest, Northland**

Payton, I.J.[1], Frampton[1], C., Forester, L. [2]
1. Landcare Reserach NZ. Ltd. P.O. Box 31-011, Christchurch
2. Department of Conservation, P.O. Box 842, Whangarei

Waipoua, Waima and Matarau forests comprise New Zealand's largest remaining tract of kauri (*Agathis australis*) forest. Possums (*Trichosurus vulpecula*) were first noted in the area in 1960 and possum-related damage to canopy species such as northern rata (*Metrosideros robusta*), Hall's totara (*Podocarpus hallii*) and kohekohe (*Dysoxylum spectabile*) was clearly evident by the late 1980s. In 1990, a major possum control operation in Waipoua Forest reduced possum numbers by an estimated 87%. Monitoring of a range of possum-preferred plant species has shown that while ongoing foliage loss has been greatly reduced or halted in the treatment area, there has been no significant improvement in canopy condition in the two years after possum control. Browse levels declined significantly after control, but showed a slight increase between 1991 and 1992 despite ongoing maintenance control of possums. Outside the treatment area possum browsing and canopy damage continued to increase during the study period.

The method used in this study is being developed for general monitoring of possum-related damage of both native forests and rare and endangered plant species.

2:40

**Creating rodent free islands**

Ian McFadden, Department of Conservation, Private Bag 68-908, Newton, Auckland

Rodents were first introduced to New Zealand 1000 years ago when kiore (*Rattus exulans*) arrived with Polynesians. Between 1780 and 1880 Europeans introduced Norway rats (*R. Norvegicus*), Housemice (*Mus musculus*) and Ship rats (*R. rattus).* Rodent eradication has for many years been considered an idealistic rather than realistic goal, even on offshore islands. For many threatened endemic species rodent free islands are their only sanctuary. Recent advances in rodent eradication have enabled Conservation Agencies to routinely eradicate rodents on islands up to 200 ha. Methodology have progressed from hand laid bait stations to aerial broadcasting Islands. which took 20 days just to bait 20 days just to bait can now be treated in 2 hours. This increases efficiency without compromising effectiveness and makes eradiation on very large islands technically possible.

3:00

**Rodent control to enhance kereru productivity**

M.N. Clout[1], I.G. McFadden[2] & B. Green[3]
1. Tamaki Campus, Auckland University, Private Bag 92-019, Auckland
2. Department of Conservation, Private Bag 68-908, Newton, Auckland
3. Auckland Regional Council, Private Bag 68-912, Auckland

Field studies of kereru (*Hemiphaga novaeseelandiae*) in Marlborough, Hawkes Bay and at Wenderholm Regional Park (Auckland) revealed very low nesting success. In coastal forest at Wenderholm all 27 nests discovered from 1988- 1991 failed. Many failures appeared to be due to predation of eggs, and rats were implicated in several cases. Ship rat (*Rattus rattus*) density at Wenderholm during the kereru breeding season was high (up to 15.8 rats/ 100 trap-nights). From October 1992 to February 1993 Talon 50WB rat poison was laid in 213 plastic tunnels distributed throughout the 70ha forest patch at Wenderholm . Bait take was monitored (and baits replaced) over a 16 week period. Monitoring indicated that rats were reduced to negligible density within 4-5 weeks. Eleven kereru nests were discovered and monitored within the poisoned area from October 1992 to March 1993 and five of these produced fledglings. Implications of this result are discussed along with plans for further work.

**SESSION 9 Lecture Theatre HSB1, Human Sciences Building Level 3**

3:50

**When and where decisions on translocations.**

Sibilla Girardet & John Craig, Centre for Conservation Biology, University of Auckland

Translocations worldwide are a necessary part of restoration and species management planning. Decisions on where to translocate include decisions on whether the place and habitat is suitable, and whether there is sufficient area for a self sustaining population. A final issue is what performance criteria can be used to decide whether a translocation is successful and how early can the decision be made.

Habitat requirements is a frequent form of research used to decide whether an area is suitable but frequently suffers from a failure to discuss explicitly common assumptions. The area of available habitat or island size is another common consideration. Treatment of territory or home range sizes as rigid characteristics and the treatment of each population as an independent entity rather than as a part of a metapopulation has limited past decisions.

These issues and the setting of performance criteria for determining success or failure of translocations will be discussed in relation to a programme involving the recent transfer of little spotted kiwi and past transfers to Tiritiri Matangi Island.

4:10

**The dynamics and possible impacts of overwintering German wasp colonies in the Waikato**

Richard Harris, Landcare Research NZ Ltd, Ruakura Science Centre, Private Bag 3123, Hamilton.

Wasp colonies normally go through an annual cycle. Occasionally, however, colonies of the German wasp (*Vespula germanica*) continue on into a second season. Little was know of the population ecology of overwintering colonies. This paper presents a summary of the first two seasons of my study into the dynamics of overwintering nests. The incidence of overwintering was low within the population, but colonies displayed exponential growth reaching sizes over 90 times that of a single season nest, and made a large contribution to the wasp population. Queen production was also high. The pattern of nest growth allows ageing of colonies and brings into question previous estimates of age. Estimates of food consumption for an overwintering nest was high, even compared to South Island beech forests where nest wasp densities are high. Impacts will, however, be very localised due to the low wasp densities recorded in the Waikato.

4:30

**Mainland habitat islands - the concept: Okarito a prototype**

Miller, C.J., D.A. Norton, F.B. Overmars and J. Lyall, Department of Conservation, Private Bag 701, Hokitika

The West Coast Conservancy is currently developing strategic directions for the protection and restoration of biodiversity on the West Coast as part of its 10 year Conservation Management Strategy (CMS). A central theme is the development of Mainland Habitat Islands; defined areas on the mainland where resources are targeted to reduce threats to native species and ecosystems as much as possible, allowing natural processes to function. This is likely to involve extensive control of introduced mammals and restoration of fragmented habitats. Because such a large-scale endeavour is largely untested in New Zealand the process will be one of research by management, similar to Mapara. Funding approval for pest control and for management of the Okarito Brown kiwi in South Okarito has provided an opportunity to begin to test the concept of the West Coast.

**7.00pm Biology Building**

**A panel discussion on issues relating to Island Management and Restoration. The discussion will centre around the interaction between the retention of natural values, archaeological values and public usage.**

**Panel:**

**Dick Veitch - Senior Conservation Officer, DoC, Auckland**
**Sue Bulmer - Archaeologist, DoC**
**Mike Lee - Chairman, Auckland Regional Council Parks Committee**

**Chair: John Craig**

CENTRE FOR CONSERVATION BIOLOGY
TE TARI TIAKI I NGA TAONGA ORA
*University of Auckland*

**The Centre for Conservation Biology is committed to bringing a better future for New Zealand by achieving greater understanding and adoption of sustainable conservation practices.**

The Centre for Conservation Biology (CCB) is a key player in the future of nature conservation in New Zealand.

CCB is an independent, non-profit group based within Auckland University's School of Biological Sciences.

**Objectives**

- provide a sound scientific basis for conservation management through field and theoretical research;
- research known conservation or environmental problems and provide cost effective solutions to managers;
- provide consultancy services for managers (both commercial and public sector);
- deliver specialist environmental impact reporting.
- communicate research findings and advocate conservation to a wide audience;
- advise and comment on conservation matters without constraint of political considerations;

**Scope**

- The Centre for Conservation Biology was established in 1991.
- Island Care New Zealand, a group committed to clean waters, seas and shores, has associated since 1992.
- Staff of the Centre have considerable experience in basic and applied conservation research in New Zealand, Antarctica, Australia and North America.
- Expertise includes terrestrial, freshwater and marine plants and animals, molecular ecology and genetics, modelling, pollution, impact assessment, restoration and mitigation.
- Techniques include: Molecular techniques (DNA fingerprinting, PCR, electrophoresis), field studies, climate modelling, dendrochronology, species identification, litter sourcing; stake-holder audits, environmental audits, and behavioural enrichment are specific skills in CCB.

## Centre Staff

Staff of the Centre have training in a wide range of disciplines. In addition they have considerable management experience and training. The Centre also attracts large numbers of post-graduate students. All staff and students are available to research and assist your problems in conservation and sustainable management.

For further information, contact:

**Centre for Conservation Biology**
School of Biological Sciences
University of Auckland
PO Box 92019
Auckland, New Zealand

Phone 64.9.373-7999
Fax 64.9.373-7417

UNIVERSITY OF AUCKLAND
ENVIRONMENTAL SCIENCE

# ENVIRONMENTAL SCIENCE

## University of Auckland

Environmental Science was established at Auckland University in 1987, in response to a recognition by the Faculty of Science, of the need for an inter-disciplinary postgraduate environmental programme. The Environmental Science programme leads to a Masters degree jointly in Environmental Science and the 'parent' discipline. The programme differs from the more usual single discipline Masters degree, in that it is designed to build on skills already obtained as an undergraduate, providing an alternative pathway to a Masters degree. It is also possible to pursue a course of research leading to a PhD.

'Environmental science' encompasses a range of scientific perspective's - from the investigation of biological and natural physical processes, through to analysis of the direct impact of humans on the environment. These may take the form of investigating perturbation of the environment; how change affects living organisms; how to maintain and encourage natural processes. The common thread that links these perspectives is one of consequences, especially that of not applying scientific knowledge to human interaction with 'the environment'. In other words, 'environmental science' attempts to answer some very fundamental 'What if....' questions. Ultimately, all such investigations aim at improving the environment where degradation occurs, or improving human interaction to prevent or ameliorate environmental degradation. The Environment Summit in Rio de Janeiro and our Resource Management Act have provided an added imperative for the need to reverse many environmental trends and to rapidly improve our knowledge of how 'the environment' operates in a sustainable manner. The course we offer, aims to develop student's existing skills and provide a contemporary environmental context within which to apply them.

## THE ENVIRONMENTAL SCIENCE PROGRAMME

The Environmental Science programme has two components: coursework and a thesis. The coursework component consists of a compulsory paper that includes many aspects of contemporary environmental science, together with practical experience; a set of postgraduate papers in the major undergraduate subject and an elective paper that may be used to broaden a student's skill base. The thesis is based on an investigation in which the major discipline skill is used to carry out a piece of original, environmental research.

Students are jointly enrolled in Environmental Science and the department of the undergraduate major. The final degree will be awarded jointly between Environmental Science and this department. Under University of Auckland regulations, the degree that is awarded depends upon the first degree - students with a BSc are awarded an MSc, all other students are awarded an MPhil.

Application for Entry to this programme should be made by October 31 in the calendar year preceding intended entry to the programme.

Academic Staff

Dr N.D. Mitchell (Director)
A/Prof J.E. Hay
Dr G.D. Lewis
Mr Norm Thom

Enquiries should be directed to:

The Director
Environmental Science
University of Auckland
Private Bag 92019
Auckland

Street Address: 10 Symonds St.
Telephone: 09-373-7599 Ext. 8438
Facsimile No: 09-373-7470

# THE SYSTEMATICS ASSOCIATION OF NEW ZEALAND

## ANNUAL CONFERENCE 1993

**in conjunction with**

**The New Zealand Ecological Society**


**24 - 26 AUGUST 1993**

**University of Auckland, Auckland**

**Venue: Human Sciences Building Lecture Theatres 1 and 2**

# Programme and Abstracts

# Tuesday, 24th August 1993

| | |
|---|---|
| 8:00 - 9:10 am | Registration outside HSB 2 |
| 9:15 - 9:30 am<br>HSB2 | Presidential Address by Dr. Allen Rodrigo, School of Biological Sciences, University of Auckland<br>*"Systematics in the marketplace: bargain bin, boutique or badly-needed science?"* |
| 9:30 - 10:00 am<br>HSB2 | Keynote address by Prof. David Penny, Department of Microbiology and Genetics, Massey University<br>*"Opportunities for Molecular Systematics in New Zealand"* |
| 10:00 - 10:30 am | Morning Tea |
| 10:30 - 12:30 am<br>HSB1 | Panel Discussion on<br>*"Biodiversity research needs: financing national collections".*<br>Chair: Prof. David Penny, Massey University<br>Panel Members:<br>Dr. Basil Walker, MoRST<br>Dr. Malcolm Crawley, FoRST<br>Dr. Roger Blakeley, MfE<br>Dr. Wendy Nelson, Museum of New Zealand<br>Dr. Colin Webb, Landcare Research NZ Ltd. |
| 12:30 - 1:30 pm | Lunch |
| 1:30 - 5:00 pm | Joint Symposium with the New Zealand Ecological Society on<br>*"Systematics, Biodiversity and Conservation".* |

(SEE ECOLSOC PROGRAMME FOR DETAILS)

| | |
|---|---|
| 7:00 pm | CONFERENCE DINNER AT HYATT |

# Wednesday, 25 August 1993

| | |
|---|---|
| 9:10 - 9:30 am<br>HSB2 | Anni Watkins, University of Otago<br>*"Cyclones, cybernetics, cyclothymia ... Oh, and the Flora of Fiji Database"* |
| 9:30 - 9:50 am<br>HSB2 | Allan Fife, Landcare Research NZ Ltd<br>*"Towards an understanding of the genus* Sphagnum *in New Zealand"* |
| 9:50 - 10:10 am<br>HSB2 | Daniel Blanchon, Plant Sciences Research Group, School of Biological Sciences, University of Auckland<br>*"A taxonomic study of the lichen genus* Ramalina *in New Zealand"* |
| 10:10 - 10:30 am<br>HSB2 | Melodie Norris, Plant Sciences Research Group, School of Biological Sciences, University of Auckland<br>*"In-situ hybridization - revealing the origins of plant hybrids"* |
| 12:20 - 12:50 pm | SYSTANZ AGM |
| 12:50 - 1:50 pm | Lunch |
| 1:50 - 2:10 pm<br>HSB2 | Gareth Jones and Russell Gray, Department of Psychology, University of Auckland<br>*"Culture and cladistics: phylogenetic analyses of Polynesian languanges"* |
| 2:10 - 2:30 pm<br>HSB2 | Phil Garnock-Jones[1], Gail Timmerman[2], and Willie Shaw[3]<br>[1]Manaaki Whenua-Landcare Research, Lincoln; [2]Crop and Food Research, Lincoln; [3]Department of Conservation, Rotorua<br>*"Exit* 'X. it'*: a mystery resolved"* |
| 2:30 - 2:50 pm<br>HSB2 | Rodney Hitchmough, School of Biological Sciences Victoria University of Wellington<br>*"Phylogenetic relationships of diplodactyline geckos - an alternative hypothesis"* |

| | |
|---|---|
| 2:50 - 3:10 pm<br>HSB2 | Adrian Paterson[1], Graham Wallis[1] and Russell Gray[2]<br>[1]Department of Zoology, University of Otago;<br>[2]Department of Psychology, University of Auckland<br>*"Redundancy, reconciliation and host switching: reconstructing cospeciation of petrels and lice"* |
| 3:10 - 3:50 pm | Afternoon Tea |
| 3:50 - 4:10 pm<br>HSB2 | Steven Trewick, School of Biological Sciences, Victoria University of Wellington<br>*"Takahe origins and conservation: specialist or generalist?"* |
| 4:10 - 4:30 pm<br>HSB2 | Rodney Hitchmough, School of Biological Sciences, Victoria University of Wellington<br>*"Systematics of New Zealand geckos: a hierarchically structured species complex"* |
| 4:30 - 4:50 pm<br>HSB2 | Allen Rodrigo[1] and Peter Ritchie[2],<br>[1]Experimental Biology Research Group and [2]Ecology and Evolution Research Group, School of Biological Sciences, University of Auckland<br>*"Quasi-polymorphic coding: a new method for coding meristic and continuous characters for phylogenetic analysis"* |
| 4:50 - 5:00 pm | Closing remarks |

## Thursday, 26 August 1993

Field Trips to Rangitoto and Motutapu Islands

# A taxonomic study of the lichen genus *Ramalina* in New Zealand

Daniel J. Blanchon
*Genetics and Systematics Laboratory, Plant Sciences Research Group,*
*School of Biological Sciences, University of Auckland*

The lichen genus *Ramalina* has been studied in the northern hemisphere for more than two centuries, and several hundred species have been named to date. Until recently, little work had been done in the southern hemispere, and many Australasian taxa were given inappropriate northern hemisphere names.

The genus is easy to recognize. However, the high morphological plasticity and the failure of authors to investigate enough specimens has led to the creation of a bewildering array of dubious species.

Fortunately, New Zealand's isolation has spared it the worst of these taxonomic excesses, and the most recent revision has reduced the number of taxa from more than 20 to 10 that are currently recognized. Despite the study for the Flora, only a small fraction of the total herbarium specimens in New Zealand had been examined.

Research carried out in the Auckland University Herbarium has shown the need for a good research herbarium on campus. The morphology of more than 1600 specimens is presently being studied in the herbarium, and the resulting data is being catalogued on computer for further analysis. This forms the largest part of the present study.

Members of the genus *Ramalina* are known to produce a wide variety of taxonomically important secondary chemicals. New Zealand species are no exception, and thin-layer chromatography is being used to determine the chemical complement of each species.

Early chemical and morphological results support the division of the present *R. australiensis* into two distinct species. One taxon, the classical *R. australiensis* has no medullary chemistry, whereas the other, previously called *R. arabum* has a distinct chemistry and a localised distribution on offshore islands. Further herbarium and literature research will be required to determine whether the name *R. arabum* is the most appropriate one for this separated taxon.

# Towards an understanding of the genus *Sphagnum* in New Zealand

Allan J. Fife
*Landcare Research NZ Ltd,*
*P. O. Box 69, Lincoln*

The New Zealand *Sphagnum* flora remains inadequately known. *Sphagnum* is a difficult genus, as reflected by different interpretations in two 20th-century accounts. These recognized four and twenty species, respectively, in the New Zealand flora. Ten species are now well documented, although investigations are incomplete with respect to one section (sect. *Cuspidata*). *Sphagnum australe, S. novo-zelandicum, S. falcatulum* and *Sphagnum cristatum* are the four most widely distributed species, with the last comprising the bulk of the material harvested for horiticultural use. *Sphagnum subnitens* and *S. squarrosum* have well-documented, restricted distributions in Nelson/Westland and Otago/Southland, respectively. *Sphagnum perichaetiale* (sect. *Sphagnum*), a pan-tropical species, occurs in the northern portion of the North Island, but its distribution and ecology are poorly known. Two predominantly northern hemisphere species are newly recognized in the New Zealand flora: *S. compactum* (sect. *Rigida*) is known from five localities in southern Nelson, Otago and Southland and *S. teres* (sect. *Squarrosa*) is well documented from the Old Man Range in Otago. These species conform to a pattern for many bipolar disjuncts in the New Zealand cryptogam flora in being restricted to high-elevation sites on the South Island. An additional species in the section Subsecunda remains undescribed. It is an unusual *Sphagnum* with elongate, unbranched stems forming compact cushions at tarn margins at high elevations through much of the South Island; given the tag name *Sphagnum* "simple", it appears to be an Australasian endemic.

# In-situ hybridization - revealing the origins of plant hybrids

Melodie M. Norris
*Plant Sciences Research Group,*
*School of Biological Sciences, University of Auckland*

In-situ hybridization, or "chromosome painting" is a powerful technique for testing genome relationships. Whole genomic DNA from a species is isolated, labelled and then hybridized in situ onto mitotic chromosome spreads of putative hybrids. Using high stringency washes, DNA sequences sharing at least 80% homology will hybridize. Sites of hybridization can be visualized using a fluorescent tag. The use of whole genomic in-situ hybridization in plant systematics will be illustrated by three examples from the literature[1,2,3].

In-situ hybridization is currently being used to identify species and hybrids of *Pratia*. There are now 5 native species of *Pratia*: *P. angulata, P. perpusilla, P. macrodon, P. arenaria* and *P. physaloides*. However, *P. angulata* is morphologically variable, and chromosome counts have revealed at least two ploidy levels (10x and 20x) and two suspected hybrid races (77 and 91 chromosomes respectively). Morphologically, the hybrids appear to be intermediate between *P. angulata* and *P. perpusilla.* It is hoped that by probing cells of the hybrids and the polyploids with DNA from other species and races, their origins and their systematic status will be clarified.

1. Bennett, S.T., Kenton, A.Y., and Bennett, M.D. (1992). Genomic in situ hybridization reveals the allopolyploid nature of *Milium montianum* (Graminaceae). *Chromosoma* **101**:420-424.
2. Parokonny, A.S., Kenton, A.Y., Meredith, L., Owens, S.J., and Bennett, M.D. (1992). Genomic divergence of allopatric sibling species studied by molecular cytogenetics of their F1 hybrids. *The Plant Journal* **2**(5):695-704.
3. Parokonny, A.S., Kenton, A.Y., Gleba, Y.Y., and Bennett, M.D. (1992) Genome reorganization in *Nicotiana* asymmetric somatic hybrids analysed by in situ hybridization. *The Plant Journal* **2**(6):863-874

| Wednesday, 25 August 1993 | HSB2 | 1:50 - 2:10 pm |
|---|---|---|

## Culture and cladistics: phylogenetic analyses of Polynesian languages

Gareth Jones and Russell Gray
*Department of Psychology,*
*University of Auckland*

In this talk, we will discuss the points of analogy and disanalogy between biological and linguistic evolution. We will present some preliminary phylogenetic analyses of Polynesian languages and discuss the merits and potential pitfalls of phylogenetic analyses of linguistic relationships.

# Exit *"X. it"*: a mystery resolved

Phil Garnock-Jones[1], Gail Timmerman[2] and Willie Shaw[3]
[1]*Manaaki-Whenua - Landcare Research, Lincoln*
[2]*Crop and Food Research, Lincoln*
[3]*Department of Conservation, Rotorua*

We have used the sequence of the chloroplast *rbc*L gene to place a mysterious native plant within a family.

*"X. it."* is the nickname of an unidentified dicotyledon collected by Willie Shaw and Sarah Beadel in Te Urewera National Park in 1983. Many New Zealand botanists, and specialists in Australia and Britain, have looked at it, but no convincing identifications have been suggested. Searching for evidence of its relationships is hampered by the lack of floral material, lack of *a priori* knowledge of which characters might be informative, and the possibility that *"X. it"* is a highly modified member of its group.

The *rbc*L gene is a valuable tool for indicating relationships at the family level. It has usually 1428 bases, exists in only one copy, evolves slowly, presents no problems with sequence alignment, and amplifying and sequencing primers are well known and available. Even more important to the *"X. it"* problem, *rbc*L has been sequenced for over 500 species worldwide, to provide a phylogeny of all the major spermatophyte groups. We used these sequence data to place *"X. it"* within that *rbc*L phylogeny.

*"X. it"* falls neatly within a well-known Gondwanic family where it represents an anomalous new genus. Being so distinct, it is unlikely that *"X. it"* is a recent immigrant or a cultivation escape, but truly a part of the endemic New Zealand flora. Study of its anatomy and morphology have allowed "*X. it*" to be compared with others in its family.

# Phylogenetic relationships of diplodactyline geckos - an alternative hypothesis

Rodney A. Hitchmough
*School of Biological Sciences,*
*Victoria University of Wellington*

The Australasian gecko subfamily Diplodactylinae was divided by Kluge (1967) into two tribes - Diplodactylini (Australia) and Carphodactylini (Australia, New Caledonia, and New Zealand). Bauer (1990) has produced a morphology-based cladogram for the Carphodactylini. However, reanalysis of Bauer's data with inclusion of taxa from the Diplodactylini strongly suggests that the tribal split is invalid, and that some of the higher-level relationships proposed by Bauer are artifacts of morphological convergence. This reanalysis is also more consistent with King's (1987) cytogenetic data, except for the position of *Carphodactylus*. A small-sclae allozyme study has suggested that the New Zealand and New Caledonian groups are each monophyletic. The survey also shows no separation among the Australian taxa consistent with the current tribal classification. Bauer (1990) suggested that the New Zealand genus *Hoplodactylus* is paraphyletic with respect to the New Caledonian genera; all my data suggest that *Hoplodactylus* is indeed paraphyletic, but with respect to *Naultinus* (which Bauer considered more ancestral) rather than the New Caledonian group.

# Takahe origins and conservation: specialist or generalist?

Steven A. Trewick
*School of Biological Sciences*
*Victoria University of Wellington*

Interpreting the ecology of rare animals is fraught with danger; there is very little information to work with. The nature and quantity of data that is obtainable may be subject to gross unobservable biases. In the case of the takahe, sterling work in Fiordland has provided much enlightenment but interpretation has been dominated by one overwhelming assumption: that the environment in which the takahe is currently found is the preferred one. Examination of the origins of takahe and takahe-like birds suggests that an alternative approach is necessary. If so, then the application of our limited knowledge must be adjusted if successful long term conservation of this species is to be achieved. Apparently radical management methods that conflict with low interference ideals may be required.

# Redundancy, reconciliation and host switching: reconstructing cospeciation of petrels and lice

Adrian Paterson[1], Graham Wallis[1] and Russell Gray[2]
[1]Department of Zoology, University of Otago
[2]Department of Psychology, University of Auckland

Incongruent host and parasite phylogenies are often explained as the result of previous host switching events. An equally likely explanation is that incongruence is the result of sympatric speciation and extinction. Reconciliation analysis is a method that can estimate the minimum number of sympatric speciation and extinction events required to reconcile incongruence between host and parasite trees. We have derived parasite and host cladistic trees for 16 louse taxa (morphological and behavioural data) that parasitise 18 seabird taxa (behavioural and genetic data). Of nine duplication events in the reconciled tree only one is incongruent with the tree topology, indicating only a single host-switching episode and eight redundancy events. This suggests that much of the radiation of seabird lice predated the evolution of the seabirds.

# Quasi-polymorphic coding: a new method for coding meristic and continuous characters for phylogenetic analysis

Allen Rodrigo[1] and Peter Ritchie[2]
[1]*Experimental Biology Research Group*
[2]*Ecology and Evolution Research Group*
*School of Biological Sciences, University of Auckland*

Systematists routinely deal with taxonomic characters that are measured on a continuous or integer (meristic) scale. However, we find the methods available for coding such characters for phylogenetic analysis unsatisfactory because they are based on a statistical interpretation of character variation rather than on a biological one. We will present a new method for coding continuous and meristic characters that is based on the underlying biology of character variation. The method is called "Quasi-Polymorphic Coding" (QPC) because it infers the presence of shared suites of alleles. QPC can handle the same types of data that other contemporary methods can, but it can also handle disjoint character distributions. QPC can also be used to infer ancestral states of continous or integer characters. We will illustrate the use of QPC on two datasets.

# Systematics of New Zealand geckos: a hierarchically structured species complex

Rodney A. Hitchmough
*School of Biological Sciences*
*Victoria University of Wellington*

The New Zealand gecko genus *Hoplodactylus*, as currently recognised, includes two widespread species as well as several species with restricted geographic ranges. Allozyme surveyshave confirmed the existence of species complexes within both widespread species ad one northern endemic, taking the number of species within *Hoplodactylus* from eight to at least 22. Examples of the variation found within the *Hoplodactylus maculatus* complex will be described. There is a hierarchy of differentiation within this complex from morphologically and genetically distinct sympatric species, through parapatric species pairs both with and without hybridisation in the contact zone, to regionally differentiated groups of populations without evidence of reproductive isolation. Because of this hierarchical structure, species-level taxonomy is subject to different interpretations dependent on the species concept used, and inevitably oversimplifies the variation seen in nature.