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EDITORIAL

This issue contains a long article (well, long for a Newsletter!) on periphyton algae in streams. A serious subject you might think, and not one to cause laughter, but the disk which came with the text on it was labelled *Slime.Doc* – shades of *Ghostbusters*!

While on the subject of humour, this issue will make available to non-S&R staff some of the humorous events in our daily lives at Tory Street. I hope you get a giggle out of it. We did.

A Happy New Year to you all, and best wishes for 1995.

Kaye Green
Editor

Department of Conservation
Te Papa Atawhai

REPORTING BACK

An Expedition to study New Zealand Southern Falcon

Between 1–11 November 1993, I joined an expedition to the Auckland Islands organised by the Department of Conservation (DoC), and spent 2½ days at Maclaren Bay, Adams Island.

One falcon nest was located. One bird was caught, measured and banded. Samples of blood and feathers were taken for DNA analysis. Feathers from the falcon and feathers from prey remains were collected to be tested for heavy metals. I collected pellets and prey remains for diet analysis, faecal samples to check for internal parasites, and rangle stones which are thought to aid digestion. The nest site was described and a laying date for the southern form recorded. Their behaviour, and the seabird prey remains found in their diet, seem to indicate that hunting at dusk and at night may be more commonplace and important among this population of New Zealand falcons. Body measurements indicate that they are intermediate between bush and eastern falcons, but more data is needed.

Organic mercury levels in the sampled feathers suggests there may be some impact on egg or chick survival and levels should be monitored in future.

A preliminary look at prey remains has identified four new species in the falcon's diet which consists mainly of native species, a large proportion being seabirds.

Noel Hyde
Collection Manager Birds
Museum of NZ – Te Papa Tongarewa

Sorry we are too late to wish you all

a MERRY CHRISTMAS,

but may we express the hope that you enjoy

GOOD HEALTH

and a SUCCESSFUL YEAR

in 1995!

NOTES AND NEWS

"There are moves afoot . . ." – A geological snippet

I wish I had time to properly read all the reports from external agencies which come over my desk. The recent batch of annual reports from several CRI's have left me a little jealous as to their standard and overall "glossiness". There was one fascinating result reported in the 1994 annual report of the Institute of Geological and Nuclear Sciences which describes the current deformation rates of parts of New Zealand. The Taupo Volcanic Zone is getting wider and wider at the rate of 18 mm per year and Christchurch is moving southwest, relative to Hokitika, at the rate of 26 mm per year! While it unlikely that this will compensate for the rate of climatic change, these are truly remarkable figures which show the rapidity of tectonic movement and therefore the incredible strains that must be placed on faults. Hold on to your hats!

Richard Sadleir
S&R Division, Tory Street

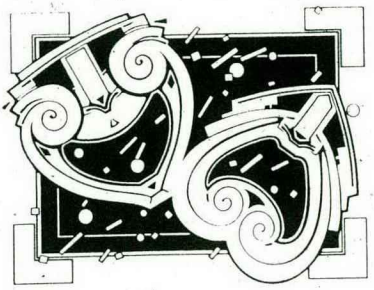
Tory Street Prize-Giving

The Department of Conservation Tory Street Prize-Giving Committee (which, as rumour had it, may have consisted of Peter Moore, with culinary assistance from Susan Timmins) recently honoured several staff members with certificates of merit for efforts during the previous year or so. Certificates and biscuits were handed out at the annual Tory Street Christmas morning tea and carol session. Please note that none of the stories here are necessarily true, and the resemblances of the characters to anyone alive or dead are purely coincidental.

Chris Pugsley received the "most inquisitive olfactory organ" award. Apparently, during the kina survey in Fiordland, Chris' innate curiosity had him shinnying up the mast of the vessel to investigate a certain pipe, which turned out to be the sewerage vent. Hopefully, having divers lungs he did not take a strong whiff!

Hugh Best received the "what happens if I pull this plug out?" award (with special commendation from the LAN administrators). Hugh, one day, in complete innocence, managed to disable the LAN network by disconnecting his computer. It seemed like a good idea at the time.

Nick Gales, although not present to recieve his award, could not get away without being nominated for both the "most expensive barbecue" and the "shortest field trip" awards. This was in honour of the fire which inconveniently destroyed the hut and equipment on the Auckland Islands while the boys (except for Hugh Best who was sound asleep in the adjacent hut) were out checking the sea lions. The only convenient thing about the episode was that it was first day of the field trip and the boat hadn't left yet. Nick is currently on Enderby Is. Trying for a double in 1995 Nick?



Dame **Christopher Robertson** was presented with the "most convincing cross-dressing" award and **Kaye Green** with the "drab Madge" award for their outrageous rendition of Dame Edna and her side-kick. This was during the very successful "Australia Day" morning tea in honour of **Richard Sadleir**'s birthday, when almost all staff dressed as an Australian icon. It just illustrated that although we are boring and conservative for 99.9% of the year, occasionally we are a bit frivolous.

Philip Simpson gained the much coveted "exemplary financial accounting" award for managing to code a whole year's work to the wrong budget number.

Duncan Cunningham got the "most complete image change" award for shaving the beard off, getting a flash haircut and wearing a jacket and tie to work. It was not that long ago that he vowed never to do any of the above, but that's what extra-curricular activities do for you. Oh how the mighty have fallen, or is that risen?

Rod Hay, one of our last surviving Hay story tellers, won the "parrot your betters" award (the most ingenious translation service). To help him with attending the CITES conference in Florida, and perhaps to deal with fellow delegates, **Janet Owen** and **Murray Hosking**, Rod purchased a toy parrot which repeated anything anyone said to it. Not sure why he needed that though!

Ian Flux received the "god on a log" award, in recognition of the rare feat of being mistaken for a white spirit floating on a red log. This was while kayaking to a remote island in Vanuatu last year. I'm sure that it did not take long to dispel this initial impression, but Ian still labours under the idea that can heal people and often blesses colleagues in the corridor.

Geoff Patterson and **Eduardo Villouta** obtained first equal for the "fecundity (most children in one year)" award for helping to add to population expansion during the year with one child apiece.

Mala Neseratnam was the proud recipient of the "surreptitious catnap" award. Rumour has it she shows great skill at falling asleep in Unit Leaders Meetings, while preserving the appearance of taking notes.

Mike Wakelin was not present to recieve the "infrequent tea-drinker club" award, presented for his perfect score of not one confirmed sighting in the tea room during the year.

Don Newman was lucky enough to be acknowledged as the "best supporting actor in the longest running show in town" for his long-standing *acting* role as research manager: 11 points out of 10 for perseverance!

Mark Stephen was awarded with the certificate for "not taking his own advice" for the inspired and zealous manner in which he pursued the culprits who had not filled out their advice sheets during the year.

Janie Pack also found recognition in the form of the "dogged nature" award for her ability to communicate with the animals. We often found her on all fours speaking their tongue

and scratching their tummies. She also seems to quite like labradors.

Janice Molloy and **Rod Cossee** got first equal in the "Bug-a-lug" award for managing to get sick while overseas, but then making marvelous recoveries. **Ian Flux** was in the running, for his malaria last year, but he already had a prize for other efforts.

Suzanne Clegg got the prize for the "smallest souvenir" (not counting bugs) from an overseas trip. This took the form of an engagement ring, but we are assured that it was not merely a case of holiday romance!

Visiting Tasmanians, **Sally Bryant** and **Mark Holdsworth** received the "NZ on a shoestring award" for managing to get to nearly every Conservancy and threatened species programme in the space of four months. Sally was here on an ANZAC scholarship. A Departmental review has now been instigated to find out why Sally did not get to visit every threatened species programme.

A late entry from the Threatened Species Unit was going to be a special commendation for **Don Merton**, however, as the award was under review, it was not available for the prize-giving.

Last but not least, we received an anonymous commendation for **Richard Sadleir**, which took the form of the "most improved farewell address (practice makes perfect)" award. Unfortunately, it came with no explanation, so we're not too sure what it means.

The Prize-Giving Committee is looking forward to another year where people rise above the morass and do truly stupid things! These stories make our daily lives worth living.

Peter Moore (for TSPGC),
S&R Division, Tory Street

DEFINITIONS

Some More Definitions

Suggested by Philip Simpson to the DoC Workshop on Significance – 10–11 November 1994

Ecosystem management – Ecosystem management is emerging as an innovative framework for achieving harmonious and mutually dependent sustainability of society and the environment. Ecosystem management focuses on human and natural systems at regional scales across inter-generational time periods.

Sustainable land management – providing the use, development, and protection of natural and physical resources in a way and at a rate which enables people to meet their needs now without compromising the ability of future generations to meet their own needs.

Desirable Outcomes – (a) minimise soil degradation; (b) maximise water quality; (c) avoid, mitigate, and remedy flood, slip and erosion damage; (d) maintain Maori and other cultural values; (e) maintain aesthetic, ecological and conservation values of land and water; and (f) educate the community so it can do its own sustainable land management.

Ecosystem management principles –

- Use an ecological approach that would recover and maintain the biological diversity, ecological function, and defining characteristics of natural ecosystems.
- Recognise that humans are part of ecosystems, and they shape and are shaped by the natural systems; the sustainability of ecological and societal systems are mutually dependent.
- Adopt a management approach that recognises ecosystems and institutions are characteristically heterogeneous in time and space.
- Integrate sustained economic and community activity into the management of ecosystems.
- Develop a shared vision of desired human/environmental conditions.
- Provide for ecosystem governance at appropriate ecological and institutional scales.
- Use adaptive management as the mechanism for achieving both desired outcomes and new understandings regarding ecosystem conditions.
- Integrate the best science available into the decision making process, while continuing scientific research to reduce uncertainties.
- Implement ecosystem management principles through coordinated government and non-government plans and activities.

Landscape ecology

From: Reed Noss "A Regional Approach to Maintain Diversity", BioScience Vol. 33 No. 11, 1983.

Landscape Ecology is the study of the interactions and fluxes of energy, mineral nutrients, and species among clustered stands or ecosystems. Landscape ecology deals with an ecological mosaic of patches with continuously varying degrees of connectedness and recognises the importance of matrix and corridors to terrestrial habitat island dynamics.

RESEARCH IN PROGRESS

Periphytic algae in streams

by Barry Biggs, NIWA, PO Box 8602, Christchurch

Have you ever lost your footing on slimy rocks in a stream? This slime is periphytic algae; periphyton, as it is more commonly known to stream ecologists. Next time you are near a stream pick up a stone and have a closer look. It may appear just as a very fine green-brown film or tufts of green, and sometimes brown, filaments. Run your fingers across the rock and feel the texture. Feel the slime ... scrape some off with a pocket knife, then notice how different the rock feels. Look hard at the texture and colour of the material you have just scraped off. This is the life-blood of our streams; the purifier of its waters; the food for its insects, and through this for its fish. In this, the first of a series of three articles, I will describe what makes up periphyton of streams and outline the fundamental importance of this community to stream ecosystems.

What makes up Periphyton?

Periphyton consists mainly of algae and associated bacteria. The algae, however, are not the familiar floating species that discolour enriched ponds or lakes. Stream algae grow specialised attachment structures such as jelly-like (mucilage) pads and stalks. Some filamentous green algae even have structures which are microscopic versions of the holdfasts of ocean kelp. These structures enable periphytic algae to exploit swift

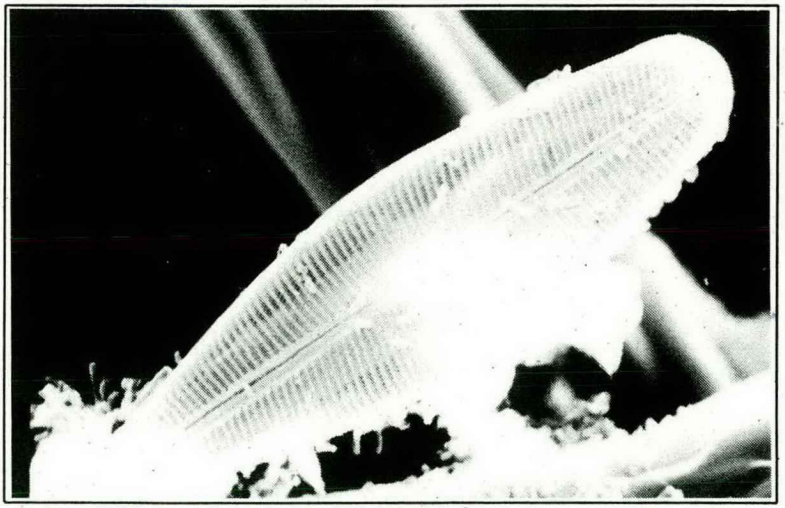


Photo 1: Scanning electron micrograph of the diatom Gomphoneis herculeana *which is very common in New Zealand streams and often proliferates forming masses of slime. It is approximately 0.06 mm (i.e. 60 microns) long. The regular stripes are part of the surface texture of the silica skeleton which are used for identification. The rod shape granules attached to the surface are epiphytic bacteria.*

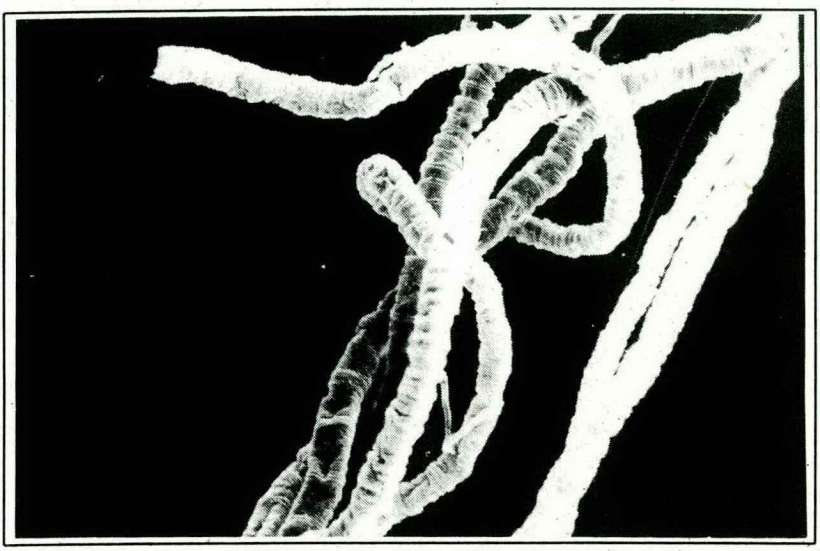


*Photo 2: Scanning electron micrograph of a small section of a filamentous green algal mat (*Ulothrix zonata*). Note how the filaments are intertwined. The section of filaments that this photo covers is approximately 0.5 mm. However, they can form strands up to a meter in length.*

flowing waters, a habitat most other plant types have not adapted to.

A community starts when tiny cells (many as small as a micron thick) settle in small crevices on the stones or in areas of very slow water movement. These colonisers then secrete their mucilage attachment structures and become firmly anchored. From there they reproduce by simple cell division, growing up and expanding out. The group which most commonly colonise the streambed first is the "diatoms" (Bacillariophyta). They are usually single celled, with an internal skeleton made of silica. The size, shape, and surface etchings of these diatoms are used to distinguish different species. Under the microscope many of them appear as delicate, beautiful, structures (see photo 1). Macroscopically these communities form fine brown, or green-brown, films over the stones. The mere presence of these cells on the stone modifies the micro-hydraulic environment by further reducing velocity at the stone surface. This enables the larger celled, and generally slower growing, filamentous green algae (a different Order of algae, Chlorophyta) to colonise the stones (see photo 2). If several months occur without flood events then these can develop into thick mats which are very conspicuous from the stream bank. Blue-green algae (they are really bacteria called Cyanobacteria) can grow among or over the diatoms and green algae if stream flows are constant for long enough. These communities form dark, purple-black, brown, or deep blue-green patches on stones.

Periphyton's role in stream ecosystems

To survive and prosper, these algal cells need prolonged periods with few floods and stable streambed sediments. They also need light and

nutrients (mainly nitrogen and phosphorus). In absorbing nutrients from the water the algae are performing a process which is extremely important to man: they are purifying the water. But this isn't just confined to nitrogen and phosphorus. The millions of bacteria which live among the algae also require food. They predominantly use organic matter with simple chemical structures. Thus, these communities can be extremely effective in cleansing streams of wastes such as occurs in farm runoff and this capability has been harnessed by waste-water engineers as part of secondary, trickling filter, sewage treatment.

Only in recent years has it been generally established that periphyton forms the base of the food chain in many streams. Previous dogma has stressed the importance of leaves from riparian vegetation as a fundamental source of energy. While this is undoubtedly true in areas which are heavily forested with deciduous trees and/or trees with soft nutrient-rich leaves, most stream and larger river systems in developed countries are unshaded. In fact, in New Zealand, few stream invertebrates are even able to eat leaves. Thus much recent research, both in New Zealand and overseas, has demonstrated how stream insects and snails can graze 'periphyton pastures'. It has become obvious that stream invertebrates need lots of periphyton to grow. In one set of experiments we increased the nutrient supply to small patches of periphyton on the streambed, thereby increasing periphyton growth. We found two to six times the numbers of invertebrates on the enriched patches, but no additional periphyton. The extra periphyton growth was being aggressively consumed by the increased numbers of invertebrates. Such results have

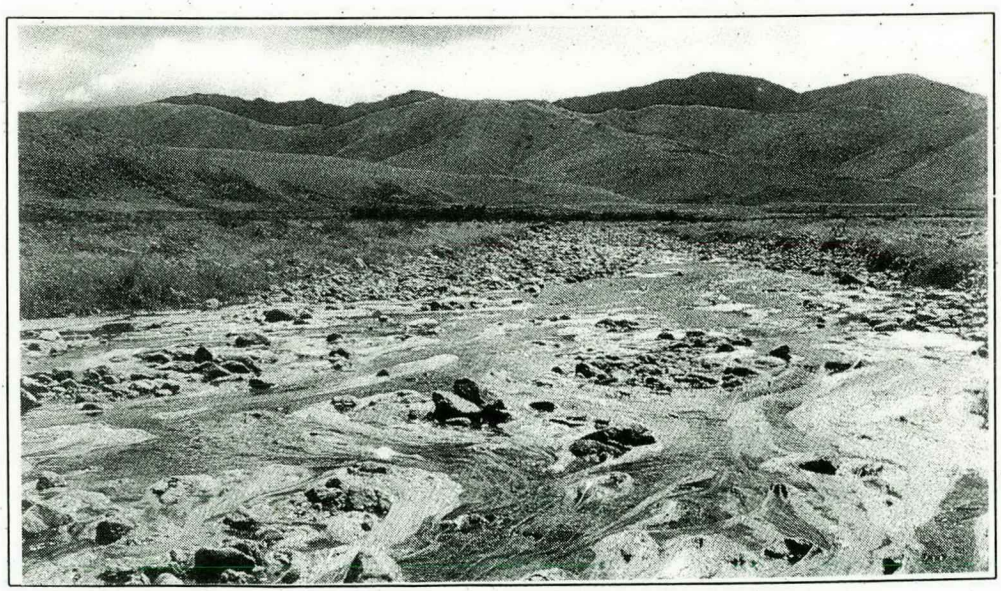


Photo 3: A bloom of green filamentous periphyton in a shallow, high country, river during summer low flows.

indicated that the development of invertebrate communities under natural conditions in some streams was being slowed down by insufficient periphyton food. Indeed, several studies in North America have shown that by adding modest quantities of nutrients to very nutrient poor streams, such as in forest and alpine catchments, both invertebrate and fish growth can be strongly stimulated.

Conversely, high levels of nutrients can allow green filamentous periphyton to grow so fast that the invertebrates cannot graze them down. In such circumstances proliferations of filaments may obliterate the stream bed (see photo 3). In streams where the enrichment is only moderate, but grazing pressure is low (e.g. in the sub-alpine zone), certain diatoms which produce masses of mucilage bloom forming very thick slimes over the streambed (often looking like sewage fungus).

Both the filamentous and slime proliferations can have major detrimental impacts on the ecosystem. Foremost are the effects on water quality. The daily cycle of photosynthesis and respiration can severely deplete near-bottom dissolved oxygen during the night (sometimes resulting in complete deoxygenation), but during the day the water becomes super-saturated again with the liberation of oxygen. This day-time photosynthesis also affects pH. In some streams we have measured changes in pH from around neutral in the morning to in excess of pH 9 by mid-afternoon, a value considered to be lethal to juvenile trout.

Excessive periphyton growth also alters the physical habitat for invertebrates. Imagine your lawn turning into 3 m high elephant grass overnight . . . now try living in it. Such conditions appear to hit invertebrates with long, gangly, legs the worst. They seem to get thoroughly entangled in it. The de-oxygenation which can occur in these mats probably has a strong impact on them as well. At the onset of one of these proliferations we have observed shifts in dominance from stone surface dwelling mayflies and stoneflies, which normally make-up a high proportion of adult fish diets, to small burrowing insects such as chironomids which don't have significant leg structures and appear to be tolerant of low oxygen levels. Many fisherman have relayed to me that the fishing goes "right-off" once such proliferations develop. This probably indicates that adult trout do not like such habitats either.

Periphyton proliferations also have major impacts on human aesthetic values. Mats of filamentous green algae are particularly conspicuous from stream banks when parts detach and are deposited in shallows or around exposed rocks and tree branches in the water (see photo 3). This is often equated with habitat degradation and pollution by New Zealanders and tourists alike. The detached mats can also cause problems with clogging of water abstraction intakes.

In the next article I will describe in more detail how different degrees of land use, different types of catchment geology, and stream management practices can impact stream periphyton. I will also highlight some basic considerations for evaluating proposals for land use and/or flow modifications to maintain the biodiversity of this important community. In the third article I will explain how periphyton can be used as a simple indicator of the health of streams. ■

NEW SCIENCE & RESEARCH PUBLICATIONS

REPORTS

Copies have been sent to all Directors, CAS, librarians, and to the Head Office library.

White, E.G. 1994. **Ecological research and monitoring of the protected grasshopper Brachaspis robustus in the Mackenzie Basin.** *Science & Research Series No. 77.*

Flux, Ian, Sherley, Greg, Bradfield, Philip, and Clegg, Suzanne 1994. **Some preliminary results and observations on North Island kokako productivity and ecology at Mapara Wildlife Reserve, King Country, July 1991 – June 1992.** *Science & Research Series No.76.*

Sherley, Greg, Green, Chris, and Owen, Keith 1994. **Distribution, conservation status and some features of the natural history of Dorcus stag beetles (Coleoptera: Lucanidae).** *Science & Research Series No. 75.*

Pugsley, C. and Turnbull, J. 1994. **Marine Reserves Monitoring Workshop, 24–25 February 1994.** *Science & Research Internal Report No. 146.*

CONSERVATION ADVISORY SCIENCE NOTES

Copies have been sent to all CAS, to librarians and to the Head Office library. Further copies are available from Science Publications, at $2.25 (incl. GST) per copy.

Lloyd, B.D. 1994. **Evaluating the potential hazard of aerial 1080 poison operations to Short-tailed bat populations.** *Conservation Advisory Science Notes No. 108.* 12p.

Simpson, P.G. 1994. **Project Crimson: an example of corporate support for conserving biodiversity.** *Conservation Advisory Science Notes No. 107. 14p.*

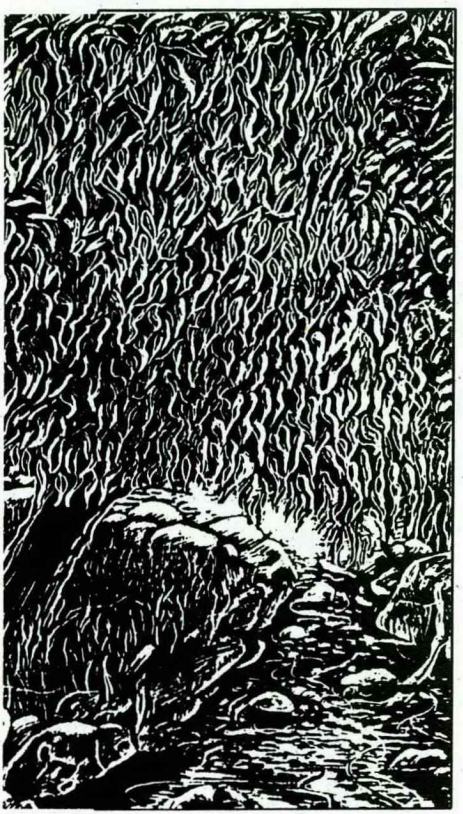
Lloyd, B.D. 1994. **A report on a brief trip to assess the status of Short-tailed bays in the Rangitaua, Ohakune area, April 1994.** *Conservation Advisory Science Notes No. 106.* 11p.

Rogers, G. 1994. **Kaimanawa feral horses: recent environmental impacts in their northern range.** *Conservation Advisory Science Notes No. 105.* 11p.

Henderson, I.M. 1994. **Population viability analysis of Blue duck (Hymenolaimus malacorhynchos).** *Conservation Advisory Science Notes No. 104. 39p.*

Moore, P.J. 1994. **What is a bad season for Yellow-eyed penguins?** *Conservation Advisory Science Notes No. 103.* 7p.

Cawthorn, M.W. 1994. **Seal finger and mycobacterial infections of man from marine mammals: occurrence, infection and treatment.** *Conservation Advisory Science Notes No. 102.* 15p.



WILD WILLOWS IN NEW ZEALAND

PROCEEDING OF A WILLOW CONTROL WORKSHOP HOSTED BY WAIKATO CONSERVANCY, HAMILTON, 24 – 26 NOVEMBER 1993

COMPILED BY CAROL J. WEST

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Department of Conservation
Te Papa Atawhai

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