

ANNUAL CONFERENCE 1983

The 32nd annual conference was held at Auckland University during 16-19 August 1983. Two joint symposia were held, one entitled "Ecological zonation and the New Zealand biota" with the Systematics Association of New Zealand, the other entitled "Pollination ecology" with the New Zealand Society of Plant Physiologists. Both symposia were well attended as were the two days of contributed papers. The full conference programme was:

Tuesday 16 August. Symposium *Ecological zonation and the New Zealand Biota*.

M. S. McGlone: Vegetation zonation during the late Quaternary.

J. Grehan: A panbiogeographic approach to New Zealand zonation.

P. R. Espie, G. T. Daly, K. F. O'Connor: Ecological zonation in *Chionochloa* alpine grasslands.

C. D. Meurk: Bioclimatic zones for the antipodes.

G. D. McSweeney: Seasonal bird movement in relation to altitudinal vegetation zones in the podocarp-hardwood forests of South Westland.

A. e. Harris: Biology, distribution and evolution of New Zealand spider-hunting wasps.

I. L. Barton: Some physiological explanations for the distribution of kauri.

Wednesday 17 August. Symposium *Pollination ecology*

D. G. Lloyd: Pollination of some New Zealand plants.

G. Sweet, G. S. Lill, W. M. McEwen: Aspects of the pollination ecology of conifers.

B. Donovan: Bee-plant interactions in pollination and crop yields.

J. L. Craig: Movement of honey-eaters and pollen flow in *Phormium tenax*.

J. R. Leathwick: Flowering phenology of temperate rain-forest at Pureora.

A. M. Stewart: Studies on the pollination biology of an introduced crop, *Feijoa sellowiana*.

Poster papers presented in the afternoon included

I. J. Horner: Effects of *Phytophthora cinnamomi* on kauri and kahikatea.

C McDonald: Hard beech in North Auckland.

M. A. Leslie: A report on the ecology of the littoral zone of the coast of the south Taranaki Bight.

C. J. Webb: Humming bird pollination of *Malviscus arboreus* in Costa Rica.

K. Wodzicki, C. J. Robertson, H. Thompson, C. Alderton: Distribution and population numbers of gannets in New Zealand.

M. B. Jones: Animals of the estuary shore: illustrated guide and ecology.

Two workshop sessions were held. They discussed *Quantitative and numeric methods for vegetation survey and Systems models and the resolution of conflicts in ecosystem management*. At the latter workshop, two papers were presented:

J. C. Ward: An ecological systems model of Lake Alexandrina.

I. Stewart: Lake Alexandrina - an approach to conflict resolutions.

Thursday 18 August. Contributed papers.

J. P. Parkes: Changes in productivity of a hunted population of feral goats on Raoul Island.

R. H. Taylor, J. A. V. Tilley: A trapping study of stoats on Adele and Fisherman Islands.

C. R. Pickard: A comparison of techniques for estimating house mouse numbers on Mana Island using mark-recapture methods.

T. A. Caithness: Presidential address - the demography of the New Zealand shoveler.

K. E. Lee: Ecological strategies of earthworms.

M. S. McGlone: Glueing the pot - an investigation into the biblical basis for christian fundamentalist beliefs about God, man and nature.

R. B. Lavers, J. A. Mills, W. G. Lee: The takahe - a relict of the Pleistocene grassland avifauna of New Zealand.

C. J. West: The regeneration of *Beilschmiedia tawa* in Pureora forest.

S. C. Myers: Factors affecting the germination of *Beilschmiedia tarairi* seeds.

W. G. Lee, R. B. Allen, P. N. Johnson: Succession and dynamics of *Ulex europaeus* communities in the Dunedin district.

J. E. Beever: Moss epiphytes on tree-ferns in the Waitakere Ranges.

D. Kelly: Population dynamics of *Euphrasia pseudokernerii*, *Gentianella amarella* and *Linum catharticum* in an English chalk grassland community.

Friday 19 August. Contributed papers.

N. D. Mitchell: The role of kiore in affecting the pattern of succession on Tiritiri Matangi Island.

L. S. Davis: Male Richardson's ground squirrels, territoriality, variability and sociality.

H. Moller: Patch choice of red squirrels in a scotch pine plantation.

G. H. Shirley: Courtship feeding in the South Island rifleman.

J. A. McLennan: Information transfer on the whereabouts of food in colonies of pigeons.

A half-day field trip to the Waitakere Ranges and to Bethells Beach completed the conference programme.

Abstracts of papers read at the conference and not published in full in this issue of the Journal, are presented below.

VEGETATION ZONATION DURING THE LATE QUATERNARY

M. S. McGlone

Botany Division, DSIR, Lincoln, New Zealand

It has commonly been supposed that the effect of the lower temperatures of the last glaciation was to shift the present day altitudinal and latitudinal vegetation zones downwards and northwards. Otherwise, they are held to have been substantially unaffected. It has also been assumed that, as in the forests of the temperate northern hemisphere, differential migration rates of some forest trees - especially beeches - has meant that not all forests are in compositional equilibrium with their environment. It now appears unlikely that the response of vegetation to climatic- change can be accurately represented as the migration of vegetation zones. It is also clear that the role of migration and disjunction in formation of present day plant communities has been over-emphasised.

ECOLOGICAL ZONATION IN CHIONOCHLOA ALPINE GRASSLANDS

P. R. Espie, G. T. Daly and K. F. O'Connor
Centre for Range Management, Lincoln College, New Zealand

A synecological investigation of 130 species in 100 sites from timberline to 1680 m near Lewis Pass by ordination showed altitude, aspect and soil maturity summarised the principle environmental gradients influencing community distribution. Cluster analysis revealed fourteen ecologically distinct communities. *Chionochloa pallens* and *C. australis* were the major physiognomic dominants in the alpine grasslands. Soil chemistry, profile morphology and reciprocal *C. pallens/C. australis* transplants demonstrated *C. pallens* to dominate younger, more fertile soils compared with *C. australis*. Pedogenic

deterioration during system maturation is postulated as the causal mechanism governing *Chionochloa* succession. Morphological and physiological variation is shown between *C. australis* populations in the Lewis Pass and in the St Arnaud Range. Sympatry in *Chionochloa* is examined in the light of these results.

SEASONAL BIRD MOVEMENT IN RELATION TO ALTITUDINAL VEGETATION ZONES IN THE PODOCARP-HARDWOOD FORESTS OF SOUTH WESTLAND

G. D. McSweeney

Royal Forest and Bird Protection Society, P. O. Box 631, Wellington, New Zealand

Monthly five-minute bird counts were made for two years between 1981 and 1983 to identify birds present in forest zones from sea level to 1000 metres altitude in podocarp-hardwood forest near Franz Josef Glacier, South Westland.

In the different vegetation zones within this altitude range, bird numbers and species diversity generally declined with increasing altitude. Many bird species also showed marked seasonal variation in their distribution in the different vegetation zones. This variation is apparently related to nectar and fruit availability in each zone.

Patterns of seasonal bird distribution in these podocarp-hardwood forests differ from those patterns found in earlier studies of South Island beech forests.

While vegetation may exhibit distinct altitudinal zonation, birdlife only exhibits partial zonation to match this, which changes in different seasons.

BIOLOGY, DISTRIBUTION AND EVOLUTION OF NEW ZEALAND SPIDER-HUNTING WASPS

A. C. Harris

Otago Museum, Private Bag, Dunedin, New Zealand

The New Zealand Pompilid fauna comprises 12 species; apart from *Cryptocheilus australis* (introduced from Australia c.1960) all species are endemic, related closely at the generic level to species in Tasmania, Australia, and Chile.

Synonymy: Ten *Priocnemis* species are placed in new synonymy. Much confusion in the past resulted from geographical variation which is frequently clinal, with interruptions at sites of past and present geographical barriers.

Melanism: Four species exhibit parallel clinal colour variation, ranging from bright red and gold in the extreme north, to jet black in the far south of New Zealand. The gradual parallel southward increase in melanism is correlated with regular southward decreasing temperature and insolation. Pompilidae are strongly heliotactic; the degree of melanism of the adult probably adapts it to the range of temperature and amount of sunlight characteristic of a given locality, latitude, and altitude.

Mimicry: Females comprise the Mullerian component of three large mimicry complexes. Male pompilids, together with leiotactic beetles and flies, are Batesian mimics of female pompilids, sometimes of another pompilid species which is more abundant than its own species in a particular area. Below about latitude 45.5°S pompilids become black and drop out of the "red and gold" mimicry complex.

Geographical barriers: Cook Strait, the former "Auckland Straits" and the waist of South Island between the latitudes of the Rangitata and Waitaki Rivers are boundaries between geographical races. Cook Strait forms a complete disjunction; the former "Auckland Straits" and the waist of South Island seem to be sites of hybrid zones of secondary intergradation.

Life histories: Many individuals of all New Zealand pompilid species were reared from egg to adult. The nest structure, manner in which the female drags the spider, and the position of the egg is characteristic for each species. *Epipompilus insularis* oviposits on spiders within their retreats without dragging spiders, making a nest, and often without paralysing the spider.

The *Priocnemis* group comprises ground nesters, rotten wood nesters, and mud daubers that nest in old beetle galleries up to sixty feet above ground, and show remarkable structural and behavioural convergence towards unrelated overseas mud-daubing Auplopidini. All intermediate stages between those that dig holes in clay, to mud-daubers that nest in trees occur among New Zealand species.

SOME PHYSIOLOGICAL EXPLANATIONS FOR THE DISTRIBUTION OF KAURI

I. L. Barton

Auckland Regional Authority, Hunua, New Zealand

The future of New Zealand's kauri forests, from

both preservation and management aspects, lies with the regenerating stands which cover some 100,000 ha of land in the northern North Island.

Factors influencing the distribution of these kauri stands are discussed, and the influence of light, temperature and water availability shown to have major effects on the siting of the species. The tendency of kauri to associate in almost pure stands, especially on ridges, is explained by the interaction of physical factors. Similar interactions influence the location of the southern limit of kauri.

POLLINATION OF SOME NEW ZEALAND PLANTS

D. G. Lloyd

Department of Botany, University of Canterbury, Christchurch, New Zealand

Many New Zealand plants have flowers that are small, dull-coloured and structurally simple. Most authors, following A. R. Wallace, have attributed these features to the limited insect fauna available in New Zealand, particularly the paucity of specialised pollinators. Despite the unique opportunities in New Zealand for pollination studies, the subject has largely been neglected. The floral syndromes of some New Zealand plants will be discussed in relation to the mode of selection operating and interactions with breeding systems, means of dispersal and vegetative ecology.

ASPECTS OF THE POLLINATION ECOLOGY OF CONIFERS

G. Sweet, G. S. Lill and W. M. McEwen

Production Forestry Division, Forest Research Institute, Private Bag, Rotorua, New Zealand

In an attempt to improve the management of areas for the production of genetically improved seed of radiata pine, studies were made of the species pollination ecology. Broadly these were designed to determine the factors influencing the "selection" of the pollen which pollinated each ovule.

Information is presented on genetic variability in the timing and duration of anthesis, the weather factors affecting the duration, behaviour of the pollination droplet mechanism, and the "pollen selection" methods used by ovules. A few of the studies were duplicated with rimu.

BEE-PLANT INTERACTIONS IN POLLINATION AND CROP YIELDS

B. Donovan

*Entomology Division, DSIR, Private Bag, Mt
Albert, New Zealand*

Bee species display a wide range of variation in many characters such as physical size and shape, behaviour and flower foraging preferences. Flower species vary in size, shape, phenology of flowering, and presentation of rewards for and attractiveness to pollinators. Examples of bee plant interactions that can increase yields will be discussed for leguminous seed crops, fruit trees and kiwifruit.

MOVEMENT OF HONEY-EATERS AND POLLEN FLOW IN *PHORMIUM TENAX*

J. L. Craig

*Department of Zoology, University of Auckland,
Auckland, New Zealand*

Numerous workers have shown that rewards for pollinators (e.g. nectar) typically promote patterns of movement that are beneficial for the plant in terms of pollen flow. For example, in self-compatible species, field studies have shown a significant variation in seed set and seed viability with pollen from different distances. The problem is even greater with self-incompatibility where extensive movement between perfect flowers on the same plant can provide minimal pollination but a loss of rewards that would attract subsequent pollinators. These patterns stimulated a study of pollinator movements on flax, *Phormium tenax* (Agavaceae); an apparently self-sterile plant with a large but simply structured inflorescence.

Flax produces copious nectar which attracts both tui (*Prothemadera novaeseelandiae*) and bell bird (*Anthornis melanura*). Both honeyeaters forage predictably moving up the primary peduncle visiting flowers on secondary peduncles in approximate order. Patterns of nectar rewards do not explain this basic pattern of movement. Such high intra-plant visitation is compounded by a high probability of moving to the nearest inflorescence and thus staying on the same plant. Only if nectar rewards are low will the pollinator move further within a feeding bout.

In addition to these general patterns, the number of flowers visited per feeding bout and the mean distance moved within a bout varies predictably in accord with body size, distance to nest site and most importantly with social status.

These will be discussed in relation to pollen flow.

FLOWERING PHENOLOGY OF TEMPERATE RAIN-FOREST AT PUREORA

J. R. Leathwick

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Institute, Private Bag, Rotorua, New Zealand*

The phenological behaviour of 29 woody species was studied over a two year period at Pureora. Of the species studied, 21 were insect or bird pollinated, and eight, including all the podocarps, were wind pollinated. Most species flowered in early or mid-summer, but several flowered in late autumn, winter or early spring.

Four basic types of flowering and fruiting behaviour were observed. In the most simple type flowering in spring or summer resulted in fruit being produced in late summer or autumn, a period of approximately six months elapsing between production of flower buds and development of ripe fruit. In the most complex type, flower buds were produced in the growing season preceding flowering, and fruit ripened 12-18 months after flowering; two years or more elapsed between production of flower buds and fruit maturation.

STUDIES ON THE POLLINATION BIOLOGY OF AN INTRODUCED CROP *FEIJOA SELLOWIANA*

A. M. Stewart

*Department of Botany, University of Auckland,
Auckland, New Zealand*

Fruit set, fruit growth and fruit quality are characters which in general have been shown to depend upon degree of pollination and on the genotype of the pollen source.

Feijoa sellowiana is a newly recognised crop plant in New Zealand and though widely grown in a non-commercial sense for many years knowledge of its floral biology is fragmentary.

This study represents a beginning of an attempt to define the three fundamental criteria on which orchard management should be defined.

1. pollen/stigma compatibility relationships between and within cultivars;
2. the relationship between pollen source and subsequent fruit development;
3. the method of pollen transfer and the characteristics of the vectors.

Vectors responsible for pollen transport seems to be birds and bees. Sugary petals serve as an attractant for birds whereas bees visit the flowers

to collect pollen. Identity and efficiency of these pollinators along with knowledge of their movement between flowers is required to determine the extent of pollen flow. This together with the knowledge of compatibility barriers existing between varieties will provide guidelines on which to base future planting to obtain maximum fruit yield.

A COMPARISON OF TECHNIQUES FOR ESTIMATING HOUSE MOUSE NUMBERS ON MANA ISLAND USING MARK-RECAPTURE METHODS

C. R. Pickard

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Estimates of house mouse (*Mus musculus*) abundance were derived from six estimating equations applied to data obtained from a live-trapping study on Mana Island, Cook Strait, carried out from March 1981 to February 1982. The estimating equations included one deterministic model (Weighted Mean), two stochastic models (Jolly Seber & Manly-Parr), two regression methods (Zippin & Marten) and a nonparametric method (Burnham-Overton). All estimates were compared with the minimum number of mice known to be alive. The stochastic models gave higher estimates for the initial months (April to June). All methods gave similar estimates during the middle period of trapping when population numbers were low. The results suggest that the probability of capture differs amongst members of the population and changes after capture. The effect of this on the population estimates is discussed.

ECOLOGICAL STRATEGIES OF EARTHWORMS

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Niche partitioning and interspecific differences in resource utilisation separate species within earthworm communities so that competition is minimised. Vertical stratification of earthworm species was recognised long ago in New Zealand forest ecosystems, and subsequently similar strategies were described for European species. Patterns of behaviour, food preferences, morphology and reproductive strategy relate to vertical subdivisions of the habitat.

Tropical earthworm communities do not clearly

parallel the patterns recognised in temperate regions and have led to consideration of demographic profiles as a basis for ecological groupings.

Ecological and reproductive strategies of earthworms are related to the concepts of r - , K - selection or r - , K - , A - selection, and to the habitat template (of Southwood 1977).

GLUEING THE POT: AN INVESTIGATION INTO THE BIBLICAL BASIS FOR CHRISTIAN FUNDAMENTALIST BELIEFS ABOUT GOD, MAN AND NATURE

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Christian fundamentalists have been actively promulgating the idea that evolution theory is scientifically unsound. Their attacks have attracted much public interest, and the overall effect has been to create widespread unease about evolution.

Scientists have responded to the attacks by defending evolution, but are handicapped by the fact that evolutionary concepts are often complex and difficult to explain to a non-scientific audience. In the eyes of many, biblically based fundamentalism is still seen as a credible alternative view of nature.

A neglected strategy has been to examine the biblical texts on which the fundamentalist case is based to see if a coherent biblical account of creation can be deduced. As this paper will show, no account can be derived, and moreover, the internal contradictions are such that no consistent biblical view of the relationship of God, man and nature exists.

"Teaching a fool is like mending pottery with glue, or like rousing a sleeper from heavy sleep". Ecclesiasticus 22: 7.

THE REGENERATION OF *BEILSCHMIEDIA TAWA* IN PUREORA FOREST

C. J. West

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Regeneration of tawa is principally achieved by seed. Two aspects of seed ecology are discussed:

1. seedfall variability, both spatial and temporal ('mast' seeding);
2. seed mortality (mainly due to possum and caterpillar predators).

The results are based on three seasons field work at Pureora Forest.

FACTORS AFFECTING THE GERMINATION OF *BEILSCHMIEDIA TARAIRI* SEEDS

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The taraire seed is surrounded by a fleshy mesocarp, tissue which is often stripped off during consumption by the New Zealand pigeon. It has been found that seed with the mesocarp removed by this bird, and artificially, has a much greater level and speed of germination than seed with an intact mesocarp. This illustrates the vital role these birds play in the germination and potential dispersal of taraire seeds.

A second controlling factor of germination is the presence of taraire leaf litter on the forest floor. Results show that seeds landing on top of the litter have a very low germination compared to seeds on bare soil or buried under the litter. It is suggested that this is related to the low moisture levels in the leaf litter.

Thus if the mesocarp of the taraire fruit is intact and if the seed remains on top of the litter in the forest, germination (and presumably its subsequent establishment) is very much reduced.

SUCCESSION AND DYNAMICS OF *ULEX EUROPAEUS* COMMUNITIES IN THE DUNEDIN DISTRICT

W. G., Lee; R. B. Allen and P. N. Johnson

Botany Division, DSIR, Dunedin, New Zealand

A quantitative study of 125 2 m x 2 m plots in communities dominated by or containing *Ulex europaeus* on sites 2 - 500 m a.s.l. has shown that in the Dunedin District dense stands of *U. europaeus* are often remarkably persistent, and capable of resisting invasion and replacement by indigenous tree species for at least 30 years. Seedlings of indigenous species become established in greater numbers where gorse is taller and less dense, with patches of bryophyte or bare soil available beneath. These sites are generally on steeper slopes.

MOSS EPIPHYTES ON TREE FERNS IN THE WAITAKERE RANGES

J. E. Beaver

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A comparison was made between the mosses present on three species of tree-fern, *Cyathea medullaris*, *Cyathea dealbata* and *Dicksonia*

squarrosa in a kauri/podocarp/broadleaf forest in the Waitakere Ranges, northern New Zealand. Observations were also made on a fourth phorophyte of similar growth form, the palm *Rhopalostylis sapida*. Frequency and cover values were obtained for the moss species present on the basal 1.5 m of trunk of 183 phorophytes. Thirty-eight moss species from 23 families were recorded. Detrended correspondence analysis ordination indicated that the moss communities on *C. dealbata* and *D. squarrosa* were similar, but quite distinct from those on *C. medullaris*. The moss communities on the palm were much more variable than those on any of the tree-fern species, and individual palm trees were found bearing moss communities typical of each of the tree-fern species.

POPULATION DYNAMICS OF *EUPHRASIA PSEUDOKERNERI*, *GENTIANELLA AMARELLA* AND *LINUM CARTHARTICUM* IN AN ENGLISH CHALK GRASSLAND COMMUNITY

D. Kelly

R. D. Papaiti, Aramoho, Wanganui, New Zealand

Over three years, the population dynamics of one annual hemiparasite (*Euphrasia pseudokerneri*) and two strict biennials (*Gentianella amarella* and *Linum cartharticum*) were studied in a natural English chalk grassland community. *Euphrasia* numbers declined in that time, while the other species' numbers fluctuated. All three species' survival was affected by the perennial species which formed the turf. *Euphrasia* and *Linum* were affected by the drought, but only *Linum* was affected by mollusc grazing. Density-dependent mortality was observed in two years out of three in *Linum*, one year of three in *Euphrasia*, and not observed in *Gentianella*. There was no measurable interference between the short-lived species at field densities.

THE ROLE OF KIORE IN AFFECTING THE PATTERN OF SUCCESSION ON TIRITIRI MATANGI ISLAND

N. D. Mitchell

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On Tiritiri Matangi Island there are large areas of pasture which have been left to revert. Kiore are one of the main herbivores on the island and they are known to eat large quantities of seed as well

as damage tree seedlings. An investigation was begun in 1979 to assess the role of kiore in altering the pattern of succession to forest. A series of exclosures was established in the grasslands, which together with their controls have been recorded annually. It is apparent that kiore have a complex role when taken in combination with the successional change that is occurring. It is evident that some species may be inhibited by kiore whilst others are promoted by grazing on their competitors. The overall effect may be to promote succession.

MALE RICHARDSON'S GROUND SQUIRRELS, TERRITORIALITY, VARIABILITY AND SOCIALITY

L. S. Davis

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Twenty adult male Richardson's ground squirrels (*Spermophilus richardsonii*) were observed at two localities in Alberta, Canada. Most males (78-85%) emerged from hibernation before the first female appeared. Males were territorial in those areas where females emerged synchronously. By contrast, males were non-territorial where emergence of females was asynchronous due to the persistence of snow cover, producing a sparse distribution of females. Territorial males tended to be heavier, more dominant, and spend more time alert and less time feeding than did non-territorial males. Dispersal by males occurred before their first hibernation (juveniles), following vernal emergence (yearlings), or following the breeding period (adults). However, some males continued to reside in the areas they had occupied during the breeding period, and in successive breeding seasons adult males were found in the same general vicinity. The mating system of Richardson's ground squirrels resembles that of the more social ground squirrel species, such as Columbian and Arctic ground squirrels.

PATCH CHOICE OF RED SQUIRRELS FEEDING IN A *PINUS SYLVESTRIS* PLANTATION

H. Moller

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Squirrels repeatedly returned to particular trees (patches) within a mature pine plantation (in Moray, Scotland) to feed on seed which they

extracted from cones. Squirrels found cones more quickly in these favoured feeding trees. Cones from favoured trees had more seed within them than cones of the same length from randomly selected trees. Larger cones allowed faster ingestion of seed than smaller cones. Adults avoided trees with small cones. Juveniles were particularly inefficient (compared with adults) at extracting seed from large cones. Juveniles concentrated their feeding in trees with smaller cones than those chosen by adults. All results, other than the avoidance of the largest cones by adults, were consistent with the hypothesis that squirrels concentrated their feeding in patches which allowed faster ingestion of seed.

COURTSHIP FEEDING IN THE SOUTH ISLAND RIFLEMAN

G. H. Sherley

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Paired male rifleman feed their females prior to and during egg-laying of first clutches only until incubation commences. Most pairs of a small population near Kowhai Bush, Kaikoura were watched daily while foraging prior to the laying of the last egg of their clutch. The frequency and size of food items fed to females were recorded plus the amount of food retrieved by male or female in the same sample period. The frequency and volume of food fed to females by males throughout the pre-incubation period is presented independently and as a proportion of the females and males daily food intake. Results are discussed with respect to the hypothesis that courtship feeding contributes to the energy requirements of egg production.

INFORMATION TRANSFER ON THE WHEREABOUTS OF FOOD IN COLONIES OF PIGEONS

J. A. McLennan

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The hypothesis that communal roosts and breeding colonies of birds act as information centres for food-finding was tested using pigeons, *Columbia livia*. The birds roosted and bred in lofts, but were free each day to search for food in the surrounding fields. Two out of three experiments showed that naive pigeons could learn the location of a patch of food when in the presence of knowledgeable birds that already had

the information. A fourth experiment showed that the mechanism of information transfer was simply that naive birds followed knowledgeable ones to a good feeding area. Pigeons returning from a successful foraging trip did not transfer information on the distance and direction of the food to other members of the colony.

THE DEMOGRAPHY OF THE NEW ZEALAND SHOVELER

T. A. Caithness

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Between 1972 and 1979, 1003 adult and 976 juvenile shoveler (*Anas rhynchos variegata*) were

banded. By July 1982, 184 adults and 171 juveniles had been reported short. The mean annual survival rate of adults was 58% (95% conf. into 53-64%) and those surviving their first year after banding had a mean expectation of further life of 1.8 (1.5-2.3) years. The mean annual survival rate of juveniles in their year of banding was 50% (37-64%). To maintain a stable population, each breeding pair is required to raise 3.4 young to fledging; limited field studies suggest an average annual production of 3.6 young. Some slender evidence indicates a tendency toward ancestral breeding but otherwise shovelers demonstrated a pattern of high mobility throughout the country.