ConScience newsletter

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EDITORIAL

This is our thirteenth issue of *ConScience*; thirteen has always been a lucky number for me and I think this issue will be, if not lucky, at least useful.

We have the second of three articles on periphytic algae in streams, and further notes on airlines and large seabirds.

Of special interest to all those in the biological sciences, is the arrival in New Zealand of Prof. William Hamilton FRS to give the Rutherford Memorial Lectures for 1995 to the Royal Society of New Zealand. There is more information about Prof. Hamilton in *Notes and News*.

Kaye Green
Editor

Department of Conservation
Te Papa Atawhai

REPORTING BACK

Science Division Achievements — Highlights of 1994–95

1. Mapara – kokako research by management. A very successful breeding season which can be attributed to the climax of years of scientific study and management pest control action.

2. Chatham Island – parea. A three year programme by Ralph Powlesland, in combination with management action on predator control has produced a very high breeding success in the last season.

3. Ohakune – short-tailed bats. At the very beginning of a study by Brian Lloyd related to the use of 1080 in forests where bats are present, advanced techniques of radio-tracking of these very small bats has revealed a large colony estimated to be over 1000 bats of this very rare species.

4. Auckland Islands – New Zealand (Hooker's) sea lion. Nick Gales has just returned from a highly successful summer which has determined an accurate and repeatable counting method for pups, shown that pup numbers are roughly similar to the last few years, and shown that females can dive to quite remarkable depths. Preliminary data shows that some individuals feed at sea in areas outside the fisheries protection zone.

5. Open Bay Islands – N.Z. fur seals. Returns from observers have shown that Hugh Best's four years tagging programme has produced excellent results. Seals from the West Coast move all around both north and south island, and one was captured in a net 100 miles of the Victorian coast, suggesting genetic interchange with the Australian population.

6. Brown and Little Spotted kiwi. Rogan Colbourne and Hugh Robertson's work in the kiwi recovery plan is showing considerable advances. They have developed methods to incubate eggs and hand rear chicks successfully and the public relations campaign on the effect of uncontrolled dogs on kiwis has considerably increased public awareness.

7. Kevin Jones's remarkable book on archaeological sites from the air was published last year and has sold well and been very well reviewed.

8. The Science Advisory Board approved a contribution to Nancy Adam's excellent book on the seaweeds of New Zealand. This was fully acknowledged in a superbly illustrated text which was recently published.

9. Bruce McFadgen has recently published a seminal paper on the accuracy of carbon 14 dates in New Zealand. His analysis indicates Maori arrival started around 1350, some five hundred years later than previously estimated by archaeologists.

10. NIWA produced on contract, the first comprehensive book on riparian management which will be published by S&R in mid 1995.

Overall, I think that this has been a quite remarkable year for outputs from the division. The above examples are only highlights, there was much good work done in many other projects, not all of which could be mentioned.

Richard Sadleir
Director, S&R Division, Tory Street

NOTES AND NEWS

Gannet be true??

Last month's excellent Taxonomy of Airline Advertising produced a response which should interest readers. Unfortunately the signature was almost indecipherable, so I hope my attribution of the authorship is correct! . . . Ed.

Mr Robertson displays his excellent research skills in tracking down the source of the apparent discrepancy between the use of *Morus bassana* and *Morus serrator* in the Air New Zealand billboard and television advertising. I regret, however, that a ganneteer as ancient and grizzled as he should have fallen into the trap laid for him and had the feathers pulled over his eyes. The evidence he found suggesting that their adverts had been prepared by artists and film animators was deliberately constructed to deceive, so as to maintain the confidentiality of the budget process; and to prevent public appreciation of the fact that some department staff have managed to train gannets of both varieties to form korus in flight so that they may be photographed both in still and in video.

This project (so secret that it was never put through the Science Board) is I believe being pursued as a fund raising venture; so much per gannet per day. The funds raised will of course be paid into the Consolidated Account, but I predict that a proportion of this will be allocated to the department in this year's budget for increased protected species funding. Indeed should this be so, my hypothesis will be proved.

J.S. Holloway, Director
EPPD, Boulcott Street

A Royal problem with Australian airline taxonomy

More airlines have problems with avian taxonomy . . .

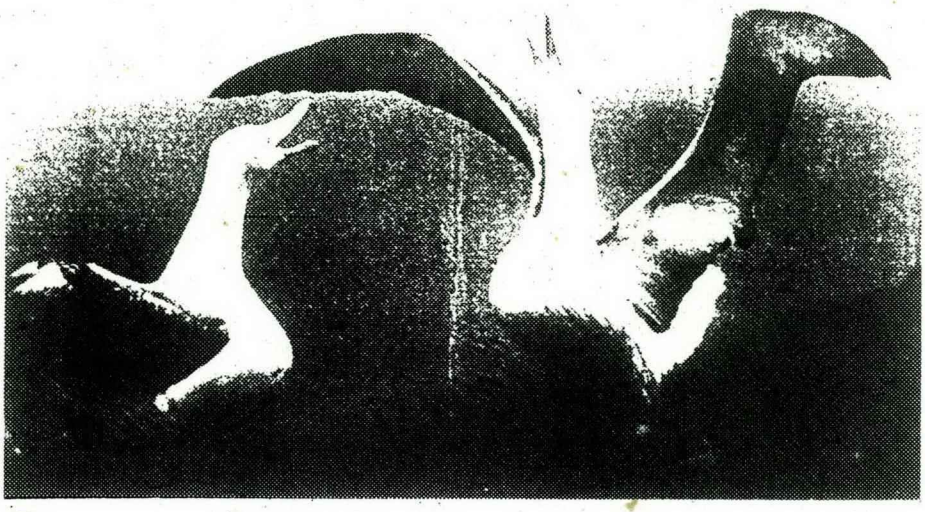
It would seem that Australians, quite apart from wanting to have their skies to themselves, have difficulty with the identification of non-republican 'Royals' as well.

In a full page advertisement placed in the *Sunday Star-Times* of 14 August 1994 by Qantas there is a pleasant photograph of a pair of adolescent Royal Albatross (*Diomedea epomophora*) in courtship display. The title reads "Until now these were the only international flights from Dunedin" while promoting the first international airline flight from Sydney to Momona (International) Airport on 16 August 1994.

Obviously the promotional department of Qantas had long been aware of the significance of the attached cartoon *(see next page)* which appeared during the 1970's in one of those colourful weekly pictorial magazines for which Australia is well known, and which are usually prone to feature extravagances in one form or another. In this extravagant vein you will of course note that the Royals in the cartoon have managed to expand their wingspans an extra metre from the normal three.

What the guys from Qantas missed was that there are two forms of the Royal Albatross; the smaller Northern (*D. e. sanfordi*) and the larger Southern (*D. e. epomophora*). The population at Taiaroa Head is predominantly made up of the Northern variety, while the photograph in the advertisement clearly shows a pair of Southern Royals in spite of the careful efforts to remove any indication of an identifiable background.

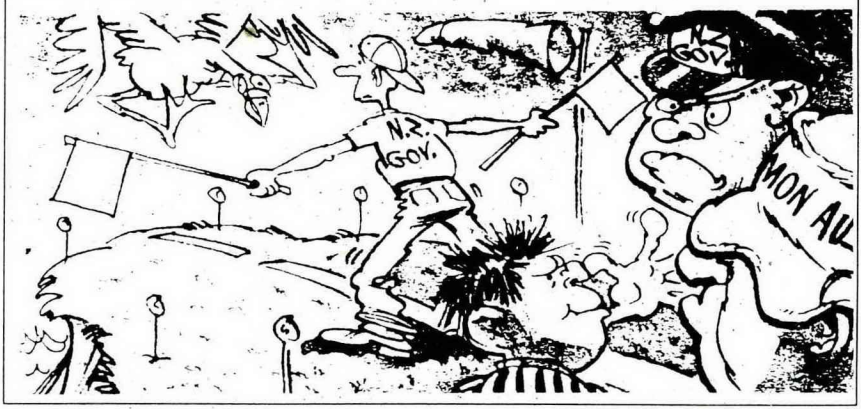
Until now these were the only international flights from Dunedin.



So what gave this latest piece of ornithological artistic licence away? Both birds show the white leading edge to the wings of Southern Royals which, when seen at sea, make it look as though the bird has just flown through a bag of flour. The female also shows the extra white feathering in the upper wing which is not found at the fully black upper wing and 'elbow' of the Northern Royal. The little vegetation that is shown seems to be entirely tussock, at present a relatively uncommon and not widely distributed species at Taiaroa Head. The photo used was taken either at Campbell Island or Enderby Island in the Auckland Islands.

Taiaroa Head is of interest however, in that from an original two Southern Royal females who joined the population there during the early development of the colony we now have records covering five generations of viable natural cross-breds who may well become the evolutionary base

KIWILAND has the honour of containing the only mainland resting place of the world's largest sea bird, the Royal Albatross. The birds — whose wingspan exceeds four metres — nest at Taiaroa Head on the Otago Peninsula, a few kilometres from Dunedin. Visits to the area are strictly supervised by the New Zealand Government.



for a future 'Taiaroa Head Royal Albatross'. They are currently tending to be dark in their plumage similar to their Northern lineage, though their size tends a little towards their larger Southern lineage.

Does this also mean, in the future of creative airline advertising and mega airlines, that we can expect to see the Royal New Zealanders (mileage millionaires) as the world's greatest travellers gaining superiority over the republican Aussies with the Taiaroa Albatross ultimately being sponsored as *Diomedea koru didgeridooensis*? Could be a windy flock, eh!

C.J.R. Robertson
S&R Division, Tory Street

Reference: Taxonomy of airline advertising. *ConScience 12*: 6.

William Hamilton – Taking Darwin into the 20th Century

Professor Hamilton is an outstanding scientist in the field of Evolutionary Biology who has received very wide recognition including a large number of honours for his original contributions in his field. He has many strong links with New Zealand as both his parents were born here.

Professor Hamilton's major scientific contribution was to propose the concept of "Inclusive Fitness", which explains the evolution of altruistic behaviour, and also gave new aspects to the theory of sex ratio. His extremely cogent ideas, which have been found substantially to be correct, have had a revolutionary influence on the field of biological sciences.

Prof. Hamilton is in New Zealand as the 1995 Rutherford Lecturer to the Royal Society of New Zealand. His Wellington lecture was on the 2 May, at Victoria University. ❑

Definitions

I was asked recently for the official S&R definition of **research**. Surprisingly there does not appear to be one, but I was directed to a booklet titled *Glossary of Terms for Scientific and Technological Activities in New Zealand;* published by the Ministry of Research, Science and Technology, in 1991. This did not have a definition of research either— but I did find definitions of some compound words which include research. Presumably we are expected to abstract the basic connection. A chocolate fish each for the two best definitions of research! Richard Sadleir will be the judge. In the meantime, consider these:

Fundamental Research
Experimental or theoretical activities undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. Sometimes referred to as pure or basic research.

Strategic Research
Research activities conducted to support long-term "national needs" and directed into specific broad areas in expectation of useful discoveries, or providing the broad knowledge base necessary for solution of recognised practical problems.

Applied Research
Research activities to acquire new knowledge which is directed primarily towards a specific and predetermined objective or application, and including possible uses for the findings of fundamental research.

Experimental Development
Systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

Scientific Research and Experimental Development
This comprises creative work undertaken on a systematic basis in order to increase knowledge of humankind, culture and society and the use of knowledge to devise new applications (1).

Any activity classified as scientific research and experimental development is characterised by originality; it should have investigation as a primary objective, the outcome of which is new knowledge, with or without a specific practical application, or new or improved materials, products, devices, processes or services. Scientific research and experimental development ends when the activity is no longer primarily investigative.

Scientific research can be distinguished from experimental development if it has all four of the elements of creativity, novelty, the use of scientific methods and the generation of new knowledge (1).

The Editor

Music has Power!

S.J. Owen in Estate Protection Policy Division, DoC, has sent us this short piece . . .

An Indian farmer has discovered a way to drive wild pigs away from his crops – he plays Michael Jackson music.

He swears that when he first played it the pigs fled immediately and it still works. The music also keeps monkeys at bay.

Maybe someone should develop a proposal to study this further?

RESEARCH IN PROGRESS

Bait Stations

The now pressing need to protect ecosystems and species leads to extensive research in pest control – Landcare Research has been studying the place of bait stations.

Our DoC research has focused on investigating and improving the use of bait stations in large forested areas which is specifically applicable to the type of pest control that DoC undertakes to preserve forest species. None of the research funded by DoC has been conducted on farmland or along forest/pasture margins which is the case for most of our work funded by the AHB. Therefore the research we have conducted for the DoC project one listed below has been specifically aimed at DoC managers so they can take the findings from this work and apply it directly to pest control in their areas of native forest.

The three projects being funded to investigate the use of bait stations are as follows.

1. Bait feeders for DoC-specific pest control

This is a three-year project funded by DoC (investigation number 1705) and the main focus of this study is to improve the cost-effectiveness of possum control on the ground using bait stations. Its aim is to supply DoC managers with techniques they can use in large tracts of forest. Minor emphasis is also given to development of improved control of deer, pigs, cats and rats. Using bait stations.

Results from this project are already being applied to the management of possums in parts of Pureora Forest and some have been published in a paper which provides a standard operating procedure, targeted specifically at DoC managers, outlining the best methods for using 1080 in bait stations for possum control in forests (Thomas 1994).

2. Maintenance control of possums

This is a five-year project funded by DoC (investigation number 1981), and the principal researcher is Bruce Warburton, Malcolm Thomas has responsibility for the bait station aspect of the study. The main focus of this study is to determine the most cost-effective method for maintaining possums at low number after initial "knockdown control" of possums in a large area of forest.

3. Possum control on farmland

This is a one year study funded by AHB where we are comparing possum control using jam paste with control using bait stations. This study is focused on providing Regional Councils and farmers with efficient and cost-effective methods for controlling possums on farms to reduce the incidence of Tb in domestic stock. Paste is the principal method of possum control used by Regional Councils on farmland however in some situation, especially where areas cannot be covered on foot, the use of bait stations may be more cost-effective. The work has been undertaken in collaboration with Wellington Regional Council.

Reference: Thomas M.D. 1994. Possum control in native forest using sodium monofluoroacetate (1080) in bait stations. *Proceedings of the 47th Plant Protection Conference*: 107–111.

[Perhaps we should draw the Landcare's attention to the success, reported in the last issue, of Hawkes Bay Conservancy's bait stations in reserves: ConScience 12*: 12.]*

The Effect of Man on Periphytic Algae in Streams

by Barry Biggs, NIWA, PO Box 8602, Christchurch

The second instalment in this series on periphytic algae in streams.

In my last article (*ConScience Newsletter 11*), I stressed the importance of periphytic algae (periphyton) in stream ecosystems. I also pointed out that given suitable conditions, stream algae can form "blooms" which are not only unsightly but also degrade the habitat for other kinds of stream life. So how do human activities impact these communities ? What should we watch out for in the way landscapes and waterways are managed so that an appropriate balance in growth and diversity of periphyton is maintained ?

Factors controlling periphyton growth in streams

The development of periphyton on the bed of a stream can be illustrated in a simple accrual and loss ledger (see Fig. 1). High nutrients, light and temperature promote growth. On the other hand, unstable bed sediments and high water velocity, suspended solids and grazing (mainly by invertebrates) all remove the community. The most significant losses in New Zealand streams occur during floods when high velocities combined with bed movement and abrasion by suspended solids to present particularly harsh conditions for periphyton.

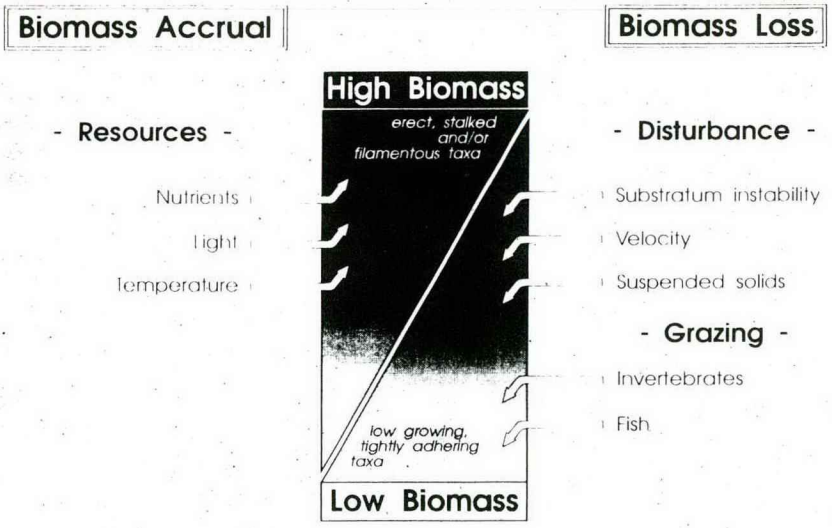


Figure 1 Summary of the main factors regulating the accumulation of periphyton biomass in streams. The relative balance of 'biomass accrual' and 'biomass loss' processes is depicted by the width of the triangles which make-up the central rectangle. The structure of the community likely to dominate each end of the gradient is also shown.

Following a flood, physical conditions gradually become benign enough to allow periphyton to grow again. At this time nutrient and light levels become important because these control the rate at which algal cells can multiply. High levels stimulate growth rates and the result is often thick mats dominated by filamentous algae. However, in streams subject to frequent flooding, little periphyton will be able to develop no matter how high the nutrients and light are. Only those streams which rarely flood have the potential to develop very high biomass in response to high nutrients and light. Grazing may not become important until many months after a flood when invertebrate populations have developed to a significant level.

Man's effects

Commonly human activities influence the development of periphyton in one of two ways. Firstly they can accelerate the loss process by destabilising bed sediments (Fig. 1). This happens through activities such as gravel extraction, alluvial mining and road building close to streams. Once loosened, bed sediments tend to mobilise more easily during small floods. Accrued periphyton is then more often abraded from the cobbles/gravels. A further consequence may be removal of most of the invertebrates. Activities such as stop-bank construction and removal of stabilising vegetation such as willows, which add new sediments from the sides of streams, can have a similar effect. The overall result can be quite barren stretches of stream bed.

Secondly, many activities reduce velocities, increase bed sediment stability, increase nutrients, and increase light, all of which can accelerate biomass gain processes. Such effects can result from abstraction, impoundment and land development. Abstraction (e.g., for irrigation) and impoundment (e.g., for hydroelectricity production) usually reduce water velocities in summer, and increase bed sediment stability. In particular, impoundment often causes "armouring" of the bed (i.e., the development of tightly packed cobbles in the channel) which greatly increases bed stability. The major problems arise when flow reductions occur in tandem with enrichment. In such circumstances, excessive periphyton growth can suffocate the invertebrate habitats, etc, as described in Conservation Science Newsletter 11. In itself, increasing periphyton growth is not necessarily a bad thing so long as proliferations do not develop. For example, North American research has shown that in nutrient poor waters this can lead to greatly enhanced development of invertebrate communities which graze periphyton. In-turn, this has then lead to a significant increase in fish production.

It is well known that conversion of catchments to intensive agriculture leads to increased nutrient concentrations in streams. With stable substrates and low water velocities, the result can be strong stimulation of periphyton growth rates during interflood periods. The effect is compounded in small streams by increased light levels where riparian vegetation has been removed.

Evaluating the potential effects of developments

Because proliferations are a product of both flow regimes and nutrient levels, both have to be considered when evaluating the potential effects of developments. While we still cannot quantitatively predict periphyton biomass from environmental variables, we can consider the following issues to determine whether proliferations are likely (or

not) following a change in water or catchment use:
(1) How long are the periods of stable baseflow in summer ?
(2) What is the velocity of the water going to be during low flows ?
(3) Are the communities already nutrient saturated or not ?
(4) If not, can additional nutrient inputs be controlled ?
(5) If the stream is enriched, what is the degree of riparian shading, or potential for it ?

As a general rule, there must be at least two months without floods before proliferations develop. However, this may be little as six weeks if water temperatures are >20°C and there are extensive areas of stable substrates. Water velocities of <0.5 m/s will generally allow large mats of filamentous periphyton to develop. The shear stress associated with higher velocities usually keeps the communities cropped to a fairly low level.

For controlling nutrient inputs, there are three main sources which need to be considered.

(1) Rocks underlying the catchment: Tertiary marine sandstones and siltstones are generally high in nutrients (e.g., in the Wanganui/Manawatu/Hawkes Bay regions) and waters draining limestone/marble areas tend to be high in nitrogen. Obviously there is nothing we can do about managing these inputs, but it is important to recognise them because their presence should affect the way applications for abstraction consents are assessed. We also need to be aware that some algal proliferations do occur naturally.

(2) Landuse activities: Even small increases in the proportion of a catchment under intensive agriculture can cause noticeable increases in enrichment. After approximately 40% of a catchment has been developed stream periphyton communities seem to become nutrient saturated (i.e., they have all the nutrients they can utilise). Any further development appears to have little additional effect. Riparian "buffer strips" can help to offset the effects of agricultural activities, particularly through the reduction in overland transport of nutrients during storm flows and shading of small streams.

(3) Enriched wastewater discharges: Problems caused by wastewater discharges have diminished considerably with the introduction of high grade treatment and extensive use of spray irrigation of effluent. However, if discharges to streams are occurring then the combination of background nutrients (measured at a time when there is little or no periphyton on the stream-bed) and nutrients from the wastewaters should not exceed 150 parts per million (ppm) of total dissolved nitrogen or 15 ppm of dissolved phosphorus. These are only approximate criteria. Some periphyton species can utilise these nutrients more efficiently than others and form a higher biomass.

Removal of riparian shading over small streams can greatly increase light levels to the bed. This then removes light limitation of the communities and in enriched streams will facilitate the development of proliferations. Thus, maintaining a good canopy cover in such situations can help control these growths.

In the next article I will briefly describe some field techniques which may be used by advisory scientists and field staff to rapidly survey periphyton and from this assess the approximate 'health' of streams.

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NEW SCIENCE & RESEARCH PUBLICATIONS

REPORTS

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

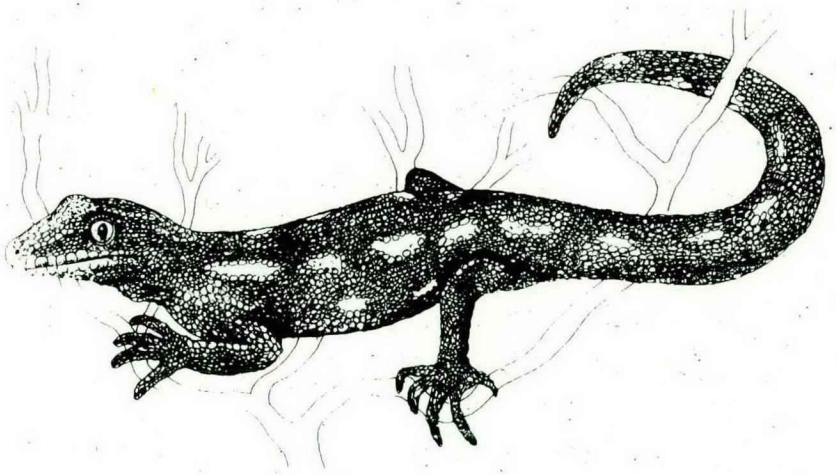
Cossee, R.O. 1995. **Report on bird banding in New Zealand 1992–1993.** *Science & Research Series No. 87.* Annual report of the bird banding scheme in New Zealand.

Flux, I.; Bradfield, P.; Clegg, S. 1995. **Preliminary results and observations on North Island kokako productivity and ecology at Mapara Wildlife Reserve, King Country, July 1992–June 1993.** *Science & Research Series No. 85.* Results from the fourth year of a five year research programme.

Jones, K.L. and Simpson, P.G. 1995. **Archaeological site stabilisation and vegetation management. Case Studies I: Coromandel, Bay of Plenty and Hawkes Bay, Central Volcanic Plateau and Taranaki.** *Science & Research Series No. 84.* The title says it all!

Powlesland, R.; Grant, A.; Dilks, P.; Flux, I.; Bell, M. 1995. **Some aspects of the ecology and breeding biology of parea on southern Chatham Island, July 1993–April 1994.** *Science & Research Series No. 82.* Results from the third year of a research programme on parea. Includes discussion on survival of marked birds, food and breeding, and recommendations.

Timmins, S.M. and Mackenzie, I.W. (Comp.) 1995. **Weeds in New Zealand protected natural areas database.** *Department of Conservation Technical Series No.8.* Information on the ecology and control of 67 environmental weed species, recording the results of trials and management operations.



NEW! from THREATENED SPECIES UNIT!

Threatened Species Recovery Plan Series Numbers 13 & 14

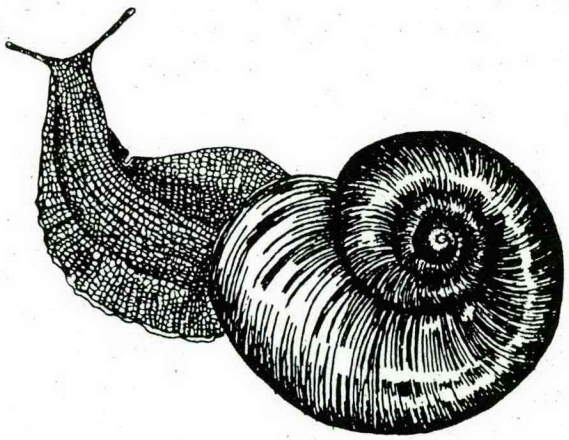
GIANT LAND SNAIL RECOVERY PLAN
***Placostylus* spp., *Paryphanta* sp.**

Prepared by Richard Parrish, Greg Sherley, and Mike Aviss

OTAGO AND GRAND SKINK RECOVERY PLAN
***Leiolopisma otagense, Leiololpisma* grande**

Prepared by A.H. Whitaker and G. Loh

Available from: Science Publications, DoC, Tory Street
PO Box 10-420, Wellington, New Zealand



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