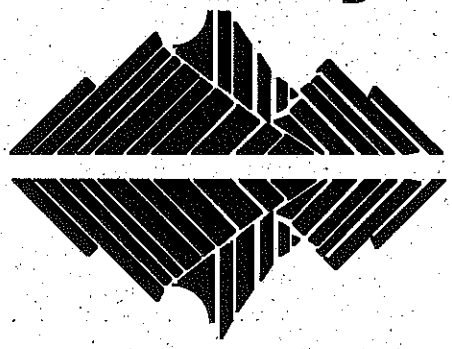
# Ecological Society Newsletter



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## 1996 CONFERENCE AND AGM AT LINCOLN UNIVERSITY

Planning for the 1996 conference at Lincoln is well under way. The organising group is Glenn Stewart, Richard Duncan (Plant Science Department), Kerry-Jayne Wilson (Entomology & Animal Ecology Department), and Rob Allen and Larry Burrows (Landcare Research). As announced in the last newsletter the conference will be held in late June/ early July. A student session will be held on **Sunday 30 June**.

Contributed papers and a symposium will be held on **Monday - Wednesday 1-3 July**, and field trips on **Thursday 4 July**.

The symposium title is :

### The Ecology of Biological Invasions

Invitations will be sent to several keynote speakers but if you have a paper to offer on this subject or a paper for the contributed papers sessions, please indicate on the form on this page.

If you are considering attending the conference, you should fill out the form below and send it to the organisers before **1st March 1996**. The information will help with planning and organisation – it is not a registration form or a binding commitment to attend.

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**NZ Ecological Society Annual Conference – Statement of Interest**

NAME .....

ADDRESS .....

.....

.....

I am interested in attending the Annual Conference and will/will not (strike out the alternative) offer a paper:

**TENTATIVE PAPER TITLE:**

.....

.....

I will/will not (strike out the alternative) need accommodation.
I would prefer (tick one option)

1. Halls of Residence
2. a motel in Christchurch (regular bus service available to Lincoln)
3. a billet if possible

I am/am not interested in taking a field trip.
I would most likely opt for (tick one option)

1. Craigieburn Forest Park
2. Hinewai Reserve
3. Other (make a suggestion)

.....

.....

**Return completed form before 1 March to Glenn Stewart, Plant Science Dept, Lincoln University, PO Box 84, Lincoln, Canterbury.**

## ACROSS THE TASMAN

### Liaison with the Ecological Society of Australia (ESA)

As only a very few members of NZES are also part of ESA, most of you probably are unaware that I've been writing a regular article on behalf of NZES for the ESA's quarterly Bulletin. This liaison emerged from discussions held with ESA Executive members while in Hobart for the Southern Connections conference in 1993 and I've been writing for the Bulletin ever since. ESA is now approaching a membership of around 1000 and for the sum of AUS $70, members receive both the Bulletin and the Australian Journal of Ecology. They also have a really good networked Bulletin Board for members. Can we have one?

I recently attended the annual conference and AGM of ESA. During discussion over locations of future meetings, a joint NZES/ESA conference was suggested for 1998. The ESA AGM members were overwhelmingly in support of this proposal. Conveying this to NZES National Council in early October, they have agreed in principle to the suggestion. So, the seed is set for an inaugural joint meeting of the Societies. Ideas/contributions welcome! In keeping with these moves, I (until an Australian-based ESA member can be persuaded) will be writing an Across The Tasman article for each NZES newsletter, as well as the ESA Bulletin.

Kath Dickinson,
NZES representative to the ESA.

## BOTANISING ON GREAT BARRIER ISLAND – 1-8 OCTOBER 1995

A group of us, Barbara Polly, Patrick Brownsey, Jill Rapson, and briefly, Norman Hawcroft, recently had the opportunity to join an "expedition" lead by Carol West, to Great Barrier Island. Carol had visited the island before and organised accommodation and an outline programme for us. This presented a great opportunity to botanise generally, though Barbara was mainly foraging for lichens, and Patrick wanted to add mosses to the Dominion Museum herbarium.

We all met up in Auckland, courtesy of Jessica and Ross Beever, and took the public ferry to Great Barrier. On some days of the week it visits Port Fitzroy and Whangaparapara as well as the "capital", Tryphena, which suited us as Carol had booked a DoC house round the bay from Fitzroy. A boat is a very nice way to do your landscape ecology, as broad scale vegetation patterns can be surveyed from a decent distance, and coastal vegetation, in which I have a particular interest, can be a much drier study than usual. The overall impression of the island is of now ubiquitous kanuka (*Kunzea ericoides*) forest with scattered kauri (*Agathis australis*) on some ridges; mangroves occur in the muddy bays and sheltered estuaries. Conspicuous on some of the Broken Islands was a heath with an interesting bright pink flowers – *Erica baccans*; it certainly was classically weedy, growing on all the exposed ridges and crests, where not much native vegetation is left these days.

We disembarked at Fitzroy, and as the luggage crates emerged from the ferry's hold, made the astonishing discovery that Patrick's luggage included 2 microscopes, and both Carol and I though that Gt. Barrier was too far to go without laptops! This necessitated a "taxi" the 2km to the DoC base. The cottage was really pleasant, with electricity (pretty weak) when the generator was running, a wet back stove to heat the shower water, and a bunkroom for 6. The harbour is about 10m away, with a banded rail nesting under the flax, and a few pukeko with chicks running about. Mouldy sunflower seed thrown on the lawn attracted sparrows, thus destroying the myth we had read somewhere that there were none on the island. Four wood pigeons sitting in a Norfolk Island hibiscus (*Lagunaria patersonii*) outside the cottage watched all our activities very superciliously. On some evenings brown teal, common only on the island, emerged to browse on the grass in front of the cottage.

After we had settled in and had a cuppa, we took a walk up the nearest track, called Warren's Track, which goes up to a waterfall, and is apparently only half an hour long, though it took the bryologists about 2 hours. It goes through pleasant kanuka scrub, which has a tall canopy, about 10m, over fernland, with a few shrubs regenerating. There are also lots of podocarps, largely all planted. There have been extensive attempts to regenerate kauri forest on the island, and most tracks seem to have a marginal belt of kauri along them. Kauri grows slowly; the ones by the jetty below the cottage, planted about 30 years ago, are only growing 20cm per year. Above the top waterfall were some fine adult kauri trees, one about 1m across. There was a nice collection of ferns along the track too, including *Adiantum hispidulum*, which has a hairy stipe, and *Adiantum aethiopicum*, with lovely round pinnae and a scrambling habit.

On an excursion to the Kaiarara Stream, after several river crossings, we puddled along the flattish track towards Mt Hobson. The fern highlight was *Loxsoma cunninghamii* in a dense stand. The forest was mainly kanuka, but with a very rich understorey,

including lots of *Alseuosmia macrophylla*, which was flowering - lovely reddish tubes with cream, waxy petals coarsely frilled. There was lots of *Brachyglottis kirkii* as well, none of it flowering, and the usual collection of species apparently planted. We ended our walk at some tarairi (*Beilschmiedia tarairi*) forest. The trees were huge, with some really mammoth puriri trees, and a dense understorey of nikau (*Rhopalostylis sapida*) and kohekohe (*Dysoxylum spectabile*). On the way back we found some *Pomaderris kumeraho* flowering profusely on the side of the road, and a rather lovely view over the Kaiarara Bay, which has mangroves separated from the sea by sedgelands, rather an odd mix.

Next morning Patrick and Barbara went off back up Warren Track, where they found lots of specimens they had apparently missed the day before, to add to Jessica Beever's list for the northern part of the island; about a dozen species were added in total. For the afternoon excursion we left Carol in charge of the computers, while we elected to wander past Port Fitzroy to the Old Lady Track. Part way in the track crossed a little gully on a pretty wobbly little bridge, with puriri (*Vitex lucens*), nikau and ponga fern (*Cyathea medullaris*), where Patrick found *Trichomanes elongatum*. We also found some odd looking tawa, and debated whether it might be the form called *Beilschmiedia* "tawaroa". We then went up the Lookout Track, through masses of kanuka, past some lovely *Lygodium articulatum*, the climbing fern, with fertile fronds at the ends of stems. The top rock has a lovely view out over Port Fitzroy and Rarohara Bay to Kaikoura Island, well worth the climb.

Having had our fill of walking on the island's rough roads, and with plants further afield in our sights, we hired a car for the next three days. First we headed over the hill towards Okiwi, and then north to a little settlement of Kawa. The map indicated the presence of sand, but there were no dunes, or at least none persisting today. Instead the foreshore was kikuyu (*Pennisetum clandestium*), and the accustomed old junk of sheds, boats, and abandoned cars, with one of the SS Wairarapa grave sites along the coast. The steamer sank on 29 October, 1894, after the captain sailed in a fog into Miners Head; about 130 people, out of a total complement of 250 died. The graves near Kawa, in Moanauriuri Bay, are now under a huge pohutukawa, behind what was probably a foredune of sand, but which is now largely covered in kikuyu, although some *Carex pumila* does form the front of the dune terrace. The graves are massed, behind a white picket fence, and were covered in a "garden" of *Doodia media*, a coastal fern with lovely red young leaves, *Zantedeschia*, and what was probably a gladiolus. A little browse up the creek feeding the bay revealed a series of patchy turves of saltmarsh species underneath a broken kanuka canopy.

The settlement of Motairehe features a huge erratic boulder (or so it looked, though no glacier had left it here) parked in the estuary. It was covered in lichens, probably because it was too high and rounded to be scaled by the local children and visitors. Additionally it had some very stunted *Pyrrosia eleagnifolia* growing on it, the odd moss, and some *Bulbophyllum pygmaeum*, a tiny orchid, with leaves 3-5 mm across, and looking rather miserable. The estuary has a number of coastal marshy plants amongst the mud and rocks, as well as some lovely specimens of *Melicope ternata*, and *Peperomia urvilleana*. There was also a community of brown teal, which are very attractive little birds, smaller than the average mallard, and a lovely soft brown shade, with slightly darker heads. They were wary, but not afraid.

Burrill's Track goes up north through the northern block of apparently relatively undisturbed forest, Great Barrier style, where the Offshore Islands Research Group had a major (though wet) expedition in 1983, reported in *Journal of the Royal Society of New Zealand*, Volume 15. We weren't so active, but did walk along the ridge for an hour, and mainly passed through kanuka, though lovely nikau and tarairi were off the side of the ridge.

Whangapoua Beach is on the eastern side where all the sizeable dune remnants are. The northern end of the beach has a belt of Norfolk pines (*Araucaria araucana*) between the dunes and radiata pines, and only a thin zone of (mainly *Spinifex sericeus*) dunes; this is the way to the other grave site of the SS Wairarapa. Towards the southern end of the beach, the foredunes were of extensive spinifex, with exotic weeds and some sand bindweed (*Calystegia soldanella*). On taller dunes are lots of *Cassinia* shrubs and some lupins. Further to the south were huge patches of pingao, a lovely bright orange colour, and really dense. In patches behind them was a mixed scrub of *Muehlenbeckia*, rushes and grasses, with 100% cover, and towards the estuary was a taller vegetation of toetoe, manuka, rushes and lupin, forming a closed canopy as far as the mangrove belt. Some of the backs of the foredunes showed a shelf of orange, sandy accretion emerging through the sand, and being eroded away.

We also had a quick look at other interesting dunes. Kaitoke Beach dunes seemed to be mainly spinifex, with some marram (*Ammophila arenaria*), backing on to pine forest. I couldn't see whether there were any decent slacks but did find a small

*Carex pumila* sand plain, and on a small pingao-spinifex dune near the picnic stop, *Austrofestuca littoralis*. At the other end of the beach is an estuary (with a large family of brown teal), and an extensive marshy margin, stretching back into the Kaitoke Swamp, an area which looks most interesting botanically. Karaka Bay is typical of most of the small duney bays on the island; the dunes are non-existent, probably because they were used as landing, and then building sites, and so suffered fatally from European colonisation. Some of the coastal cliff vegetation is in better shape, and we saw *Coprosma acerosa* and *Pimelea arenaria* amongst others.

South of Okiwi, we climbed abruptly up the ridge line towards Windy Canyon, and spent a morning collecting mosses from roadside banks, a very fruitful, if rather unnatural habitat. We also inspected a ridge-top kauri stand, with a range of ages, good regeneration, some *Phyllocladus aspleniifolius*, both handsome adults and lots of juveniles, and occasional rimu. We also sampled the Hot Springs Track, crossing Kaitoke Swamp, with some nasty boggy swamp crossings where the vegetation was suffering badly from walkers, to the picnic area. The streams were pleasantly warm with a lovely blue-green algae growing in them. The area was surrounded by huge swards of *Sticherus flabellatus*, a new fern to me on the island. The marginal forest was the usual kanuka, with some nice puriri in it, and lots of *Lycopodium deuterodensum*, *Pomaderris kumeraho*, as well as patches of *Hakea*. The only decent bit of boardwalk covered and protected a huge patch of *Ageratina*, an exotic.

Our final day was reserved for the track over Mount Hudson, which, at 627 m is the highest point of the island, and Norman joined us for this. We started part way up, at Windy Canyon, which is really spectacular, with huge, steep bluffs, and precipitous stairways. *Olearia allomii*, the Great Barrier endemic, was there; it has very thick leaves, and white ray flowers, with mauve disc florets with orange stamens. We passed prostrate kanuka, *Kunzea sinclairii*, which has really tiny capsules, and lots of interestingly coloured *Pseudopanax discolor*. Further along, the track moved through heathland of manuka, *Weinmannia silvicola*, and *Phebalium nudum*, about 1.5m high, with the occasional regenerating kauri, where Patrick found *Schizaea fistulosa* and *Schizaea dichotoma*. Nearer the summit, we climbed steeply through real kauri forest, which had not been logged, and contained lots of podocarps. The view from the summit was really excellent, of the Gulf islands, including the Hen and Chickens, and Little Barrier just offshore, as well as the Poor Knights, and Cuvier behind. Going down was quite an experience because there were enormous numbers of steep flights of steps, separated by little platforms, and then yet more steps, extended about 200 m downslope (vertically). However hard it is to bryologise from a boardwalk, at least the vegetation gets a much better chance to survive when so protected, and the track clearly gets a lot of use by tourists, as we met the entire complement of the sailing ship, the *Spirit of New Zealand*, on its way to the summit.

We inspected the kauri dams on the way down; these consists of several massive kauri beams (about 50cm diameter) placed at right angles across the stream, with a series of kauri spars hanging off an upper one. These spars used to hold the water in place until released to wash logged stems down-stream. Apparently the upstream dams (2 in adjacent headwaters) were triggered a few seconds before the main dam. The resulting rush of water washed downstream all the kauri logs which had been skidded to the stream bed. Naturally, the stream gullies were completely scoured of organic material, and are cut down to bedrock. This explained the curious deposits of sand and silt seawards of the mangroves in Kaiarara Bay.

Despite it's relative accessibility, Great Barrier Island is not often frequented by other than local botanists, but it is a unique and very interesting experience, and still a delightfully quiet place to visit.

Jill Rapson
Department of Ecology
Massey University

Thank you Jill for this interesting report. We could do with more articles of this kind to liven up the newsletter. Editor.

## QUOTATION FROM NEW ZEALAND OUTDOOR MAGAZINE

"What is Man without the beasts? Man would die from great loneliness of spirit, for whatever happens to the beasts also happens to Man. All things are connected."

Chief Sealth, Suquamish Indian Tribe, 1855.

Sent in by Ray Zander.

## A SELECTION OF ABSTRACTS FROM NZ ECOLOGICAL SOCIETY CONFERENCE, MASSEY UNIVERSITY, 1995

### Differences in responses to a model predator and results of a cross-fostering experiment between Takahe and Pukeko.

Judah Bunin and Ian Jamieson

Ineffective defence responses towards introduced mammalian predators have been implicated in the decline of many of New Zealand's endemic species of birds including the Takahe (*Porphyrio mantelli*). This paper compares predator defence behaviour of Takahe with that of their closest extant relative, the widespread Pukeko (*Porphyrio porphyrio*), and summarises results of a cross-fostering experiment on Mana Island involving transfer of Takahe eggs to Pukeko nests. The aims of the cross fostering experiment were to determine its feasibility in increasing Takahe productivity and to determine whether cross-fostered Takahe chicks responded to model predators differently than parent-reared chicks. Pukeko parents responded more strongly to model predators, exhibiting higher levels of tail-flicking, vigilance, and alarm calling than Takahe parents. The cross-fostering experiment was constrained by a shortage of viable Takahe eggs. Two cross-fostered Takahe chicks have been successfully reared by Pukeko foster parents, from a total of 12 trials. Low fledging success of cross-fostered chicks (25%) may reflect poor quality of Takahe eggs/chicks rather than poor parental care by Pukeko foster parents as hatching success of parent-reared Takahe eggs on Mana Island was only 22%. Of the one cross-fostered chick tested its predator defence response was higher than the parent-reared chick.

### Current and prospective distributions of Hall's totara and other forest trees in the pastoral landscapes of Central Otago.

Alex Wearing

Proposals in the Crown Pastoral Lands Bill, 1995, along with the continuance of extensive freeholding, raise questions about the prospects of woody species of forest and shrubland ecosystems in pastoral areas. Hall's totara (*Podocarpus hallii*), like other forest species, is found at several Central Otago locations, but it is not generally common. The original communities of which it was a member no longer exist, formal protection for survivors is limited, survival of isolated plants and small stands rests on a combination of topographic protection and benign land use, and recruitment is uncertain. While individuals of Hall's totara are long-lived, their future at many locales is not assured.

This paper comments on the current, and indicates the prospective, distribution of Hall's totara and other forest trees in a predominantly pastoral landscape. Recruitment of Hall's totara and other forest trees was assessed on the Pisa Range in terms of its persistence and localised range expansion.

Hall's totara is a distinctive, albeit residual and seldom seen element in the Central Otago landscape. It is a survivor from an earlier period when the vegetation of Central Otago had a more prominent woody component. It persists amidst the 'successor' indigenous tussock grasslands which in the public mind constitutes the region's 'natural' vegetation. These grasslands have been transformed to create a new mix of indigenous and introduced species.

It is argued that the current concern for rare species needs to be extended, to encompass plants like Hall's totara which engender landscape continuity, distinctiveness and future potential, albeit under different climatic and/or land management regimes, at the regional scale.

### Hatching success of fairy prions (*Pachyptila turtur*) and the relationship with tuatara (*Sphenodon punctatus*) on Takapourewa (Stephens Island) during 1994-1995.

Tim Markwell

Using a CCD video camera, I observed the hatching success of fairy prions (*Pachyptla turtur*) in different habitats on Takapourewa (Stephens Island) in Cook Strait during the 1994-1995 season. The findings were related to the occurrence of tuatara (*Sphenodon punctatus*) in the same habitats. Overall, 75% of the burrows investigated on the island contained nesting pairs of fairy prions and 12% contained tuatara. The mean hatching success of fairy prions from all sites was 77%. The range was 88% in pasture to 55% in bush. Although predation by tuatara on prions appears important, I found no significant correlation between hatching success and tuatara abundance. This result is compared with mainland petrel populations, where hatching success is much lower, presumably due to mammalian predation.

### Experimental tests of food limitation in translocated hihi populations

Doug Armstrong, John Perrott, Isabel Castro, Paul Jansen and John Ewen

Hihi (or stitchbirds) became extinct everywhere except Little Barrier Island following European colonisation. In the 1980s hihi were translocated Hen, Cuvier and Kapiti islands, but in all cases the populations failed to be self-sustaining. Hihi have recently been released on Mokoia Island (September

1994), and are due to be released on Tiritiri Matangi this year. With these new populations, we have initiated an experimental research programme to determine what limits the viability of reintroduced hihi populations.

This talk will outline experiments designed to test whether hihi are limited by availability of carbohydrate food – i.e, nectar and fruit. The experiments involve measuring responses of birds to supplementary sugar water. In the non-breeding season, we compare condition (weight) of birds when they do and don't have access to supplementary food. From these data we can identify times of year when mortality is likely to occur due to lack of food. In the breeding season, we test whether reproduction is limited by food supply by comparing reproductive success and condition of birds that do and don't have access to feeders. The degree of access depends on how close a bird's nest is to a feeder. So far, our results on Mokoia suggest that reproduction on Mokoia was limited by natural food supply, but that food supply has not limited condition of birds since the end of the breeding season.

## SYMPOSIUM ABSTRACTS

### Levels of evidence in studies of competition, predation, and disease.

Brian McArdle

The aim of the paper is to examine the different kinds of evidence field ecologists habitually acquire, and the problems they have in actually establishing the existence and importance of the effects of biotic interactions (like competition, predation, and disease). I discuss the use of observational data to separate one particular hypothesis from among alternatives, and consider the use of experimental design techniques to improve the quality of information from such studies. I also examine the use of manipulative experiments. The concept of pseudoreplication (Hurlbert 1986) has had enormous influence on field studies in recent years. I correct a mistake in its definition and clarify some misconceptions. Finally I consider some of the problems with getting evidence accepted.

### Research by Management on agents of decline – possums and kokako at Mapara

Phil Thomson and John Innes

A "Research-by-Management" (RbM) experiment to test whether a mainland kokako population could be maintained by introduced mammal control started at Mapara Wildlife Reserve (King Country) in 1989. Possums were trapped and poisoned; ship rats and mice were poisoned; mustelids were trapped, and feral cats, goats and pigs were shot each year. Kokako and pests were monitored with standard methods to determine the response of both to management, and invertebrates, vegetation and other bird species were monitored to a lesser extent. Kokako chick output increased from zero in 1990-91 to 78% of monitored pairs in 1994-95, and the number of adults in the Reserve increased from 52 to 62 in the same period. Some kokako pairs originally consisted of two males, which may explain why recovery has been slower than expected.

The RbM experiment also included a replicate management block (Kaharoa, Bay of Plenty, 1990-91 to 1992-93) and a non-treatment block (Rotoehu, Bay of Plenty, 1990-91 to 1993-94) in which mammal pests and kokako were monitored with the same methods as at Mapara. Considering all areas, log linear modelling showed that mammal management significantly improved the proportion of kokako pairs fledging young, when annual differences were controlled. Chick output at Kaharoa was 85% (n=13) in 1992/93, but never exceeded 30% (n=13) at Rotoehu. Pest control was turned off at Kaharoa in 1993-94 and on at Rotoehu in 1994-95 as a treatment switch to further challenge the causal connection between pest control and kokako population recovery. Replication is usually difficult in large-scale community perturbation experiments, and this one is no exception. Our interpretation that pest control has been responsible for improved chick output is supported by the results of a 4-year study of kokako breeding attempts and outcomes in the absence of management, which showed that 80% of nesting attempts failed, mostly due to predation by ship rats, possums and kahu (harriers).

### Kaka population decline – competition or predation?

Peter Wilson, Brian Karl & Richard Toft

There are now fewer kaka (*Nestor meridionalis*) found on mainland New Zealand than at the turn of the century. Research initiated in the 1980s suggested that a possible reason for this decline was competition with introduced browsers and wasps for high energy food. A supplementary feeding experiment was undertaken to test this hypothesis. This paper reports on the breeding success of South Island kaka in relation to supplementary food and the natural pulses of beech seeding and predator numbers. Kaka bred successfully only in years when some beech seeding occurred. Supplementary feeding by itself did not trigger breeding. Up to 80% (n=10) of nestlings were killed, presumably by stoats. In addition, 3 out of 5 breeding females were killed on the nest in 1 year – again stoats were implicated. It is likely that stoats are responsible for the imbalance in sex ratio recorded in our study area, and in the North Island. In contrast, the sex ratio on

Kapiti Island (where there are no stoats) is about 50:50. We suggest that stoats are now the major factor in kaka population decline on mainland New Zealand.

### Old or New, One or Many, Agents of Decline in Skinks of Central Otago.

Graeme Loh

The Otago skink and the grand skink are two diurnal species endemic to schist rock outcrops of Central Otago. Both are vulnerable to extinction and need urgent conservation action. Their current distribution does not match their apparent available habitat. This is a feature of several threatened reptile species.

Since 1982 their status has been the subject of systematic investigation, recently guided by the species recovery plan. Distribution has been surveyed. Priority sites for protection have been identified and some protected. Some populations in tussock and exotic pasture have been monitored for six years. Reproductive success has been described. The diet and distribution of mammal predators has been examined.

Skinks are still present where typical pastoral farming practices, including burning, ploughing and rabbit poisoning have been carried out. The core of current distribution is only 3,000 ha with a few remnant outliers, so there has been a substantial reduction in range this century. Monitoring has detected no significant declines in the last ten years. Developed areas adjacent to tussock have significantly lower numbers but no cause for this has been identified yet. Recently movements between rocks of up to 1.5 km have been found.

Despite considerable investigation no factor to explain the current distribution of skinks has been identified, but it has suffered a catastrophic decline in the last one hundred years. Is the factor that caused the decline still operating? Has there been a series of local catastrophes that may yet occur in the remaining range? At present there is no evidence to support an hypothesis of chronic gradual decline from one key factor. Perhaps the search for a key factor is inappropriate in an environment which is dominated by continual new waves of disturbance arising from european and polynesian settlement.

### Demonic intrusion and predator removal experiments

Gary Bramley

To test the hypothesis that predation on eggs and chicks by ferrets and cats was limiting the productivity of North Island weka (*Gallirallus australis greyii*), predators were removed by trapping from the home ranges of 4 breeding weka pairs. Reproduction by four other breeding pairs was monitored to provide a control. Two of the pairs breeding in areas from which predators were removed reared 5 chicks to independence, while 2 Control pairs reared no chicks to independence after 3 breeding attempts. Unfortunately, the death of 1 weka in the Experimental pairs and the loss of radio transmission from 2 wekas in the Control pairs meant that no statistically valid conclusion can be drawn from these results. Since research into causes of decline of species with small populations inevitably means doing experiments with small samples sizes, some remedy is needed for when 'demons' intrude in a way that further threatens statistical power. Single subject designs developed in the social sciences offer an alternative route for investigating agents of decline in rare species. A common experimental procedure in single subject studies is the A-B-A series or some variant of it where A and B refer to experimental conditions with A being the control and B the treatment. This is applied to individuals (e.g. animals, or areas) which are so stable they can be regarded as representative. Well designed, directly replicated single subject studies might remedy demons and additionally allow costs of replication to be shared amongst conservancies or between agencies with the results of each study being meaningful, cumulative and even more publishable. For some species, all that may be required is a re-analysis of existing data.

### Nesting success of New Zealand pigeons (*Hemiphaga novaeseelandiae*) in response to rat (*Rattus rattus*) control at Wenderholm Regional Park.

Roger James and Mick Clout

Predation of New Zealand pigeon (*Hemiphaga novaeseelandiae*) nests was significantly lower in forest where poison had been laid for rats than in control areas. This was so both for natural nests and for artificial nests baited with Rock Dove (*Columba livia*) eggs. Hatching and fledging success were not significantly different in experimental and control areas, due to a higher level of desertion in the experimental area.

### Cat tales from the Orongorongo Valley

Mike Fitzgerald

Cats and their prey have been studied in the Orongorongo Valley for more than 20 years. Their numbers have been monitored throughout that time and the diet of cats has been studied twice; first when they were common and again later when they were scarce. Cats preyed mainly on small mammals (rats, rabbits and mice); birds were a minor item in the diet. Stoats are also present and may be both a

competitor with, and prey of, cats. During the study the numbers of cats and prey changed substantially; cats because of human intervention and prey because of a combination of reduction in the numbers of predators and variations in climatic and habitat factors. Some of these events have acted as "natural experiments", providing insights into the inter-relationships of predators and prey. The complexity of these interactions needs to be appreciated if management strategies for predators are to be effective.

### Role of predation in the decline of kiwi, *Apteryx* spp.

John McLennan

At least three of the four species of kiwi have declined significantly in abundance and range since European settlement. Little spotted kiwi (*A. owenii*) are now probably extinct on the mainland; great spotted kiwi (*A. haastii*) are retreating to high rainfall regions in the north-western corner of the South Island; northern brown kiwi (*A. mantelli*) are declining in all parts of their range except the northern tip of Northland; and the conservation status of southern brown kiwi (*A. australis*) is uncertain, though the species is still locally numerous on Stewart Island and in parts of Fiordland.

Introduced mammalian predators are strongly implicated in the decline of kiwi, with the major predators varying regionally and between kiwi species. Evidence of predator impacts on kiwi is presented form studies of the survival of eggs, juveniles and adults in mainland forest, and the age-structure of mainland populations. Results are reviewed and used to model the likely outcomes of various predator control strategies, and to assess the long-term conservation requirements for kiwi in the New Zealand mainland.

### The ecology of *Bonamia* and decline of bivalve molluscs

Mike Hine

*Bonamia* is a protozoan parasite of the haemocytes of oysters (*Tiostrea chilensis*), in which it has an annual developmental cycle between November and August each year. The parasite transmits directly, oyster to oyster, and therefore disease spread is related to host stock density. The Foveaux Strait oyster population experiences large mortalities every 20-30 years, and these may be attributable to *Bonamia*. The parasite appears to become less pathogenic at the end of, and probably between, mass mortalities, and some oyster populations appear more tolerant of infection than others. On the basis of these observations, and considering other protist-pathogen:oyster models, likely interaction of virulent and benign *Bonamia* with susceptible and infection-tolerant oysters is discussed. The genetics of parasite and host stocks, and the interaction of *Bonamia* with host haemocytes, may explain the cyclic nature of large-scale mortalities in Foveaux Strait.

### Sudden Decline of cabbage tree (*Cordyline australis*): search for the cause

Ross E. Beever and Richard L.S. Forster

Many cabbage trees (*Cordyline australis*) are dying throughout much of the North Island and the northern South Island of New Zealand. The symptomatology of those dying in urban environments is described, and concluded to be consistent with the hypothesis that death is caused by a biotic agent entering through a leafy tuft of the branch system. This disease, which has been named Sudden Decline, usually leads to almost total defoliation of affected trees within 6-12 months. Disease incidence has increased linearly in rural populations at about 11% per annum since 1987/88. Cultivated trees of *C. kaspar* and *C. obtecta* have been observed dying, also with Sudden Decline symptoms. Investigations aimed at identifying the causal agent are described, and the hypothesis is advanced that a phytoplasma (mycoplasma-like organism) is the cause. Sudden Decline is contrasted with the widespread ill-health apparent in many pastoral populations of cabbage tree throughout the country. This Rural Decline is characterised by a general loss of branch and leaf vigour and occasional slow tree death. It is suggested that Rural Decline is a complex disease caused by various biotic and abiotic agents interacting with an ageing population growing in situations where regeneration is prevented. In many pastoral situations Sudden Decline is superimposed on Rural Decline. The ecological implications of Sudden Decline are discussed.

### Towards greener pastures: pathogen and pasture pests

Tracey Bourner, Travis Glare and Trevor Jackson

Pasture in an important resource in New Zealand agriculture as sheep and cattle are major industries. Insect damage can reduce pasture growth dramatically. Two of the major insect pests of pasture are endemic grass grub, *Costelytra zealandica* (Coleoptera: Scarabaeidae) and porina, *Wiseana* spp. (Lepidoptera: Hepialidae). For both pests, the larval stage is the most damaging. There are several pathogens associated with each pest and these can regulate insect populations under both natural and induced conditions.

Grass grub has over 20 microbial pathogens

which can cause fatal diseases in larvae, pupae and adults. In different geographical regions of New Zealand, different pathogens or combinations of pathogens cause population collapse. However natural collapse often occurs only after significant pasture damage has occurred. Early, artificial introduction of a virulent pathogen is usually necessary to reduce pasture damage. *Serratia* spp. can cause the chronic amber disease in grass grub larvae. This novel disease has been developed as a commercial pesticide and has been sold in New Zealand for 5 years. It is applied early in the year-long life cycle of grass grub, in a window of about 6 weeks from late February. Infection in up to 50% of larvae is generally sufficient to reduce damage in the early years of pasture. In later years, a full range of diseases manifest in larvae, assisting in population control.

For porina, the situation is less well understood. There are several diseases known, but few have been recorded as controlling populations naturally. Candidates as control agents for development include the virus complex, predominantly a nuclear polyhedrosis virus. This type of virus has been used successfully overseas against Lepidoptera. A fungus, *Metarhizium anisopliae*, has potential against both grass grub and porina. However different strains may be required for each host. The fungus survives well in soil, but its development is temperature dependent. Strain selection may be the most important factor in further development of this pathogen. The development of existing agents as inundative control agents for pasture pests is discussed.

### Predicting the impacts of biological and physical disturbances: does theoretical ecology hold any answers?

Russell Death

Biological and physical disturbance has had a severe impact on New Zealand's endemic flora and fauna. However, despite the lessons of the past, predicting the sensitivity of communities to disturbance in the future may help direct more attention to those communities with a greater need for preservation (i.e., a lower ability to recover from any such disturbances). In theory it is possible to measure the local stability of a community by constructing a matrix to describe that community and then examining its eigenvalues. Local stability characteristics of invertebrate communities in 11 aquatic habitats were examined with respect to differing levels of habitat disturbance. All communities had eigenvalues outside the stability criteria, although those in the unstable habitats did have eigenvalues closer to these criteria. The open and/or patchy nature of stream communities may explain why local stability is not a prerequisite for these communities, however it still remains a potentially useful tool for predicting the effects of physical and biological disturbances.

### Predation by Kiore (*Rattus exulans*) of Little Shearwater (*Puffinus assimilis haurakiensis*) eggs.

Andrea Booth

Evidence of kiore predation of Little Shearwater eggs was collected during a study of Little Shearwater breeding biology on Lady Alice Island in the Hen and Chickens Group. Predation by kiore was the suspected cause of failure for 38% of the Little Shearwater nests monitored during the study. These nests contained Little Shearwater eggshells with signs of damage typical of rat predation. Kiore were filmed moving or preying on eggs in a Little Shearwater burrow on 2 separate occasions. A kiore was filmed entering the burrow and rolling out a Little Shearwater egg. A kiore also preyed on a hen's egg which had been placed in the nesting chamber. The remains of both eggs were collected, and showed signs of rat predation. The breeding success of small petrels and shearwaters on islands with and without kiore is discussed.

### Improving ways in catch and kill rats

Dick Veitch, Grant Harper and Mike Thorsen

Trials with a variety of trap types and setting methods were carried out on Raoul and Little Barrier Islands. On Raoul Norway rats are the more abundant species with some kiore present. On Little Barrier Island kiore only are present. All results indicate that rats are more readily caught in traps which have less enclosing cover.

Trials with a variety of flavoured baits were carried out on Norway Rats. Rentokil Rid Rat baits in their standard form and with various combinations of sucaryl, vegetable oil, coconut and chocolate were tested. A combination of chocolate, vegetable oil and sucaryl was preferred.

### Effects of possum browsing on northern rata, Orongorongo Valley, Wellington, New Zealand

Phil Cowan, B Chilvers, Murray Efford and G McElrea

Browse damage to northern rata (*Metrosideros robusta*) caused by brushtail possums (*Trichosurus vulpecula*) was assessed in the Orongorongo Valley, near Wellington in 1970-74. During the last 29 years, possum density in the area has fluctuated between 6 and 12 possums $ha^{-1}$, but in early 1990, it was at its highest level since 1966. An annual survey of rata browse and defoliation was therefore begun in 1990, using many of the same trees last assessed in 1974. This has allowed a check on mortality rate since

1974 for comparison with Meads's (1976) predictions, and an assessment of the importance of fluctuations in possum density on impacts on northern rata. In 1990, all trees surviving in 1974 were still alive, and the 15 trees surveyed showed nil to light possum browse. By 1994, one tree had been wind damaged, 7 showed heavy browse damage and extensive defoliation, and the remaining 7 trees still showed only light browse. Levels of possum damage varied markedly between years, and from tree to tree, but overall damage levels increased progressively from 1990 to 1994. This study has reinforced Meads's (1976) findings that possums are the main cause of decline in numbers of northern rata, but reveals that the ongoing high mortality rate proposed by Meads has not occurred. The high level of mortality in 1970-74 and the increasing levels of damage seen in 1990-94 seem to result from a combination of periods of above average possum numbers and other stress factors such as drought.

### The Silver Spoon effect: what use is it to be born rich?

Carolyn King

In three New Zealand southern beech forests, huge annual variations in productivity of young stoats (*Mustela erminea*) were associated with the irregular seeding (masting) of southern beech (*Nothofagus* sp.) and consequent population irruptions of feral house mice (*Mus musculus*). These variations in productivity were detectable in the age structures of stoat populations for several following seasons. Young stoats born in years of heavy beech seedfall grew consistently larger in size and survived better to independence (2-3 months old) than those born in years of poor or no seedfall, but then (a) suffered higher mortality rates over the ages of 3 to 12 months ($q_x$ = 0.91-0.92 for cohorts born in years of heavy beech seedfall compared with $q_x$ = 0.55 - 0.73), and (b) died younger, especially males (mean age at death 11.0 months in males; 10.9 months in females for cohorts born in years of heavy beech seedfall, compared with 16.1 months in males, 11.5 in females for cohorts born in poor or non-seedfall years). A disproportionate majority (82%) of the males that lived to be old (> 36 mn) and presumably socially dominant were born in non-seedfall years: few males born in years of heavy beech seedfall lived past 3 years, and those that did were among the smaller members of their cohorts. Age-specific survivorship rates of males and females controlled for the effects of seeding were similar. There was no relationship between fecundity and age, but survival of young during dependency was much more important then fecundity in determining productivity and density.

### Hen eggs poisoned with sodium monofluoroacetate (1080) for control of stoats (*Mustela erminea*)

Eric Spurr

Control of stoats (*Mustela erminea*) using sodium monofluoroacetate (1080) in hen eggs was investigated in pen and field trials. The amount of 1080 required to kill captive stoats was about 0.5 mg/kg. One stoat survived 0.25 mg/kg but others died <12 h after receiving 0.5, 0.75, and 1.0 mg/kg. In a field trial in Craigieburn Forest Park, non-toxic eggs were placed in a line of 38 bait stations, 100 m apart, in one catchment (the poison area), from 14 February - 15 March 1994 followed by toxic eggs from 16 March - 5 April. Non-toxic eggs only were placed in 38 bait stations from 14 February-5 April in an adjacent catchment (the non-poison area). Video recordings showed stoats, possums, and kea approached bait stations but only stoats were able to enter and eat eggs. Initially, stoats rolled or carried non-toxic eggs away from bait stations. After 5 March, entraces of baits stations were restricted to 60 x 35 mm to prevent stoats removing eggs without eating them *in situ*. In the non-poison area, stoats ate 5.5 eggs/day from 6-15 March, and 5.9 eggs/day from 16 March-5 April. In the poison area, the number of eggs eaten by stoats decline from 6.4 eggs/day pre-poison to 1 egg on the last day post-poison. Estimates of percentage reduction range from 82-92%, depending upon the method of calculation. Traps set from 6-8 April caught eight stoats (and one mouse) in the non-poison area and one stoat in the poison area. Success should be even greater in management operations because toxic eggs would be left out longer in the field.

### Arthropod predators in successional vegetation: an assessment of their value to agroecosystems.

Vanessa Munro and Russell Death

Some schools of ecological theory predict that predator species abundance will be greater in patches of more mature habitat than in earlier successional habitats such as pasture. To examine this, ground active invertebrates were sampled by pitfall trapping between December 1992 and January 1994 in five habitats of increasing successional age; pasture, gorse, manuka, broadleaf/podocarp forest and a mature podocarp forest remnant in the northern Wairarapa. Diversity of predators increased through early successional sites, peaked in mid successional stages, and declined in later successional sites. Individual predator numbers were highest in the pasture and declined through habitats of increasing succession in most months.