Conservation of lizards in West Coast/Tai Poutini Conservancy

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Preface

Following on from recent discoveries on the herpetofauna of the West Coast, additional specialist advice was needed to guide conservation actions. This plan is a collation of only the technical actions required for lizard conservation and will assist Area Offices in determining which actions are appropriate for conservation of each species. It does not include all the actions that are required for successful conservation management, in particular Iwi consultation. The reader is reminded that Iwi consultation needs to be undertaken for management to be successful as much as any of the technical actions recorded in this document.

As new information is collected, this plan will be updated accordingly.

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Conservation of lizards in West Coast/Tai Poutini Conservancy

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ABSTRACT

This action plan sets goals and objectives for the conservation management of lizards within the West Coast/Tai Poutini Conservancy. For each of the five Areas within the Conservancy, the current status and knowledge of the lizard fauna is given and conservation management opportunities are summarised. Priorities are set for research, survey and management for each Area that will result in a better understanding of the lizard fauna, and which should reduce the vulnerability of threatened species and secure the long-term future of all other lizard taxa at localities representative of their natural range. For each lizard taxon known from the Conservancy, the current data on distribution, ecology and conservation status is summarised, and possible threats and limiting factors are discussed. When appropriate this information is used to develop management actions aimed at enhancing the species' conservation status; significant gaps in this information are identified as research needs.

Keywords: Reptilia, Squamata, Lacertilia, *Hoplodactylus*, *Naultinus*, *Oligosoma*, reptiles, lizards, geckos, skinks, conservation management, West Coast, Westland, New Zealand

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1. Introduction

For the purpose of administering Crown-owned land in the conservation estate the Department of Conservation (DOC) has divided New Zealand into three 'regions', together containing 13 'conservancies', which in turn are further subdivided into a variable number of 'areas'. West Coast/Tai Poutini Conservancy (WC/TP) is within the Southern Region and contains five areas (Buller/Kawatiri, Greymouth/Mawheranui, Hokitika, Franz Josef/Waiau, and South Westland/Weheka) (see Fig. 1). It lies west of the main divide and extends from Kahurangi Point, north of Karamea, to Big Bay in northern Fiordland.

The boundaries of the administrative units within DOC have been decided mainly on geographic grounds. Although the conservation management of a relatively few, generally rare or threatened habitats or taxa extends beyond conservancy boundaries, the close association of geography and the biota means that for the most part management decisions and actions have to be conservancy-based. Issues significant in one conservancy are not necessarily so in another where different priorities will take precedence. Such an administrative background means conservancies need to develop their own plans for the management of the indigenous biota in their area of jurisdiction.

This action plan for the lizards of WC/TP is one in a series that have been prepared for the herpetofauna (Roberts 1999; Whitaker & Gaze 1999; Whitaker et al. 2002). Although loosely based on the concept and format of the Species Recovery Plans (SRPs) produced by DOC, these action plans have two fundamental differences:

- They consider a **large group of species** in relation to a **specific geographic and administrative area** (cf. relatively few—or often just single—species throughout their entire range)
- They include **non-threatened species**—although this has since been done in some lizard SRPs (Towns 1999; Towns et al. 2002)

There are currently five SRPs relating to the New Zealand herpetofauna (Whitaker & Loh 1995; Newman 1996; Towns 1999; Gaze 2001; Towns et al. 2002). None of these address the lizard species in Westland[1].

The known species richness of the extant herpetofauna in WC/TP is not high in comparison to other conservancies, comprising about 17 species of lizards (see Appendix 1). Both native frogs (*Leiopelma hamiltoni, L. hochstetteri*, and *L. markhami*) and tuatara (*Sphenodon* sp.), present in Westland in the relatively recent past, are now locally extinct (Worthy 1987a, b, 1993; Worthy & Holdaway 1993, 1994).

Long considered depauperate, recent research and survey work on the lizard fauna of Westland points to hitherto unrecognised diversity in both the brown geckos (*Hoplodactylus* spp., n = c. 7)) and the skinks (*Oligosoma* spp., n = c. 8), and suggests a high level of endemism[2]—particularly for skinks—and

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[1] Towns et al. (2002) does include *Oligosoma infrapunctatum*, *O. nigriplantare polychroma,* and *O. zelandicum,* but only those populations located in the North Island.

[2] In this context 'endemic species' are defined as those found only within a single conservancy.

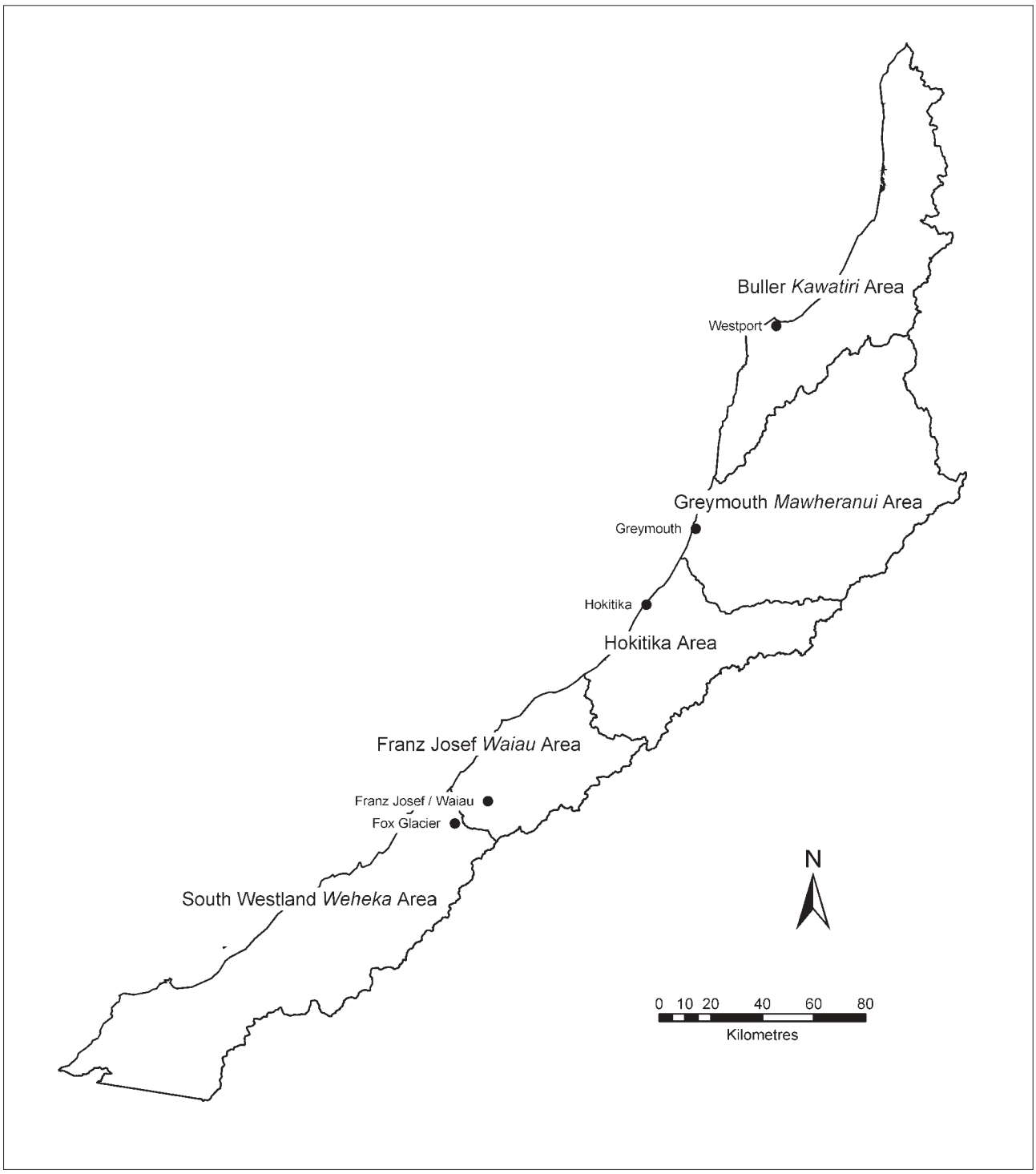

Figure 1. Boundaries and names of the five areas in the West Coast / Tai Poutini Conservancy.

a high proportion of species confined to mainland habitats (Hitchmough 1997, 2002c; van Mierlo 1998; Miller 1999; Miller et al. 1999) (see Table 1 and Appendix 1). However, as the genetic and taxonomic identity of several of these taxa is far from clear, and some are presently known from just single specimens (e.g. Okarito forest gecko, Paparoa skink), it will be some time before the situation can be fully resolved. The situation is further complicated because some taxa that are genetically distinctive are seemingly impossible to separate from sibling taxa on morphometric grounds (e.g. Grey Valley skink).

Until recently few of the lizard taxa in WC/TP had been assigned a threat classification or been ranked for conservation priority (IUCN 1996; Molloy & Davis 1994; Hilton-Taylor 2000) (see Table 1). This certainly did not indicate their position was secure, but was simply a reflection of the fact most had only recently been recognised, had not been formally described and/or were not well-known. The latest DOC ranking system (Molloy et al. 2002) does allow for the inclusion of undefined taxa and thus all lizards from Westland have now been classified according to perceived threat (Hitchmough 2002a).

Two lizard species in WC/TP are regarded as 'nationally critical', three are in 'gradual decline', three are 'range restricted' or 'sparse', and four are so poorly known they are regarded as 'data deficient' (Hitchmough 2002a). The remaining five (30%) of the lizard species known from WC/TP are listed as 'not threatened'. However, in four of these cases the classification is on the basis of their national status as they are rare or extremely restricted in Westland, where only the forest gecko could be truly regarded as not at risk.

TABLE 1. SUMMARY OF THE LIZARD FAUNA OF WEST COAST/TAI POUTINI CONSERVANCY, INCLUDING DISTRIBUTION (ENDEMISM), AND THE CURRENTLY ASSIGNED THREAT, CONSERVATION PRIORITY AND CAPTIVE MANAGEMENT CATEGORIES.

SPECIES	COMMON NAME	DISTRIBUTION/ ENDEMISM*	IUCN '*Red List*' category†	DOC threat rank‡	DOC priority rank§	DOC captivity category‖
Hoplodactylus maculatus	common gecko	widespread	–	NT	–	A
Hoplodactylus sp. 'Canterbury'	Canterbury gecko	regional		GD(hi)		C
Hoplodactylus sp. 'Southern Alps'	Southern Alps gecko	widespread	–	NT	–	C
Hoplodactylus granulatus	forest gecko	widespread	–	NT	–	A
Hoplodactylus sp. 'Cascade'	Cascade forest gecko	endemic	–	DD(ol)	–	C
Hoplodactylus sp. 'Okarito'	Okarito forest gecko	endemic	–	DD(ol)	–	C
Hoplodactylus sp. 'Open Bay Island'	Open Bay Island gecko	endemic	–	NC(dp,ol)	–	C
Naultinus stellatus	Nelson green gecko	regional		GD(dp,hi)		B
Naultinus tuberculatus	West Coast green gecko	regional	LR(lc)	SP(Ddp)	–	B
Oligosoma infrapunctatum	speckled skink	widespread	LR(nt)	GD(hi)	– ¶	B
Oligosoma sp. 'Open Bay Island'	Open Bay Island skink	endemic	–	NC(dp,ol)	A	C
Oligosoma nigriplantare polychroma	common skink	widespread	–	NT	–	A
Oligosoma sp. 'Grey Valley'	Grey Valley skink	endemic	–	RR(dp)	–	C
Oligosoma zelandicum	brown skink	widespread	–	NT	–	A
Oligosoma sp. 'Big Bay'	Big Bay skink'	regional	–	RR	–	C
Oligosoma sp. 'Paparoa'	Paparoa skink'	endemic	–	DD(ol)	–	C
Oligosoma indet. 'Denniston'	Denniston skink	endemic	–	DD(ol)	–	C

* Distribution categories are: endemic = confined to WC/TP; regional = known from WC/TP and one (or rarely two) adjacent conservancies; widespread = in three or more conservancies.

† IUCN 1996, Hilton-Taylor 2000.

‡ Molloy et al. 2002 and Hitchmough 2002a. Categories are: NC = nationally critical, GD = gradual decline, RR = range restricted, SP = sparse, DD = data deficient, NT = not threatened; Qualifiers are: hi = human induced, ol = one locality, dp = data poor.

§ Molloy & Davis 1994.

‖ DOC (1990). Category C is the highest rank. All new and undescribed species are assigned to Category C by default.

¶ See footnote 7 in Section 4.11.4.

Overall species richness diminishes from north (8–9 spp.) to south (3–5 spp.) (see Table 2). No species—with the possible exception of the West Coast green gecko—occurs throughout the area, but 'forest geckos' *sensu lato* are likely to be present in all natural forest or shrubland habitats. However, about half the taxa known from WC/TP are known from just a single area, or often just a single site or specimen. This apparent restriction to a single area is more likely to reflect current knowledge than represent a genuinely small range.

Species richness at any one locality is very unlikely to exceed four taxa; typically forested habitats would have 2 (or perhaps 3) gecko taxa and open or coastal habitats just 1–2 taxa.

Elsewhere in New Zealand, islands are important refugia for lizard populations and are fundamental to many reptile conservation programmes. More than 75 islands and islets occur along the coast of WC/TP, and although most are very small (< 1 ha) and close to shore (< 400 m), this does not preclude their value as lizard habitat, especially as they all appear to be free of mammalian predators. To date lizards have been found only on Taumaka Island, Open Bay Islands

TABLE 2. DISTRIBUTION OF LIZARD SPECIES IN THE ADMINISTRATIVE AREAS OF WEST COAST/TAI POUTINI CONSERVANCY.

COMMON NAME		BULLER/ KAWATIRI	GREYMOUTH/ MAWHERANUI	HOKITIKA	FRANZ JOSEF/ WAIAU	S. WESTLAND/ WEHEKA
common gecko		O	O	–	–	–
Canterbury gecko		–	?	–	–	–
Southern Alps gecko		–	O	–	–	–
forest gecko		O	O	O	O	–
Cascade forest gecko		–	–	–	–	●
Okarito forest gecko		–	–	–	●	–
Open Bay Island gecko		–	–	–	–	●
Nelson green gecko		O	–	–	–	–
West Coast green gecko		O	O	O	?	?
speckled skink		O	O	O	O	–
Open Bay Island skink		–	–	–	–	●
common skink		–	O	O	O	–
Grey Valley skink		–	●	–	–	–
brown skink		O	–	–	–	–
Big Bay skink		–	–	–	–	O
Paparoa skink		O	O	–	–	–
Denniston skink		●	–	–	–	–
Total lizard species	(*n* = 17)	8	8–9	4	5	5
IUCN threat-ranked species*	(*n* = 2)	2	2	2	2?	1?
DOC threat-ranked species†	(*n* = 12)	5	5	2	3	5
DOC priority-ranked species‡	(*n* = 2)	–	–	–	–	1

* IUCN (1996), Hilton-Taylor (2000), and Bell (1997).
† Molloy et al. (2002); Hitchmough (2002a). Includes 'data deficient' taxa.
‡ Molloy & Davis (1994); but see footnote 7 in Section 4.11.4.
● = species with a national range limited to a single area.

group, where there are two endemic species. The lack of lizard records from the other islands is presumed to be a function of search effort.

Prior to the first human contact with New Zealand, lizards of at least one species or other would have occupied every habitat in WC/TP from the coast to at least the timberline or probably higher. At that time they would have had an integral role in these ecosystems as prey for a variety of native birds, as consumers of invertebrates, fruit and nectar, and for their part in the reproduction of some plant species (Whitaker 1987). As a result of the introduction of kiore about 2000 ybp (Holdaway 1996, 1999), the widespread habitat loss and modification that followed human settlement about 1000 ybp, and the later introduction of further mammalian predators by European settlers, lizard populations in New Zealand have been decimated (Towns & Daugherty 1994). The combined effect of this predation and habitat loss or modification has been the extinction of a few species (e.g. kawekaweau *Hoplodactylus delcourti*), the extirpation of several species from most of their former range (e.g. robust skink *Cyclodina alani*), and for some species the fragmentation and isolation of populations (e.g. speckled skink). In WC/TP these factors have resulted in the local extinction of three native frog species and tuatara. Although no lizard species are known to have gone from the region the distribution of many skink species appears extremely fragmented.

Throughout Westland lizards and lizard populations continue to face a number of very serious threats. Foremost amongst these are predation by a wide range of introduced mammalian and avian predators[3], and the effects of introduced competitors such as vespulid wasps. On-going habitat loss or modification—a serious issue for lizards in other parts of New Zealand—is not such a major concern in WC/TP though some local lizard populations are at risk.

This action plan for WC/TP lizard fauna identifies the research, survey, and conservation requirements for the different species and sets priorities for conservation management actions that should safe-guard their future. Like its predecessors (Whitaker & Gaze 1999; Whitaker et al. 2002), this plan has three main parts:

- An opening statement with the overall goal and general objectives
- Conservation action priorities for lizards for each area
- Summary statements for each lizard species (including the current status, threats, and specific research, survey and management needs)

The plan ends with an overall priority ranking of the top actions for lizard conservation in Westland. Actions or recommendations are listed in decreasing order of priority.

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[3] Feral cats, ferrets, stoats, weasels, hedgehogs, ship rats, Norway rats, house mice, possums, feral pigs, little owls, magpies, starlings, blackbirds.

2. Management plan for lizards in West Coast/Tai Poutini Conservancy

2.1 GOALS AND OBJECTIVES

Long-term goal: To ensure the continued existence of all indigenous lizard species in the West Coast/Tai Poutini Conservancy at sites that are fully representative of their natural range.

The objectives to this action plan fall into three broad groups—research, survey, and management—which can be summarised as follows:

- **Research**—To fully understand the genetic variation and taxonomic status of each lizard species occurring within WC/TP, and to determine those aspects of their biology and ecology that are critical to their conservation management
- **Survey**—To determine and map the distribution of each lizard species occurring within WC/TP so that their conservation needs and priorities can be better assessed. Particular attention should be given to geographical and altitudinal limits of range, and to the variety of habitats occupied
- **Management**—To ensure the survival of multiple populations of each threatened lizard species, if necessary through the establishment of new populations, **and**
  to ensure the survival of multiple populations of less threatened species at a range of sites that collectively secure the full genetic variation of the species, and are also fully representative of the habitats occupied and of the geographical and altitudinal range (especially geographic limits of distribution where they occur within WC/TP)

Together, the research and survey objectives will determine the conservation status of the lizard species and set the management objectives for their conservation. In turn, these management objectives will be met by a series of recommended management actions. Many of the recommendations are in reality just general, common-sense actions that apply to and broadly benefit a wide range of native species (e.g. legal protection of habitats or predator and pest control); others relate specifically to taxa or sites at risk. The general topics are discussed below (see Sections 2.2–2.4).

Success in achieving the primary management goal and the objectives of this action plan can only be established by monitoring key species, populations or sites. The methodology for such monitoring will differ for each species and situation (see Sections 2.4.3–2.4.4).

2.2 RESEARCH

Informed conservation management decisions for the lizard fauna cannot be made unless the taxonomy, relationships, and genetic variation of the species are clearly understood (Miller & Daugherty 2000; Hitchmough 2002b). The situation relating to the taxonomic status of the lizard species is a much more significant issue in WC/TP than in any other conservancy. This is because it has by far the highest proportion of taxa that are not formally described (56% n = 9), known from only one locality (31%, n = 5), or known from just a single specimen (19%, n = 3). Although pure taxonomic research is outside DOC's terms of reference, its importance to the management of the species must be recognised, and any studies that will increase this knowledge should be supported. DOC staff must also accept that taxonomic research will require the collection and killing of a small number of lizards (Miller & Daugherty 2000).

The need for—and success of—conservation management actions can only be gauged against thorough background knowledge of the biology and ecology of the lizard species concerned. This should include—but not be limited to—habitat use, population density and dynamics, reproductive biology, diet, and the effects of predation and competition. DOC staff could undertake some of this research, but much of it is likely to be carried out by contractors or third parties (e.g. CRIs or universities).

Any taxonomic, ecological or biological research on lizards that has a conservation application or benefit must be actively supported or—if need be—such research should be solicited. Research on lizards that has no immediate conservation benefit should not be vetoed unless it is detrimental to the species or has some other clearly negative impact.

2.3 SURVEY

Accurate and detailed knowledge of a species' distribution is essential for making informed conservation management decisions. Baseline data on the distribution of lizards in Westland is available from the *'HERPETOFAUNA'*[4] database managed by SRU (see Appendix 3). However, numerous taxonomic changes in the lizard fauna (both at generic and specific level) since this database was established mean that search parameters need to be chosen carefully and the output must be interpreted with caution. *'HERPETOFAUNA'* can be searched on-line and records can be extracted in a variety of formats using a wide range of search parameters. Locality information in the database up to 1988 has been summarised as an atlas that maps distribution as simple presence/ absence within the 10 000-yard squares of the old map grid (Pickard & Towns 1988).

Until very recently there had been no dedicated surveys for lizards in WC/TP and distribution data was derived from broad biological surveys (e.g. Morse 1981), site-specific surveys (e.g. Whitaker & Meads 1993), species-based research (e.g. Miller 1999), or in most cases from random records and reports.

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[4] Formerly the Amphibian and Reptile Distribution Scheme (ARDS).

Tightening legislation through the 1980s and 1990s meant that more-detailed environmental assessments were required for development associated with the mining and timber industry, and these assessments frequently included surveys for lizards (Williams & Hay 1988; Williams et al. 1990; Whitaker & Meads 1993; Thomas & Toft 1997; Thomas et al. 1997; Whitaker 1997, 1998, 1999; Ussher 2000; Mitchell Partnerships & Landcare Research 2001). Despite the fact these surveys were usually undertaken by very experienced people, they produced few lizard records (e.g. Thomas & Toft 1997; Whitaker 1999) or, frequently, none (e.g. Whitaker 1998; Ussher 2000). This is indicative of both the difficulty of searching for lizards in the Westland environment, and their present scarcity there.

This 'piecemeal' approach meant there were large parts of WC/TP and some habitats for which data on lizards was lacking. To remedy this, DOC commissioned two broad-scale surveys in the period 1997–1999 which covered the region from Karamea to Cascade (van Mierlo 1998; Miller et al. 1999). Although these surveys produced important new data on diversity and distribution, there are still significant areas (e.g. most of South Westland) and habitats (e.g. sub-alpine grassland and herbfield) for which there is little or no information on the lizard fauna. These will require priority attention.

With few exceptions (e.g. some boulder beach sites) lizards in Westland are sufficiently uncommon and/or elusive that they are difficult to find—even for skilled people during dedicated surveys. For this reason it is important that any chance encounters of lizards by DOC staff engaged in other activities, or reports of lizards by the public, are documented and investigated. To get the greatest benefit from such encounters, **all** DOC staff should be made fully aware of the need for keeping detailed records and for reporting these observations immediately. Each area must implement an advocacy and basic training programme to ensure staff are well-informed.

The basic methods for lizard surveys, including capturing and handling, have been set out (Whitaker 1994) but, because their use and effectiveness varies according to the habitat and target species, areas should always seek advice before undertaking any major survey programme.

The difficulty associated with identifying many lizard species in the field is particularly acute in Westland where there are several ill-defined taxa, and even those that are genetically quite distinct (e.g. 'Okarito forest gecko', 'Grey Valley skink') often show little or no clear morphometric differentiation (Miller 1999; Rod Hitchmough pers. comm. 2001). Although it is intended to issue a regional 'field guide' (cf. Whitaker 2001) in conjunction with this action plan there will still be many occasions when lizards will need to be captured and held for short periods while specialist identification is sought (see Appendix 4). This calls for strict hygiene with field equipment and collecting bags (as per the draft Wildlife Health SOP) to ensure that lizard populations are not exposed to new pathogens or parasites.

2.4 MANAGEMENT ACTIONS

There are four key components to successful conservation management:

- Legal protection of the species
- Legal protection of key habitats/sites
- Maintaining or enhancing habitat quality in key areas/sites
- Ensuring that key lizard populations do not decline

The relative importance and implementation of these management actions will be affected by the changing conservation status of the lizard species—as determined by research, distribution surveys or population monitoring—either before or as a result of management. This section is intended as an overview with specific recommendations presented by area or by species.

2.4.1 Legal protection of lizard species

The Wildlife Act 1953 and its subsequent amendments (Wildlife Order 1981, Wildlife Order (No. 2) 1996) provide for the total protection of all indigenous lizard species. The combined effect of this legislation makes it an offence to capture, handle or remove native lizards from the wild unless DOC has issued a specific permit to do so under s.53 of the Wildlife Act. Furthermore, the Wildlife Act is worded in such a way that taxa lacking formal names are included.

Indigenous lizards can be held in captivity by pet-keepers **provided** they hold an authority from DOC issued under s.53 of the Wildlife Act and satisfy certain criteria relating to prior lizard husbandry experience, the quality of holding facilities, and regular reporting. For the purpose of captive management DOC has assigned the lizard species to three categories based on their conservation status—A, B and C, where A is lowest, for the species at least risk (see Table 1) (DOC 1990; Dix 1993). All new and/or undescribed taxa are automatically assigned to Category C.

Despite formal protection of the lizard fauna, and severe restrictions on holding lizards in captivity, this legislation is poorly known and largely ignored by the public at large. Furthermore, ignorance of the legislation means public assistance in addressing the increasing illegal trade in reptiles (especially geckos) is essentially lacking.

Management action—Improved advocacy for lizards to ensure the public is fully aware of the protected status of the lizard fauna and the threats it faces.

2.4.2 Legal protection of lizard habitat

Any legislation that safeguards the natural environment (e.g. National Parks Act 1980, Reserves Act 1977, Conservation Act 1987, Wildlife Act 1953) provides legal protection for lizard habitat. In Westland this comprises more than 84% of the total area, including five National Parks and most of the islands. The most common and widespread lizard species have their full geographic, altitudinal, and habitat range protected within the conservation estate, but for the less well-known taxa (e.g. brown skink) the situation is unclear and some (e.g. Grey Valley skink) are not known from protected sites.

Other mechanisms which could be used to safeguard important lizard habitat are the Resource Management Act 1991 and District Schemes.

Management actions—Identify the need for additional protected land for lizards and seek formal protection of key sites.

Habitat protection could be achieved through a range of options from covenants on private land to out-right purchase. Whenever possible, sites chosen for protection should seek to safeguard a diverse lizard fauna and recognise the role of lizards in fully-functional ecosystems.

2.4.3 Maintaining the quality of lizard habitat

Over most of Westland the habitat for forest or shrubland lizard species is relatively secure. Unfortunately the habitat of open habitat species is at continued risk of destruction or serious modification from a wide range of factors including production activities (e.g. plantation forestry, cultivation, scrub clearance), anthropogenic factors (e.g. grazing, fire), and introduced pests (e.g. mammalian herbivores, weeds). In particular, the rapid escalation of the dairying industry has led to dramatic pasture improvement and subsequent loss of the 'wasteland' habitats occupied by many skink species (e.g. speckled skink, common skink, 'Grey Valley skink'). At some sites there are peculiar local impacts, e.g. mining or the use of cobble strands by recreational 4WD vehicles.

Management actions—Undertake detailed habitat assessments at key sites and for important lizard species. Monitor habitat quality at some sites to determine if detrimental changes are occurring.

These actions may determine the need to limit some production activities, to prevent some anthropogenic factors, or to control or eradicate some herbivores or weeds. They may also indicate that re-vegetation or habitat restoration is required at some sites or that for critical species at critical sites some form of habitat enhancement (e.g. the provision of additional cover) would be of benefit.

2.4.4 Maintaining lizard populations

The most serious threat to lizard species and populations is predation by introduced species, especially mammals. Just the presence of kiore (*Rattus exulans*) has been shown to result in local extinctions of lizard species, significantly reduced population densities, and changed patterns of habitat use and behaviour (Whitaker 1978; Towns 1996). Since the arrival of kiore in New Zealand about 2000 years ago (Holdaway 1996, 1999) at least three lizard species have become extinct and many others now have disjunct distributions or isolated relict populations that can be attributed primarily to the direct effects of this predation (Towns & Daugherty 1994). Following the arrival of Europeans many more lizard predators[5] became widely established in New Zealand and further decimated lizard populations.

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[5] Including feral cats, rodents, mustelids, hedgehogs, feral pigs, little owls, magpies, starlings and blackbirds, and perhaps possums (e.g. Thomson & Challies 1988; Baker 1989; King 1990; Newman 1994; Middlemiss 1995; Bell 1996; Whiting 1996; Sluijs & Spitzen 2000; Thompson 2000).

There have been no studies on the impacts of introduced predators specifically on the lizard populations of Westland. No lizard species are known to have become extinct there although subfossil remains in cave deposits may indicate a greater diversity in the recent past (Worthy 1993; Worthy & Holdaway 1993, 1994). Nonetheless, the extremely patchy distribution of skink species, particularly in coastal localities where many areas of potential habitat appear to be unoccupied, suggests that predation has had a serious effect.

The continuing impact of introduced predators on the lizards of Westland will vary widely according to the availability of relatively secure habitat (e.g. boulder banks, creviced bluffs), the habits and habitat of the lizard species, and on the predator guilds that are present. Furthermore, the impact of predators will vary seasonally and from year to year as environmental changes cause changes in their population densities. Indirect impacts will occur from changes in the density of other prey species, thus leading to 'prey-switching'.

Introduced vespulid wasps (*Vespula germanica* and *V. vulgaris*) are also known to prey on lizards (Thomas 1987; Rob Mason pers. comm. 1997). Furthermore, wasps are serious competitors with lizards and in Westland beech forests, and they seasonally reach such high population densities that they have the capacity to totally deplete two staples of lizard diet: invertebrate populations, and honeydew.

Thus far Taumaka Island (20 ha, in the Open Bay Islands group) is the only island known to have lizards present—an endemic species of gecko and an endemic species of skink—but conversely, no other islands on the Westland coast have had more than a cursory search for lizards. Although weka (*Gallirallus australis*), voracious lizard predators, have been introduced to Taumaka Island it remains free of introduced mammals. Also mammalian predators are not known from any other island in Westland (Neale 1999). The mammal-free status of all islands must be maintained.

Although predator eradication and control in 'mainland island' situations has yet to result in significant improvements in lizard populations, the experience from the eradication of introduced predators on real islands shows their removal having immense benefit. When released from predation island lizard populations usually respond rapidly and in spectacular fashion, showing not just greater population densities but changed spatial distribution, habitat use, behaviour and body size (Towns 1991, 1994, 1996; Newman 1994; Brown 1997; Rufaut & Clearwater 1997).

Management action—Protocols for maintaining the mammal-free status of Westland islands must be established and enforced. Monitoring to detect the accidental colonisation of Taumaka Island (and other critical island sites for lizards) by predators must be implemented and the frequency of this monitoring must recognise the speed with which predators such as rats can destroy reptile populations (Newman 1986).

Quarantine protocols must be established to ensure lizard pathogens and parasites do not reach naïve populations of threatened species—especially on Taumaka Island. This should include the sterilisation of research equipment used with lizards and the non-return of any lizards temporarily removed from a site unless they have been housed in strict isolation. Particular caution must be

taken with translocated lizards, and captive-bred lizards should never be released into the wild unless there are compelling reasons for doing so.

Data on baseline population densities and trends should be collected for threatened lizard species by monitoring key sites. Particular attention must be given to situations that increase risk (e.g. periodic irruptions of predators or habitat changes through succession). If the monitoring detects detrimental changes, subsequent conservation actions may entail habitat management (see Section 2.4.3) or require some level of control of predators and/or competitors. This could be either long-term suppression of predators and competitors ('mainland island') or a short-term responses to a specific event.

The potential for increasing the security of rare or threatened lizard species through establishing new populations should be fully investigated. These will almost invariably be on islands. Only in exceptional circumstances should species be translocated beyond the ED in which they occur naturally.

2.5 SPECIES PRIORITY RANKINGS

The 17 lizard taxa currently recorded from Westland have been assigned a conservation management priority arbitrarily based on a 3-point scale where:

- **High**—active conservation management required to secure and improve the conservation status
- **Moderate**—management intervention desirable to maintain or improve the conservation status
- **Low**—not at risk and management intervention not required

The WC/TP priority rankings are listed in Table 3 in comparison to the national priority rankings, national threat classification, and the IUCN threat categories (Molloy & Davis 1994; IUCN 1996; Bell 1997; Hilton-Taylor 2000; Molloy et al. 2002; Hitchmough 2002a), and in relation to the Areas within the conservancy. When assigning the WC/TP rankings the national priority of each species was taken into account (and the same criteria formed the basis of the rankings—see Molloy & Davis 1994 and Molloy et al. 2002). However, the priority rankings given here apply **within this Conservancy only**.

Of the 17 lizard taxa known from Westland, this action plan allocates 'high' priority for conservation management to six species (35%), 'moderate' priority to eight (47%), and 'low' priority to 3 (18%). The three gecko species in the *maculatus* species-complex, ranked as 'low' in previous assessments (Whitaker & Gaze 1999; Whitaker et al. 2002), have been listed here as moderate priority. This is because their status in Westland is unclear, no extant populations are known, and their identity has not been verified, whereas elsewhere in the South Island they are well known. Similarly, the common skink is more highly ranked ('moderate') in Westland than elsewhere ('low') because its taxonomic and conservation status is quite unclear. The speckled skink is given a lower ranking ('moderate') in Westland than in Nelson/Marlborough ('high'), primarily because more populations are known in Westland and the sites at which it occurs seem somewhat more secure.

The distribution of lizard taxa (in relation to their priority ranking) in the Areas within WC/TP is given in Table 3. The South Westland/Weheka area has the greatest number of high priority species for conservation action (n = 3), but Greymouth/Mawheranui and Buller/Kawatiri have greater numbers of species ranked for action of some kind (n = 7 and 5 respectively).

2.6 TIME FRAME

This action plan is based on the prevailing knowledge at the time of writing. Although it will unquestionably evolve and change as new data is acquired and the recommended management proceeds, it is intended that the entire document should be revised at approximately 5-yearly intervals.

TABLE 3. PRIORITY RANKING OF LIZARDS FOR CONSERVATION MANAGEMENT WITHIN WEST COAST/TAI POUTINI CONSERVANCY IN COMPARISON TO NATIONAL AND INTERNATIONAL THREAT AND PRIORITY RANKINGS AND THEIR DISTRIBUTION IN THE AREAS .

COMMON NAME	WC/TP priority rank	DOC threat rank*	DOC priority rank†	IUCN '*Red List*' category‡	BULLER/ KAWATIRI	GREYMOUTH/ MAWHERANUI	HOKITIKA	FRANZ JOSEF/ WAIAU	SOUTH WESTLAND/ WEHEKA
Open Bay Island gecko	**high**	**NC**	–	–	–	–	–	–	●
Open Bay Island skink	**high**	**NC**	**A**	–	–	–	–	–	●
Grey Valley skink	**high**	**RR**	–	–	–	●	–	–	–
Big Bay skink	high	RR	–	–	-	-	-	-	O
Paparoa skink	**high**	**DD**	–	–	**O**	**O**	–	–	–
Denniston skink	**high**	**DD**	–	–	●	–	–	–	–
Common gecko	moderate	NT	–	–	O	O	-	-	-
Canterbury gecko	moderate	GD	–	–	-	?	-	-	-
Southern Alps gecko	moderate	NT	–	–	-	O	-	-	-
Cascade forest gecko	**moderate**	**DD**	–	–	–	–	–	–	●
Okarito forest gecko	**moderate**	**DD**	–	–	–	–	–	●	–
Speckled skink	moderate	GD	–	LR (lc)	O	O	O	-	-
Common skink	moderate	NT	–	–	-	O	O	O	-
brown skink	moderate	NT	–	–	O	-	-	-	-
forest gecko	low	NT	–	–	O	O	O	O	-
Nelson green gecko	low	GD	–	–	O	-	-	-	-
West Coast green gecko	low	SP	–	LR (lc)	O	O	O	?	?

* Molloy et al. (2002); Hitchmough (2002a).
† Molloy & Davis 1994; but see footnote 7 in Section 4.11.4.
‡ IUCN (1996); Bell (1997); Hilton-Taylor (2000).
Species in **bold** type are endemic to WC/TP.
● = species with a national range limited to a single area.

3. Conservation management priorities

This section lists conservation actions for the lizard fauna that are either applicable to the Conservancy as a whole, or which relate to the specific areas within it. Some recommended research could be undertaken in more than one area, or is more broadly applicable than to just a single area. In such a case it has been listed for each of the areas in which it could be done, but on the understanding it need only be done in one. Actions relating to particular taxa are presented in Section 4. Species.

3.1 GENERAL

3.1.1 General actions

Some priority actions relating to the conservation management of the lizard fauna are common to all species and/or all areas within WC/TP. These actions are listed below.

Staff training

To effectively implement this action plan, it is a requirement that the Programme Manager Biodiversity–Assets (PMB) and key ranger staff in each area are properly trained and conversant with lizard surveying techniques, basic identification, and data collection.

Action—Technical Support Officer–Fauna (TSO) to arrange training courses and seminars for key area staff, and to distribute important new information on lizards or survey methods as soon as they are available.

Staff advocacy

Many significant observations on lizards will be made by DOC staff engaged on other duties (e.g. the discovery of the Paparoa skink on Mount Micawber). The importance of recording and reporting observations of lizards must be stressed to all staff. Although this is most important for rare or threatened taxa or for areas where lizards are scarce or otherwise unknown (see elsewhere in this plan), reporting lizard sightings is nevertheless something that should become habit for everyone. The only exception to this would be where lizards of **known identity** are observed at sites where they are **known to be numerous**. In the first instance observations should be reported to the TSO.

Action—PMBs to heighten the awareness of lizards amongst all staff in their area (including such things as the taxa present, the known distribution, significant species and habitats), emphasising the kind of data to collect and the need to report observations quickly.

Distribution data

Good data on distribution is fundamental to making informed decisions for conservation management. DOC maintains a 'live' database within 'Bioweb', called *'HERPETOFAUNA'*, in which all amphibian and reptile distribution records are kept. All lizard observations should be recorded on to ARDS data cards and forwarded to the TSO.

Three general rules apply to the collection of distribution data:

- Any reports of lizards that are in any way unusual, are of taxa that are poorly known, or are from localities where lizards have not been recorded or are scarce, should be followed up immediately. Valuable new records are coming to light unexpectedly all the time, e.g. common skink at Kowhitirangi.
- To determine population trends it is important that ARDS cards are submitted for any subsequent ('repeat') visits to the same site or locality. The only exception to this would be for somewhere that lizards of known identity are known to be abundant, e.g. Cobden Beach, in which case the cards should be submitted no less than annually.
- Whenever possible, the collection of distribution data should be correlated to the EDs and a determined effort made to sample the lizard faunas of each district (see Appendix 2).

Action—TSO and PMBs to have a supply of ARDS cards on hand and to encourage all staff to use them. Distribution and abundance surveys should be actively promoted (see elsewhere in this plan for specific recommendations).

Public education and advocacy

Public support is critical to the success of conservation management for lizards. Members of the public can also contribute significantly by reporting finds and observations of lizards.

Action—TSO, PMBs and Programme Manager Community Relations/Rural Advocates should prepare and distribute information on lizards—both printed and through talks—to increase the public awareness of the fauna and its importance, and to ensure people are aware of the protected status of the lizards. PMBs should develop and foster relationships with key land-holders and stakeholders.

3.1.2 Islands

Throughout New Zealand, small islands present special conservation opportunities for lizards. A few lizard species are primary endemics on islands—islands that have remained free (or largely free) of introduced predators are refugia for a wide range of vulnerable lizard species formerly widespread on the mainland (Whitaker 1978; Towns & Robb 1986; Towns and Daugherty 1994). Following predator eradication, islands can be important sites for translocation of threatened lizard species (Towns & Parrish 1999; Towns & Ferreira 2001; Towns et al. 2001).

Within WC/TP there are 79 islands and islets between Kahurangi Point in the north and Big Bay in Fiordland, most of them are very small (< 1 ha, max. 20 ha) and relatively close to the coastline (mean 313 m, max. 4.4 km) (Neale 1999). Elsewhere around New Zealand, including the southern part of the country

(Otago, Stewart Island, and Fiordland), both skinks and geckos occur on very tiny islands and, in the absence of introduced predators, small islands and stacks can sustain very high lizard population densities (e.g. Thomas 1985). Fiordland skink (*Oligosoma acrinasum*) populations have even been recorded on islets completely lacking vascular vegetation (e.g. Hare's Ears off Doubtful Sound).

Mammalian predators have not been recorded on any of the Westland islands even though most are well within swimming range of rats and stoats (Neale 1999). If this apparent absence of mammals is real, it may result from one or more of the following factors: the prevailing westerly (on-shore) seas, the generally cliff-bound nature of the islands, the very small size and correspondingly small areas of vegetation (lack of habitat), and the lack of human use of the islands. Weka are only known on Taumaka Island, in the Open Bay Islands group, where they were introduced early last century (Neale 1999).

Taumaka Island is the only island on the entire Westland coast from which lizards have been recorded (Neale 1999). Despite the presence of weka, apparently endemic species of skink and gecko are present, albeit at low densities. The lack of lizard records from other islands may be largely a function of search effort. Only a few islands have been checked and none have had thorough surveys by experienced searchers.

The Open Bay Island skink and Open Bay Island gecko are apparently confined to a single island (Taumaka). As the only species known from the islands, they are currently the only taxa that could be considered for translocation—a conservation action which would improve their security.

Priority actions relating to islands are to:

- **Maintain the predator-free status of all islands lacking introduced predators.** This is particularly important for the security of the Open Bay Islands, where rare lizard taxa are known to occur.

Action—PMBs in Buller/Kawatiri, Greymouth/Mawheranui, and South Westland/Weheka areas.

- **Determine the lizard faunas of islands that have not been surveyed.** The almost complete lack of data on lizards for the Westland islands means informed conservation management decisions can not be made. It is possible that populations of lizard species of conservation significance (e.g. Open Bay Island gecko) are present on other small islands (e.g. Barn Islands). When staff are visiting islands for any reason they should be made aware of the importance of searching for lizards (and if necessary trained in how to do so) and asked to report their observations even if nothing was found.

Action—PMBs in Buller/Kawatiri, Greymouth/Mawheranui and South Westland/Weheka areas.

3.2 BULLER/KAWATIRI AREA

3.2.1 Current situation

The Buller/Kawatiri area, together with the Greymouth/Mawheranui area, has the highest species richness for lizards in WC/TP, with 8 species. The area is

notable for being the southern limit of range for two species (Nelson green gecko, brown skink) and for two taxa that are presently known from just single specimens—the Denniston skink and the Paparoa skink (found quite literally on the boundary with Greymouth/Mawheranui area).

Forest geckos and 'green geckos' seem to be ubiquitous, but the records are generally sparse, especially away from developed areas, and there are none from high elevation (> 800 m). The 'green gecko' records north of the Mokihinui River appear to be Nelson green geckos, but no specimens have been collected to verify the identity. South of this district, all the 'green geckos' are the West Coast green gecko. Nonetheless, there remains considerable doubt over just where the boundary between the two taxa occurs, or whether they meet in a narrow hybridisation zone or a broad morphocline. There are reasonably reliable reports of common geckos from coastal sites north of Westport, and the species is also known from a few hundred metres outside the eastern boundary of the conservancy at the Maruia River (Whitaker & Gaze 1999).

The most widespread and common skink species is the speckled skink, though even then populations are primarily coastal (supralittoral), and are scattered and isolated. Brown skinks are known from several coastal sites as far south as Birchfield, the southernmost limit of range for the species. Two other skink taxa are known from just single sites—the so-called Denniston skink was collected from wasteland habitat within the old mining township of Denniston; the Paparoa skink was found in a rocky area within natural sub-alpine tussock grassland and herbfield right on the crest of the Paparoa Range.

There is no indication that any other gecko species occur in coastal or lowland habitats, however other species may be present in subalpine habitats in Kahurangi NP (e.g. black-eyed gecko, *Hoplodactylus kahutarae*, and Mount Arthur gecko, an unnamed taxon in the *H. maculatus* species complex). Two other skink taxa are known from adjacent areas—the common skink and the Grey Valley skink—and either could be in this area.

There are no records of lizards on any of the islands within Buller/Kawatiri area.

3.2.2 Immediate management opportunities

None identified at present.

3.2.3 Research priorities

- Determine the taxonomic identity of the Denniston skink and the Paparoa skink, and formally describe (if appropriate)
- If the Denniston skink and/or Paparoa skink proves a distinct taxon, undertake population studies to determine habitat requirements, and population density and dynamics
- Taxonomic (including genetic) assessment of common geckos to verify their identity
- Genetic studies to re-evaluate taxonomic status of speckled skinks (and perhaps brown skinks), compared with key populations in the North Island and Nelson/Marlborough, to determine the significance of the reported morphometric differences

- Population studies of speckled skinks and brown skinks to determine their habitat requirements, and population density and dynamics
- Genetic status of the green geckos to clarify the relationship of the Nelson green gecko to the West Coast green gecko, and determine the extent of the hybridisation zone between them (if it exists)

3.2.4 Survey priorities

- Islands (especially the Steeples Islands because they are comparatively large and remote)
- Beach habitats (known skink populations are far patchier than the available boulder-beach habitat and there are currently no records of lizards from dune lands. Also to determine southern limit of brown skink)
- Gentle Annie Point, and lowland forest habitats in north Westland (to confirm occurrence of common geckos within the area)
- Forest and shrubland habitats between Karamea and Waimangaroa (to determine boundary between the Nelson green gecko and West Coast green gecko)
- Subalpine tussock land, herbfields, boulder-fields, screes and outcrops in Kahurangi NP (for skinks and geckos, in particular black-eyed geckos and Mount Arthur geckos)
- Subalpine boulder-fields, screes and outcrops in Paparoa Range (to determine distribution and population status of Paparoa skink, to confirm report of common skink (Hardy 1977), and to look for geckos)
- Mount Micawber to determine local distribution and population density of Paparoa skink
- Denniston Plateau and similar habitats elsewhere (to locate further specimens of the Denniston skink and determine its distribution and status)
- Inangahua Junction (to determine occurrence and identity of skinks reported by Whitaker & Meads 1993)
- Barrytown Flats and coastline (to determine occurrence and identity of skinks reported; ARDS)
- Area close to confluence of Maruia River and Buller River (to determine distribution of common gecko)
- Cape Foulwind (to determine status and identity of green geckos reported there; ARDS)

3.2.4 Management priorities

- Protect and monitor population(s) of the Denniston skink (if research shows it is a distinct taxon)
- Protect and monitor key populations of common geckos, Nelson green geckos, speckled skinks and brown skinks, particularly to secure limits of range

3.3 GREYMOUTH/MAWHERANUI AREA

3.3.1 Current situation

The Greymouth/Mawheranui area, together with the Buller/Kawatiri area, has the highest species richness for lizards in WC/TP, with at least 8 species. Of particular interest in this Area is an endemic skink species apparently confined to the Grey Valley (Grey Valley skink). Another taxon is known from a single specimen collected on the boundary with Buller/Kawatiri area (Paparoa skink).

Forest geckos and West Coast green geckos are known from throughout the area. Although records are patchy, it is likely they occur in all forest and shrubland habitats up to the bush-line. Three specimens of geckos in the *Hoplodactylus maculatus* species complex have been found within the area—two from Greymouth and one from Lake Brunner. The only recent one (Blaketown, in 1999) is a Canterbury gecko. The other animal from Greymouth, a 50-year old museum specimen, has features of both the common gecko and the Canterbury gecko and its identity is uncertain. Either (or both) of these geckos could be escapees from captivity, rather than natural populations, but the presence of the common gecko (cf. the Canterbury gecko) in natural habitats in the Buller/Kawatiri area indicates its occurrence in Greymouth is more likely to be valid. The gecko from the Lake Brunner district has been tentatively identified as the Southern Alps gecko, but the old museum specimen is in poor condition. If it is indeed a Southern Alps gecko, it is perhaps at or close to the western limit for this species, otherwise mainly known from along the eastern side of the Southern Alps.

Speckled skinks are known from just two sites—boulder-beach habitat near Greymouth (Cobden), where they are relatively abundant, and near Reefton (Alborn Mine) where they are present in regenerating shrubland. Common skinks are present in open habitats and pasture in the montane valleys of the upper Maruia River and upper Grey River. near Springs Junction. Grey Valley skinks have been found at three sites in the lower Grey River—in rough pasture/wasteland habitats at Mawheraiti and Ngahere, and in a boulder-beach habitat on the coast at Blaketown, but only at the latter site are they at all common. These three skink species are likely to be much more widespread than these records suggest, even if isolated and localised. The sole Paparoa skink was collected from natural sub-alpine tussock grassland and herbfield near the summit of Mount Micawber, right on the crest of the Paparoa Range so clearly the taxon occurs in both Buller/Kawatiri and Greymouth/Mawheranui areas.

The only other skink species that could be expected in the region is the spotted skink (*Oligosoma lineoocellatum*), which may occur in the montane valleys to the northeast (e.g. Maruia River), or on in subalpine tussock grassland on the Main Divide. This species is known from just east of the area in the upper Buller River and from mountain areas around Lewis Pass (Spencer et al. 1998; ARDS 2001). No geckos have been recorded from mountain habitats along the Main Divide within this area, but it is likely that at least the Southern Alps gecko is present, and possibly the black-eyed gecko or one of the ill-defined montane taxa in the *H. granulatus* species complex.

Skinks have been observed in sub-alpine tussock grassland at 1400 m on Mount Victoria, in the Victoria Range north of Reefton, but the species was not identified (Roger Frost pers. comm., January 2003).

3.3.2 Immediate management opportunities

None identified at present.

3.3.3 Research priorities

- Studies to confirm the genetic and taxonomic identity of the Paparoa skink and Grey Valley skink, and their relationships to other taxa
- Formally describe the Paparoa skink (if needed) and the Grey Valley skink
- If the distinctiveness of the Paparoa skink is confirmed, undertake population studies to determine habitat requirements, and population density and dynamics of this and the Grey Valley skink
- Genetic studies to re-evaluate the taxonomic status speckled skinks compared with key populations in the North Island and Nelson/Marlborough, to determine the significance of the reported morphometric differences
- Population studies of speckled skinks to determine their habitat requirements, and population density and dynamics
- Assess the impact of introduced species on gecko populations in forest environments. Forest geckos and West Coast green geckos are exposed to the full suite of mammalian predators, and to predation and competition from vespulid wasps, but there is no information on whether gecko populations in forests are stable or declining, nor whether this is primarily a consequence of predation, direct or indirect competition, or some other factor
- If natural populations of common geckos, Canterbury geckos or Southern Alps geckos are found (see survey recommendations, below), undertake taxonomic and genetic research to compare with populations elsewhere
- Genetic and morphometric studies of green geckos to clarify the relationship of the Nelson green gecko to the West Coast green gecko (and determine the extent of the hybridisation zone between them if it exists), and to assess the relative status of the eastern (Lewis Pass) populations of the West Coast green gecko compared to those further west

3.3.4 Survey priorities

- Islands (especially those off Point Elizabeth because they are comparatively large and remote)
- Beach habitats (known skink populations are far patchier than the available boulder-beach habitat and there are currently no records of lizards from dune lands)
- Subalpine boulder-fields, screes and outcrops in Paparoa Range (to determine distribution and population status of Paparoa skink; to confirm report of common skink (Hardy 1977); and to look for geckos)
- Mount Micawber to determine local distribution and population density of Paparoa skink

- Subalpine habitats along Southern Alps and the Victoria Range to determine occurrence and status of lizards (species present could include Southern Alps gecko, forest gecko, and/or taxa within the *H. granulatus* species complex, a 'green gecko', common skink)
- Grey Valley/Inangahua Valley to determine occurrence and identity of skink species. Particular effort should be given to defining the extent of the known populations of Grey Valley skinks (Miller 1999) and identifying previous records of unidentified skinks (Whitaker & Meads 1993; Whitaker 1997, 1998, 1999)
- Greymouth, including Cobden and Blaketown (to determine occurrence and status of common gecko and Canterbury gecko. If either species is found, search further south to determine limits of range)
- Lake Brunner district (to determine occurrence and status of Southern Alps gecko)
- Area around to confluence of Maruia River and Buller River (to determine distribution of common gecko).
- Forest and shrubland habitats in upper Maruia River/Lewis Pass district (to determine whether the Nelson green gecko extends into WC/TP in this district and, if so, where the boundary with the West Coast green gecko occurs)

3.3.5 Management priorities

- Protect and monitor key populations of Grey Valley skink, including implementing management (e.g. weed control) for these sites
- Ensure protection of populations of common geckos and/or Canterbury geckos at sites that secure the limit of range

3.4 HOKITIKA AREA

3.4.1 Current situation:

The Hokitika area has a small lizard fauna (4 species). Scattered records of 'forest geckos' and 'green geckos' from throughout the area indicate these species are likely to occur in all forest and shrubland habitats up to the bush-line. The forest gecko s.s. is probably present throughout the area, but the identity of populations south of Hokitika have not been confirmed by genetic techniques. Although the identity of the 'green geckos' south of the Taramakau River require confirmation they are likely to be West Coast green geckos.

Speckled skinks are quite widely distributed and well known in the Hokitika district within a few kilometres of the coast. Recognition of a distinct taxon—the so-called "Chesterfield skink" (Aviss & Lyall 1995)—is not supported by recent genetic data (Miller 1999). Common skinks have only been found at Kowhitirangi, but are probably more widespread than this single record indicates.

Of other taxa that could be present, it is possible that common geckos occur in the north. Geckos have not been recorded from subalpine habitats within the area but it is likely that at least the Southern Alps gecko is present west of the

Main Divide, and possibly also the black-eyed gecko or one of the ill-defined montane taxa within the *H. granulatus* species complex. There are no other skink taxa that could be expected within the Hokitika area.

3.4.2 Immediate management opportunities

None identified at present.

3.4.3 Research priorities

- DNA-based genetic studies to re-evaluate the taxonomic status of speckled skinks and common skinks compared with populations elsewhere, particularly in the light of reported morphometric differences

3.4.4 Survey priorities

- Subalpine habitats along Southern Alps to determine occurrence and status of lizards (species present could include Southern Alps gecko, forest gecko and/or taxa within the *H. granulatus* species complex, a 'green gecko', and the common skink)
- Forest and shrubland habitats throughout the Area to determine the occurrence and identity of 'green geckos' (e.g. reports from Lake Kaniere)
- Hokitika district to determine the distribution and status of speckled skink populations in and around the township

3.4.5 Management priorities

- Protect and monitor key populations of speckled skinks

3.5 FRANZ JOSEF/WAIAU AREA

3.5.1 Current situation

The confirmed lizard fauna of the Franz Josef/Waiau area comprises just four species—the forest gecko, the Okarito forest gecko (presently confirmed from a single specimen), the speckled skink, and the common skink. 'Forest geckos' have been relatively widely reported, but in light of the recognition that *Hoplodactylus granulatus* s.l. contains at least three cryptic taxa in Westland, the identity of these records requires confirmation. Those in the northern part of the area are likely to be forest geckos (s.s.). From the limited information currently available, the boundary between the forest gecko and the Okarito forest gecko appears to lie between Lake Ianthe State Forest and Okarito. Similarly, 'green geckos' have occasionally been reported, but the precise taxon is unknown.

The common skink has been found at Harihari and Oneone River, but is likely to be somewhat more widespread than these two records indicate. A single specimen of the speckled skink has been found in pakihi at Okarito. This is well south of previous records of this species, and is the southern limit of its range as currently understood.

There are few other species that might occur within the area. There are presently no records of geckos from subalpine habitats west of the Main Divide in central or southern Westland, but it is possible that the Southern Alps gecko, or even the black-eyed gecko or one of the ill-defined montane taxa within the *H. granulatus* species complex, could be present. The speckled skink is well-known in the Hokitika district, but its southern limit of range has yet to be established and in supralittoral habitats it may extend considerably further south.

3.5.2 Immediate management opportunities

None identified at present.

3.5.3 Research priorities

- Taxonomic and genetic studies to determine the relationship of the Okarito forest gecko to the other taxa in the *H. granulatus* complex, where the geographic boundaries between them are, and whether there are hybridisation zones where they meet
- Formal taxonomic description of the Okarito forest gecko (if appropriate)
- Genetic studies to re-evaluate the status of common skinks compared with populations elsewhere in the South Island

3.5.4 Survey priorities

- Okarito district (to determine local distribution, relative abundance, and habitat use by Okarito forest geckos)
- Forest and shrubland habitats between Lake Ianthe State Forest and Okarito to determine the southern limit of range for the forest gecko, and the boundary between it and the Okarito forest gecko
- Forest and shrubland habitats between Ross and Haast to determine the boundaries between the forest gecko (s.s.), the Okarito forest gecko, and the Cascade forest gecko
- Coastal and open habitats, e.g. pakihi, riparian habitats, wasteland to determine occurrence and southern limit of common skinks and speckled skinks
- Forest and shrubland habitats throughout the area to determine the occurrence and identity of 'green geckos
- Subalpine habitats along Southern Alps to determine occurrence and status of lizards (species present could include Southern Alps gecko, forest gecko and/or taxa within the *H. granulatus* species complex, a 'green gecko', and the common skink)

3.5.5 Management priorities

- If needed (see research and survey recommendations above), protect and monitor representative populations of the Okarito forest gecko and the common skink, especially to secure the limits of range
- Protect and monitor key populations of speckled skinks to secure southern limit of range

- Protect and monitor key populations of forest geckos to secure southern limit of range

3.6 SOUTH WESTLAND/WEHEKA AREA

3.6.1 Current situation

The lizard fauna of South Westland is remarkable for apparently having no species in common with the rest of the WC/TP. Three of the species recorded within the area are currently regarded as endemic to it, and the fourth extends into northern Fiordland (Southland Conservancy). Two of the endemic taxa are in fact only known from the 20 ha Taumaka Island in the Open Bay Islands group, making them amongst the rarest and potentially most threatened of New Zealand lizards. Whilst this situation to some extent reflects current knowledge, it is also clear that the lizard fauna of South Westland is quite distinctive.

The forest gecko in South Westland/Weheka area is a genetically distinct member of the *H. granulatus* complex—the Cascade forest gecko—presently known only from the Cascade Plateau and Gorge River. Just where the northern limit of range for this species lies is unclear. The only other gecko confirmed from this area is the Open Bay Island gecko, although there are unconfirmed reports of 'green geckos' of unknown identity (i.e. it is unclear if they are West Coast green geckos or jewelled geckos).

The two skinks known from the area are the Open Bay Island skink and the Big Bay skink, the latter being locally common in cobble strands in northern Fiordland and at Barn Bay, and possibly the skink species that is relatively abundant in rocky areas on the Cascade Plateau (Miller et al.1999). A brown, striped skink of unknown identity and affinity has been found in sphagnum swamp at Okuru.

Few other lizard species are likely to occur in the South Westland/Weheka area. Just east of the Main Divide in Otago and Fiordland there are large Otago geckos (*Hoplodactylus* sp. 'Otago large'), jewelled geckos, green skinks (*Oligosoma chloronoton*) and cryptic skinks (*O. inconspicuum*) (Whitaker et al. 2002; ARDS), any one of which may occur further west. Perhaps more likely is one of the montane taxa within the *H. granulatus* species-complex that are present in mountain areas in Otago, Southland and Fiordland. The Fiordland skink (*Oligosoma acrinasum*) inhabits small islets and rock stacks along the Fiordland coast but there have been no detailed surveys to determine its northern limit of range.

3.6.2 Immediate management opportunities

Weka were introduced to the Open Bay Islands group about 100 years ago (Neale 1999) so, whilst admitting they may be of historical interest and cultural significance, they should not be considered part of the indigenous fauna. Removal of weka from Open Bay Islands would have an immediate and significant benefit to the two, apparently endemic, lizard species known from Taumaka Island (as well as benefiting other native fauna).

3.6.3 Research priorities

- Investigate the population density and dynamics of Open Bay Island geckos and Open Bay Island skinks to determine the seriousness of weka predation and whether management intervention is required
- Taxonomic and genetic studies to determine the relationship of the Open Bay Island gecko and the Cascade forest gecko to the other taxa in the *H. granulatus* complex and whether hybridisation zones exist where they meet
- Genetic studies of the Open Bay Island skink and the Big Bay skink to determine their identity, status and relationships
- Formal taxonomic description of the Open Bay Island gecko, Open Bay Island skink, Big Bay skink, and—if appropriate—Cascade forest gecko
- Population studies of Big Bay skinks to determine their habitat requirements, and population density and dynamics
- Morphological and genetic assessment of specific status of 'green geckos' in South Westland

3.6.4 Survey priorities

- Islands (in particular Popotai Island and Barn Islands, but also any islands with good vegetative cover, as these have the highest potential for Open Bay Island geckos and Open Bay Island skinks)
- Coastal habitats from Paringa River to Big Bay (in particular to determine occurrence of Open Bay Island geckos, Open Bay Island skinks and set limits of range for Big Bay skinks)
- Forest and shrubland habitats between Okarito and Haast (to determine the boundary between the Okarito forest gecko and the Cascade forest gecko
- Forest and shrubland habitats throughout the area to determine the occurrence and identity of 'green geckos'. In particular, it is important to determine the boundary between the West Coast green gecko and the jewelled gecko (*Naultinus gemmeus*), which has been recorded from the Hunter Valley (just east of the Southern Alps) and whether a hybridisation zone exists
- Coastal and open habitats, e.g. pakihi, riparian habitats, wasteland to determine occurrence and southern limit of common skinks
- Subalpine habitats along Southern Alps to determine occurrence and status of lizards (species present could include Southern Alps gecko, forest gecko and/or taxa within the *H. granulatus* species complex, a 'green gecko', and the common skink)
- Cascade Plateau (to determine the local distribution, relative abundance, and habitat use of Cascade forest geckos, and to verify the identity of the skinks present and to determine the size, extent and status of the population)
- Gorge River (to confirm identity of 'forest geckos' observed there)
- Gillespies Beach (to determine identity of skinks reported there; ARDS)
- Okuru (to determine the population status, and collect material for identification, of an indeterminate skink found there in pakihi habitat)

3.6.5 Management priorities

- Maintaining a strong pro-active approach to prevent predators, pest and pathogens from reaching the Open Bay Islands, monitoring to detect incursions, and developing contingency plans for dealing with them if they occur
- Maintain a strong pro-active approach to preventing wildfires on the Open Bay Islands and a contingency plan for controlling them if they do
- Monitor the Open Bay Island gecko and Open Bay Island skink populations, with a view to management intervention if necessary
- Investigate the options for establishing populations of the Open Bay Island gecko and Open Bay Island skink on at least one other island (if needed, see survey recommendations above)
- Negotiate with the islands' iwi owners for the removal of weka from Open Bay Islands and—if successful—plan for and undertake such action
- If needed (see research and survey recommendations above), protect and monitor representative populations of the Cascade forest gecko, common skink and Big Bay skink, especially to secure limits of range

4. Species

4.1 INTRODUCTION

4.1.1 Identification of Lizards

Identification

Most New Zealand lizards can be identified by referring to the following sources:

Skinks—Hardy 1977, Patterson & Daugherty 1990, Patterson 1997

Geckos—Bauer 1990, Hitchmough 1997

All lizards—Towns 1988, Gill & Whitaker 1996

However, there are many that are difficult to distinguish without considerable experience. This is particularly so for geckos in the *Hoplodactylus maculatus* and *Hoplodactylus granulatus* cryptic-species complexes (Hitchmough 1997), and for skinks in the *Oligosoma nigriplantare* cryptic-species complex (Daugherty et al. 1990), or with similar colouration to *O. nigriplantare* s.l. Unfortunately it is these very groups which are most diverse in Westland, where the situation is made more difficult because the taxa are poorly known and mostly undescribed.

It is not practical to provide full identification details for the WC/TP lizard species in this action plan. Instead, the intention is to produce an illustrated field guide and key as a supporting document.

If there is **any doubt whatsoever** about the identity of a lizard, or if a recognised species is found in an unusual habitat or at an unexpected locality (e.g. significant extension of known range), specimens should be held in captivity (see Appendix 4) while specialist identification is sought. It is also important to take detailed photographs of the animal(s), the habitat and the locality. If a dead lizard is found or one dies accidentally while in captivity, it should be preserved immediately (see Whitaker 1994 for protocols) and forwarded to the national repository at MONZ.

Taxonomic changes

Recent changes to the taxonomy, and the re-assignment of some locality records, means that some names used in the literature and in the '*HERPETOFAUNA*' database are no longer valid. Changes to generic names to keep in mind are *Lygosoma* to *Leiolopisma* to *Oligosoma* for skinks (Patterson & Daugherty 1995) and *Heteropholis* to *Naultinus* for green geckos (Bauer 1990). Changes to specific names have also occurred, in many cases because it is now recognised that what were formerly regarded as widespread, variable taxa are in fact cryptic-species complexes. Specific name changes that affect taxa in WC/TP are: for the common skink from *zelandica* to *nigriplantare maccanni* to *nigriplantare polychroma* (Patterson & Daugherty 1990); for the brown skink from *ornata* to *zelandicum* (Hardy 1977); for the common gecko from *pacificus* to *maculatus* (Robb & Rowlands 1977); and for the so-called Lewis Pass gecko *poecilochlorus* to *tuberculatus* (Hitchmough 1997). Furthermore, because formal description has

not kept up with the recognition of cryptic species a significant number of the taxa in Westland currently lack scientific names.

Information sources
Sources of further information are summarised in Appendix 5.

4.1.2 Structure of the species accounts

The species accounts that follow consider each of the following points.

Taxonomic status
Scientific name and authority, or for an undescribed taxon the reasons it is regarded as distinctive. Genetic and morphometric variation within WC/TP is described because of its importance to conservation management decisions.

Description and habitat
Brief description (**not** suitable for identification), habits, and habitat.

Distribution
Present nation-wide distribution, distribution within WC/TP in relation to EDs, endemism at conservancy level, and occurrence within the WC/TP areas. If distribution information is given without a source it has usually been obtained from the ARDS database. The type locality is given only if it is within WC/TP.

The past distribution of a taxon is given only when it is known to differ from the present. However, subfossil deposits in WC/TP contain the remains of both skinks and geckos that can not readily be assigned to extant species (Worthy 1993; Worthy & Holdaway 1993, 1994) and some may be from taxa no longer occurring within the conservancy.

Conservation status
The IUCN Red List category (IUCN 1996; Bell 1997; Hilton-Taylor 2000) DOC threat classification (Molloy et al. 2002; Hitchmough 2002a), and DOC conservation priority (Molloy & Davis 1994) are given at a national level. Each species is also assigned a priority within WC/TP based on an arbitrary 3-point scale—high, moderate, and low. These WC/TP action priority rankings are defined in Section 2.5 and listed in Table 3).

Vulnerability, threats, research needs, and survey needs
These categories are assessed **only** for WC/TP and are presented in priority order. Research and survey needs are included only if they are required for better determining and undertaking the conservation management actions.

Management actions
The overriding objective for management action is given, followed by the key tasks required to meet this objective (in priority order). The WC/TP Area(s) responsible for undertaking these tasks is also indicated.

Key literature
Selected references that provide key information about the taxon.

4.2 COMMON GECKO

4.2.1 Taxonomic status

Hoplodactylus maculatus (Gray 1845)—see Robb & Rowlands 1977 and Hitchmough 1997.

Genetic research has shown that *Hoplodactylus maculatus* sensu Robb & Rowlands 1977 is in fact a cryptic-species complex comprising at least ten discrete taxa, most of them in the South Island (Daugherty et al. 1994; Hitchmough 1997). Animals in this complex are not easy to identify on morphological characters and colouration, and the problem of assigning names to them is made more difficult because in many parts of the country two or more taxa may occur sympatrically. The possible identities of the geckos from this group known from Westland include three taxa in the maculatus complex—the common gecko (s.s.), the Canterbury gecko (see Section 4.3) and the Southern Alps gecko (see Section 4.4), with the first two of these having both been found in Greymouth.

'Common geckos' have been reported from the Westland region in the past, but in most cases these records are unsupported by voucher specimens and thus the precise taxon is not known (McCann 1955; Robb & Rowlands 1977; Robb 1986; Pickard & Towns 1988). Note that literature references and ARDS database records to *H. maculatus* sensu Robb & Rowlands 1977, or to the earlier synonym *H. pacificus* sensu McCann 1955, in WC/TP could refer any one of several cryptic species in the maculatus complex (*H. pacificus* s.s. occurs only in the North Island; Hitchmough 1997).

4.2.2 Description and habitat

Medium-sized gecko (SVL to 80 mm). Markings generally comprising pale transverse blotches on a dark, sometimes almost black, background. Can be readily distinguished from geckos in the *granulatus* complex by the pink interior to the mouth and throat (cf. orange mouth and black throat) but difficult to separate from other species in the *maculatus* complex. Nocturnal; terrestrial, saxicolous or arboreal. Occupies a very wide range of habitats from the littoral zone on tiny islands to inland broadleaf and beech forests. Isolated remnant populations sometimes occur in highly modified farmland or urban habitats. In WC/TP is presently known only from one urban, coastal locality (Blaketown), but in the Buller region (just over the boundary with Nelson/Marlborough Conservancy) has been found in podocarp/beech forest.

4.2.3 Distribution

Nation-wide—North Island south of Whangarei, Marlborough, Nelson and northern Westland; also most offshore islands from Cavalli Islands to Cook Strait (Hitchmough 1997). The south-westernmost known locality is at Greymouth (but see below).

West Coast/Tai Poutini Conservancy—There is only one possible record from within WC/TP—from Greymouth (Greymouth ED). If this record can be validated (i.e. if the identification is correct, and a population is present and it is not an isolated escapee from captivity or an animal accidentally transported

from elsewhere) it is the southern limit of distribution for this wide-ranging species.

Records of 'common geckos' from North Westland, for example Karamea and Seddonville (Karamea ED), and Punakaiki (Punakaiki ED) (Robb & Rowlands 1977) (ARDS), are likely to be *Hoplodactylus maculatus* s.s. given the wide distribution of this species in Nelson/Marlborough Conservancy. Some populations are in close proximity to the conservancy boundary, for example, < 500 m north of the boundary on the true right of the Maruia River (Reefton ED) and on the Paterau coastline (West Whanganui ED).

Probably present in Buller/Kawatiri and Greymouth/Mawheranui areas.

4.2.4 Conservation status

DOC threat category Not Threatened (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Moderate.

4.2.5 Vulnerability

Risk factors

- Not known with certainty from any locality
- None of the possible localities reported for the species are on protected land
- Reported populations appear to be localised and isolated, and/or at very low population density
- Sensitivity to predation by introduced mammals through nocturnal habits and relatively large body size (Whitaker 1978)

Positive factors

- Large areas of potential habitat available
- Can occupy a wide range of habitats
- Able to survive in highly modified habitats (e.g. farmland, urban environments)

4.2.6 Threats

- Exposure to the full suite of introduced mammalian predators

4.2.7 Research needs

- Investigate the genetic and taxonomic status of any 'common gecko' populations found in WC/TP in comparison to those found further north

4.2.8 Survey needs

- Greymouth and coast south from the Grey River. The record from Greymouth needs investigating and, if verified, the southern limit of range should be determined
- Reported localities for 'common geckos' between Karamea and Punakaiki to determine occurrence and identity

- Upper Buller Gorge between Inangahua and the Maruia River. The occurrence of the species immediately north of the Maruia River (Whitaker & Gaze 1999) indicates they are likely to be present lower in the Buller Gorge

4.2.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the southern limits of the geographic range and are representative of the major habitats occupied by the species within WC/TP.

Tasks

Verify that the habitat of at least two populations is protected—one in north Westland and one at the southern limit of distribution.

Action—Buller/Kawatiri and Greymouth/Mawheranui

4.2.10 Key literature

Hitchmough 1997.

4.3 CANTERBURY GECKO

4.3.1 Taxonomic status

Hoplodactylus sp. 'Canterbury'—see Hitchmough 1997.

An undescribed species presently contained within *H. maculatus* sensu Robb & Rowlands 1977 (see comments under Section 4.2.1).

4.3.2 Description and habitat

Medium-sized (SVL to 75 mm). Difficult to distinguish from other species in the *maculatus* complex, particularly *H. maculatus* s.s., but easily separated from geckos in the *granulatus* complex by the pink interior to the mouth (cf. orange with black throat). Nocturnal; terrestrial or arboreal. Occupies a wide variety of habitats, including boulder beaches, outcrops, screes, boulder banks, and lowland forests. Also inhabits trees and buildings in modified environments such as farmland or urban areas.

4.3.3 Distribution

Nation-wide—From southern Marlborough to mid-Canterbury, including Banks Peninsula; on the coast, plains and foothills (Hitchmough 1997).

West Coast/Tai Poutini Conservancy—There is only one confirmed record from within WC/TP—from an urban area at Blaketown, Greymouth (Greymouth ED). However, this record requires verification to show a population is present and that it is not just an isolated escapee from captivity or an animal accidentally transported from elsewhere. If a population is present it would represent a significant range extension to the west for a taxon previously known only east of the Southern Alps.

Possibly in Greymouth/Mawheranui area.

4.3.4 Conservation status

DOC threat category Gradual Decline (hi) (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Moderate.

4.3.5 Vulnerability

Risk factors

- Presently only reported from a single locality
- Nocturnal habits and relatively large size increase the risk of predation by introduced mammals (Whitaker 1978; Freeman 1993)

Positive factors

None identified at present.

4.3.6 Threats

- Exposure to the full suite of introduced mammalian predators The abundance of Canterbury geckos on predator-free Motunau Island and in mainland habitats offering good protection suggests they are vulnerable.

4.3.7 Research needs

- Investigate the genetic and taxonomic status of any Canterbury gecko populations found in WC/TP in comparison to those east of the Alps
- Formal taxonomic description is required

4.3.8 Survey needs

- Greymouth: Confirm whether a population of this species is present at Blaketown, Greymouth, and that it is, in fact, a valid part of the WC/TP fauna.

4.3.9 Management actions

Objectives

To ensure the continued survival of populations—if they occur—at sites that secure the western limits of the geographic range and are representative of the major habitats occupied by the species within WC/TP.

Tasks

None identified at present.

Action—N/A

4.3.10 Key literature

Tocher 1992a, b, 1993; Tocher & Davison 1996; Hitchmough 1997.

4.4 SOUTHERN ALPS GECKO

4.4.1 Taxonomic status

Hoplodactylus sp. 'Southern Alps'—see Hitchmough 1997.

An undescribed species presently contained within *H. maculatus* sensu Robb & Rowlands 1977 (see comments under Section 4.2.1). There is substantial divergence in DNA sequences between the northern and southern parts of the species' range, indicating that further taxonomic division may be required if the two forms meet at an abrupt boundary rather than intergrading. Substantial allozyme differences between populations in the southern parts of the range (Hitchmough 1997) were not paralleled by DNA sequence diversity, indicating that this is population-level, not species level variation.

4.4.2 Description and habitat

A small (SVL to 66 mm) greyish-brown gecko, usually marked with pale cross-bands. Distinguishable from geckos in the *granulatus* complex by its pink mouth colour (cf. orange with black throat). Difficult to separate from other taxa in the *maculatus* complex although iris colour usually greenish (cf. brownish). Nocturnal; primarily terrestrial, saxicolous. Generally inhabits talus slopes, screes and shattered outcrops in open montane environments. It is occasionally arboreal in shrublands; rarely arboreal in beech forest (Jewell & McFarlane 1997).

4.4.3 Distribution

Nation-wide—Found along the eastern side of the Southern Alps from southern Marlborough to northern Otago (Hitchmough 1997; Hitchmough et al. 1997; Jewell & McFarlane 1997).

West Coast/Tai Poutini Conservancy—Known from a single record from 'Lake Brunner' (Greymouth ED), but the museum specimen on which this record is based is old and in poor condition, and its identity requires confirmation. The habitat in the immediate vicinity of Lake Brunner is highly atypical for this species and it seems likely that the locality data is merely indicative of the area where it was collected (maybe from the mountains east of the lake). This is a significant range extension and the first west of the main divide.

Present in Greymouth/Mawheranui area.

4.4.4 Conservation status

DOC threat category Not Threatened (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Moderate.

4.4.5 Vulnerability

Risk factors

None identified at present.

Positive factors

- Area of potential habitat along Alps is vast
- Virtually all the potential habitat is on protected land
- Habitat is at little risk of modification
- Species' preferred habitat offers a level of protection from introduced mammalian predators

4.4.6 Threats

None identified at present.

4.4.7 Research needs

- Investigate the genetic and taxonomic status of the Westland populations of this taxon in comparison to others east of the Alps
- Formal taxonomic description is required

4.4.8 Survey needs

- Lake Brunner district: The record of the Southern Alps gecko from 'Lake Brunner' requires confirmation as it is the only reported occurrence of this species in WC/TP
- Montane habitats along the Southern Alps: The western limit of distribution of this widespread species is not known, nor is its occurrence west of the main divide in WC/TP

4.4.9 Management actions

Objectives

To secure the western limits of distribution and to ensure several representative populations survive in the long-term.

Tasks

None identified at present.

Action—N/A

4.4.10 Key literature

Tocher 1992a, b, 1993; Tocher & Davison 1996; Hitchmough 1997; Jewell & McFarlane 1997; Hitchmough et al. 1997.

4.5 FOREST GECKO

4.5.1 Taxonomic status

Hoplodactylus granulatus (Gray 1845)—see Thomas 1981, Bauer 1990, and Hitchmough 1997.

Genetic, morphometric and reproductive data have shown that *H. granulatus* s.l. (Thomas 1981) comprises at least five cryptic species (Hitchmough 1997). Although resolution of this complex is far from complete, it appears that at least three taxa are present in Westland. Early indications relevant to WC/TP are:

- That the typical form (*H. granulatus* s.s.)—which occurs throughout the North Island (except Wellington), and in Marlborough and Nelson—is present at least as far south as Ross
- That the populations in forests further south in Westland are genetically distinct and comprise one or more new parapatric species (see Sections 4.6 and 4.7)
- That populations found in subalpine habitats (in Nelson and Fiordland) may also be a distinct taxon

Very localised populations of distinctive geckos in the *granulatus* complex have recently been discovered in montane habitats in the southern South Island—the Roys Peak gecko (Tocher 1998; Tocher & Marshall 2001; Whitaker et al. 2002), at Moke Valley (Jewell 2002), on the Dunstan Mountains (T. Jewell pers. comm.), and the Takitimu Range population of *Hoplodactylus nebulosus*—indicating further taxa within this complex are possibly present along the Alps.

Forest geckos on the Denniston Plateau include an unusual colour morph with unique longitudinal markings (cf. transverse bands) and a brown base colouration (cf. grey), but their distinctive status is not supported by genetic tests (Miller et al. 1999).

4.5.2 Description and habitat

Medium-sized gecko (SVL to 90 mm). Very difficult to distinguish from other taxa in the *granulatus* complex, but readily separated from geckos in the *maculatus* complex by the bright orange interior to the mouth (cf. pink), black interior to the throat, and slender toes. Diurno-nocturnal; arboreal. Inhabits forest and shrubland habitats to at least 1400 m.

4.5.3 Distribution

Nation-wide—The forest gecko s.l. occurs throughout the North Island, in the north, west and south of the South Island, and on some of the larger offshore islands (Pickard & Towns 1988; Bauer & Henle 1994). The only part of the country from which it is conspicuously absent is the eastern South Island. The typical form, *H. granulatus* s.s., reaches its southern limit of distribution somewhere in the central Westland region.

West Coast/Tai Poutini Conservancy—Widespread and relatively common in the forests and shrublands of northern Westland at least as far south as Ross (Hokitika ED), and probably as far south as Lake Ianthe Forest (Harihari ED). 'Forest geckos' reported from Pukekura and Harihari (Harihari ED) (ARDS) could be this taxon or the Okarito forest gecko (see Section 4.7). The most commonly encountered lizard in WC/TP.

Present in the Buller/Kawatiri, Greymouth/Mawheranui, Hokitika, and Franz Josef/ Waiau areas.

4.5.4 Conservation status

DOC threat category Not Threatened (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Low.

4.5.5 Vulnerability

Risk factors

None identified at present.

Positive factors

- Widely distributed
- Very large areas of habitat remain
- A very high proportion of the habitat is on protected land
- Able to occupy seral habitats such as regenerating manuka (*Leptospermum scoparium*) or kanuka (*Kunzea ericoides*) shrubland

4.5.6 Threats

- Exposure to full suite of introduced mammalian predators
- Competition for food (invertebrates, nectar, honeydew) from vespulid wasps, especially in beech forests (Whitaker 1997). May also be at risk to predation by wasps (Thomas 1987)

4.5.7 Research needs

- Taxonomic studies—including more detailed genetic examination—to determine the relationship of the forest gecko (s.s.) to the other taxa in the *granulatus* complex (see Section 4.6 and 4.7)
- Determine more precisely the boundary between the forest gecko (s.s.) and the Okarito forest gecko (see Section 4.7), in particular whether there is any hybridisation zone. Forest geckos can be difficult to find due to their nocturnal and arboreal habits so any that are found by chance within the area of interest should be retained for specialist examination
- Assess the population density and dynamics at one (or more) sites to determine the seriousness of introduced predators and competitors, and whether management intervention is required

4.5.8 Survey needs

- Forest habitats south of Ross in order to determine the species' southern limit of distribution

4.5.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range, including the southern limits of distribution, and are representative of the major habitats occupied by the species.

Tasks

None identified at present.

Action—N/A

4.5.10 Key literature

Thomas 1981; Hitchmough 1997

4.6 CASCADE FOREST GECKO

4.6.1 Taxonomic status

Hoplodactylus sp. 'Cascade'—see Miller et al. 1999.

Very limited material of geckos in the *granulatus* complex from South Westland means that their taxonomic status is still unclear. However, preliminary investigations based solely on specimens from the Cascade Plateau indicate they represent an undescribed taxon presently contained within *Hoplodactylus granulatus* s.l. (see comments in Section 4.5.1).

4.6.2 Description and habitat

Small- to medium-sized gecko (SVL to 80 mm) with slender body (cf. robust in nominate form) Very difficult to distinguish from other taxa in the *granulatus* complex but readily separated from geckos in the *maculatus* complex by the bright orange interior to the mouth (cf. pink), black interior to the throat, and slender toes. Diurno-nocturnal; arboreal. Inhabits forest and shrubland habitats.

4.6.3 Distribution

Nation-wide—Apparently confined to South Westland.

West Coast/Tai Poutini Conservancy—Known with certainty only from the Cascade Plateau (Cascade ED) (Miller et al. 1999). A photographic record from the Jerry River (Pyke ED) appears to be the same taxon (ARDS).

Endemic to WC/TP; occurs only in South Westland/Weheka area.

4.6.4 Conservation status

DOC threat category Data Deficient (ol) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994) but given secondary priority by Hitchmough (2002c).

Conservation status within WC/TP—Moderate.

4.6.5 Vulnerability

Risk factors

- Apparently restricted range

Positive factors

- Very large areas of habitat are present
- A very high proportion of the habitat is on protected land
- Able to occupy seral habitats such as regenerating manuka or kanuka shrubland

4.6.6 Threats

- Exposure to full suite of introduced mammalian predators
- Pakihi populations in fernland or shrubland are at risk from wild fires

4.6.7 Research needs

- Taxonomic studies—including more detailed genetic examination—to determine the relationship of 'forest geckos' in the Cascade district to the other taxa in the *granulatus* complex (see Sections 4.5 and 4.7)
- Formal taxonomic description (if appropriate)
- Determine the boundary between the Cascade and Okarito forms of 'forest gecko', and whether there is any hybridisation zone. 'Forest geckos' are often difficult to find due to their nocturnal and arboreal habits so any that are found by chance within the area of interest (Okarito to Big Bay) should be retained for specialist examination (see Appendix 4)
- Assess the population density and dynamics at one (or more) sites to determine the seriousness of introduced predators and competitors, and whether management intervention is required

4.6.8 Survey needs

- Cascade Plateau—With just a single collection made the local distribution, relative abundance, and habitat-use requires investigation
- Gorge River—The identity of the 'forest geckos' observed in the Jerry River/ Lowe Creek area require confirmation
- Haast district—The area north of Jacksons Bay needs to be surveyed to determine which 'forest gecko' taxon is present in this district

4.6.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

Verify that the species occurs on protected land.

Action—South Westland/Weheka area

4.6.10 Key literature

Miller et al. 1999.

4.7 OKARITO FOREST GECKO

4.7.1 Taxonomic status

Hoplodactylus sp. 'Okarito'—see Miller et al. 1999.

Preliminary genetic studies of the only 'forest gecko' specimen examined from central Westland—collected at Okarito—indicate it represents an undescribed taxon presently contained within *Hoplodactylus granulatus* s.l. (see comments in Section 4.5.1). Lack of comparative material means further resolution of the taxonomy and relationships of this animal is impossible at present.

4.7.2 Description and habitat

Medium-sized gecko (SVL to 85 mm). Very difficult to separate from other taxa in the *granulatus* complex but easily distinguished from geckos in the *maculatus* complex by the bright orange interior to the mouth (cf. pink), black interior to the throat, and slender toes. Diurno-nocturnal; arboreal. Inhabits forest and shrubland habitats.

4.7.3 Distribution

Nation-wide—Known only from central Westland.

West Coast/Tai Poutini Conservancy—Known from a single specimen collected at Okarito (Waiho ED) (Miller et al. 1999). 'Forest geckos' reported from Pukekura and Harihari (Harihari ED) (ARDS) could be this taxon or the forest gecko s.s. (see Section 4.5)

Endemic to WC/TP; occurs only in Franz Josef/Waiau Area.

4.7.4 Conservation status

DOC threat category Data Deficient (ol) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994) but given secondary priority by Hitchmough (2002c).

Conservation status within WC/TP—Moderate.

4.7.5 Vulnerability

Risk factors

- Apparently restricted range

Positive factors

- Very large areas of potential habitat are present
- A high proportion of the potential habitat is on protected land
- Able to occupy seral habitats such as regenerating manuka or kanuka shrubland

4.7.6 Threats

- Exposure to full suite of introduced mammalian predators

4.7.7 Research needs

- Taxonomic studies—including more detailed genetic examination—to determine the relationship of the 'forest geckos' from Okarito to the other taxa in the *granulatus* complex (see Section 4.5 and 4.6)
- Formal taxonomic description (if appropriate)
- Determine the boundaries between the Okarito forest gecko and the related taxa to the north and south, and whether there are hybridisation zones with either species. 'Forest geckos' can be difficult to find due to their nocturnal and arboreal habits, so any that are encountered by chance within the area of interest (Ross to Jacksons Bay) should be retained for specialist examination

- Assess the population density and dynamics at one (or more) sites to determine the seriousness of introduced predators and competitors and whether management intervention is required

4.7.8 Survey needs

- Okarito area—With just a single specimen known the local distribution, relative abundance and habitat use requires investigation
- Forest and shrubland habitats between Ross and Okarito to determine which 'forest gecko' taxon is present in this district
- Forest and shrubland habitats between Okarito and Jacksons Bay to determine which 'forest gecko' taxon is present in this district

4.7.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

Verify that the species occurs on protected land.

Action—Franz Josef/Waiau area

4.7.10 Key literature

Miller et al. 1999.

4.8 OPEN BAY ISLAND GECKO

4.8.1 Taxonomic status

Hoplodactylus sp. 'Open Bay Island'—see Hitchmough 1997.

An undescribed species within the *granulatus* complex (Hitchmough 1997, 2002c). Geckos were first seen on the Open Bay Islands in 1970 (Burrows 1972). At that time they were thought to be forest geckos but the lack of material made further taxonomic assessment impossible. Although visitors to the island saw other geckos very rarely in the intervening period, it was not until January 2000 that more animals were collected. Morphometric data from the recent specimens shows they are a distinctive taxon, the status and relationships of which will have to await genetic study.

4.8.2 Description and habitat

Small gecko (SVL to 70 mm) characterised by the bright orange lining to the mouth, tail shorter than SVL, and very small size of body scales. Nocturnal; arboreal. Inhabits coastal forest and shrubland.

4.8.3 Distribution

Nation-wide—Known only from Open Bay Islands off the South Westland coast at Haast.

West Coast/Tai Poutini Conservancy—Known only from Taumaka Island, Open Bay Island group (Haast ED).

Endemic to WC/TP; occurs only in South Westland/Weheka area.

4.8.4 Conservation status

DOC threat category Nationally Critical (ol, dp) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994) but given highest priority by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.8.5 Vulnerability

Risk factors

- Single known population
- Extremely restricted range (single island, 20 ha)
- Apparently low population density
- Island is in private ownership

Positive factors

- Present on an island > 2 km from coast (i.e. beyond swimming range of mammalian predators)
- Nocturnal and arboreal, and thus reducing risk of predation by weka (*Gallirallus australis*)
- Island has protected status (Wildlife Refuge)

4.8.6 Threats

- Exposure to predation by very high population density of weka
- Colonisation of island by rodents
- Introduction of disease or disease outbreak
- Accidental destruction of habitat by fire

4.8.7 Research needs

- Formal taxonomic description
- Taxonomic studies—including more detailed genetic examination—to determine the relationship of the Open Bay Island gecko to the other taxa in the *granulatus* complex
- Investigate the population density and dynamics to determine the seriousness of weka predation and whether management intervention is required

4.8.8 Survey needs

- Popotai Island: Thus far Open Bay Island geckos have only been recorded on Taumaka Island, but no night work has been undertaken on Popotai Island, the other island in the Open Bay Islands group. Although the area of scrub on Popotai Island is very limited, it is large enough to support a gecko population, particularly if weka are absent.

- Barn Islands: The two islands in Barn Bay are the only other scrub or forest-covered islands of any size off South Westland. Although only 1 km from the coast, the very exposed South Westland coastline and the cliff-bound nature of the islands means stoats or rats may not have colonised them.
- The larger, scrub-covered islands north and south of Haast (including Hanata Island to the north, and Cascade Island, Browne Island and Gorge Islands to the south) are the only other potential island habitat for this species.
- Coastal shrubland habitats between the Paringa River and the Cascade River. If the Open Bay Island gecko is not an island endemic it is most likely to be present in similar habitats on the adjacent mainland (Hitchmough 2002c).

4.8.9 Management actions

Objectives

To ensure the security and continued survival of sole known population of the Open Bay Island gecko.

To enhance the security of the species, if needed, by establishing one (or more) new populations.

To further enhance the security of the species by removing weka from the Open Bay Islands group.

Tasks

Maintain a strong, pro-active approach to rodent (and other introduced predators) quarantine on the Open Bay Islands, including measures to prevent rodents from establishing should they get ashore and monitoring to detect if they do so.

Maintain a contingency plan for the removal of rodents if they are detected on the Open Bay Islands.

Maintain a strong, pro-active approach to limiting the wild-fire risk on Taumaka Island and a contingency plan to control a fire in the unfortunate situation one should occur.

Maintain a strong, pro-active approach to quarantine to prevent pathogens and parasites reaching the naïve gecko population on the island via equipment used for reptile research or via [re-]introduced lizards.

Monitor the Open Bay Island gecko population, with a view to management intervention if necessary.

Following a feasibility study and impact review, establish at least one new population of Open Bay Island geckos on a predator-free island on the South Westland coast. This task is dependent upon the outcome of the survey needs identified above, but in the first instance consideration should be given to Popotai Island.

Negotiate for the removal of weka with the iwi owners of the Open Bay Islands and—if successful—plan for and undertake such action.

Action—South Westland/Weheka area

4.8.10 Key literature

Hitchmough 1997, 2002c.

4.9 NELSON GREEN GECKO

4.9.1 Taxonomic status

Naultinus stellatus Hutton 1872—see Bauer 1990, Hitchmough 1997, and Pringle 1998.

Genetic studies show the Nelson green gecko is part of a closely-related clade that includes the West Coast green gecko and the Marlborough green gecko (*Naultinus manukanus*) (Pringle 1998).

Across their range Nelson green geckos exhibit an extraordinarily wide morphometric variation. For example, animals to the west of Golden Bay are small (SVL < 60 mm), with relatively long tails and almost plain green in colour, whereas those from the upper Buller area are much larger (SVL to 80 mm), with shorter tails and a complex colouration of brown, green and white. These broad differences between populations are presently unsupported by genetic studies and although it is unclear whether they are the result of uniform clinal variation across the species' range or regional differentiation, fixed variations in the reproductive cycle suggest the latter (Hitchmough 1997).

Until relatively recently the green geckos found in the western part of Golden Bay (west of the Aorere River) and in northern Westland (Kahurangi Point to Cape Farewell) were believed to be West Coast green geckos (e.g. Robb 1986, Pickard & Towns 1988). These animals are now recognised as Nelson green geckos, and the boundary between these two taxa is clearly much further south—probably south of Karamea (Hitchmough 1997). This means that any literature references or ARDS database records to '*N. tuberculatus*' from the Karamea district probably refer to the Nelson green gecko, and that Nelson green geckos should be regarded as part of the WC/TP fauna.

4.9.2 Description and habitat

A small to medium-sized (SVL up to 80 mm) gecko with very variable colouration—predominantly green (in the west) but variously including brown, black and white (in the east). Diurnal; arboreal. Inhabits forests and shrublands to the subalpine zone. Also in seral shrubland, including kanuka and manuka, and [rarely] in subalpine herbfields.

4.9.3 Distribution

Nation-wide—Greater Nelson region; west of the main divide and south of the Bryant Range, south to the Murchison district and north Westland (Hitchmough 1997).

West Coast/Tai Poutini Conservancy—All verified records of the Nelson green gecko are within the Nelson/Marlborough Conservancy. However, reports unsupported by voucher material indicate the species occurs in the Heaphy and Karamea district (Heaphy ED, Karamea ED), perhaps as far south as Mohikinui River (unsupported ARDS record for north branch) (Wangapeka ED). May also be present in the upper Maruia River or Glenroy River catchments (Ella ED) as it has been reported from the adjacent Matakitaki River catchment

(Hunter 1874), and in the Upper Buller Gorge as there is an unsubstantiated record from Lyell (ARDS).

Present in Buller/Kawatiri Area.

4.9.4 Conservation status

DOC threat category is Gradual Decline (dp, hi) (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Low.

4.9.5 Vulnerability

Risk factors

None identified at present.

Positive factors

- Widely distributed
- Very large areas of habitat remain
- Large areas of habitat on protected land, including Kahurangi NP
- Able to occupy seral habitats such as regenerating manuka or kanuka shrubland

4.9.6 Threats

- Exposure to full suite of introduced mammalian predators
- Competition from vespulid wasps for invertebrates, nectar and honeydew, especially in beech forests (Whitaker 1997). Perhaps also at risk to predation by wasps (Thomas 1987)

4.9.7 Research needs

- Investigate the genetic and morphometric status of animals along the boundary with the West Coast green gecko in order to establish the extent of the hybridisation zone (if it occurs) (Hitchmough 1997). Understanding what happens where the species meet is important for interpreting the taxonomic relationships and status.
- Assess the population density and dynamics at one or more sites to determine the seriousness of introduced predators and competitors, and whether management intervention is required.

4.9.8 Survey needs

- Karamea district: The identity of green geckos in the Karamea district has never been confirmed. Nelson green geckos are known from the Westhaven area but the southern limit of distribution needs to be determined.
- Maruia/Springs Junction/Lewis Pass district: Nelson green geckos occur around Murchison and in the Matakitaki Valley but their southern limit of distribution is not precisely known. West Coast green geckos occur at the Maruia Saddle (between the Matakitaki River and the Maruia River) (Pringle

1998), yet animals a few kilometres away in the Maruia Valley at Shenandoah, display morphological characteristics intermediate between the Nelson green gecko and the West Coast green gecko. This suggests there may be a hybridisation zone around the boundary between these species.

4.9.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the southern limit of distribution for the species.

Tasks

To verify that the habitat of key populations at the southern limit of distribution is protected.

Action—Buller/Kawatiri area.

4.9.10 Key literature

Bauer 1990; Bauer & Henle 1994; Hitchmough 1997; Pringle 1998.

4.10 WEST COAST GREEN GECKO

4.10.1 Taxonomic Status

Naultinus tuberculatus (McCann 1955)—see Robb 1980, Bauer 1990, Daugherty et al. 1994, Hitchmough 1997, and Pringle 1998.

Genetic research has shown the West Coast green gecko is part of a closely-related clade that includes the Nelson green gecko and the Marlborough green gecko (*Naultinus manukanus*) (Pringle 1998).

The so-called 'Lewis Pass gecko'—*Naultinus poecilochlorus* (Robb 1980)—was regarded by Daugherty et al. (1994) as a synonym of the West Coast green gecko on the basis that, although geckos from the Lewis Pass area differ from those in Westland in their bolder, more intricate colour pattern, significant differences in morphology and allozymes are lacking (Hitchmough 1997). However, recent DNA data shows the Lewis Pass populations are genetically distinct from geckos further west—but not at a specific level—and attributes this minor difference to an introgression of mitochondrial DNA from rough geckos (*Naultinus rudis*) (Rod Hitchmough pers. comm.).

4.10.2 Description and habitat

A large gecko (SVL to 78 mm) characterised by a yellowish-green colour and generally with a complex colour pattern of paler blotches. Diurnal; arboreal. Inhabits lowland and montane shrublands and forests. Also in seral vegetation such as kanuka and manuka shrubland, and in umbrella (*Gleichenia*) fernlands on pakihi terraces.

4.10.3 Distribution

Nation-wide—Westland, from at least Denniston, the Maruia Valley and Lewis Pass, south as far as the Hokitika district. 'Green geckos' reported from further south—to at least Haast—are probably also this species. Distribution east of the main divide limited to a small area in north Canterbury at the Hope River and Boyle River (Hitchmough 1997).

West Coast/Tai Poutini Conservancy—Probably present throughout most of WC/TP, except the extreme north, although the identity of 'green geckos' south of the Hokitika district requires confirmation.

Type locality 'Westland'; paratype 'Ikamaroa' (= Ikamatua, Grey Valley) (McCann 1955).

Virtually endemic to WC/TP; present in Buller/Kawatiri, Greymouth/Mawhera-nui, and Hokitika areas, and probably also present in Franz Josef/Waiau and South Westland/Weheka areas.

4.10.4 Conservation status

DOC threat category is Sparse (dp) (Hitchmough 2002a); IUCN 'Red List', classification is Lower Risk (lc) (Hilton-Taylor 2000); not listed for conservation priority by Molloy & Davis (1994), but given secondary priority by Hitchmough (2002c).

Conservation status within WC/TP—Low.

4.10.5 Vulnerability

Risk factors

None identified at present.

Positive factors

- Widely distributed
- Large areas of habitat remain
- Large areas of habitat are on protected land
- Able to occupy seral habitats such as regenerating manuka or kanuka shrubland

4.10.6 Threats

- Exposure to full suite of introduced mammalian predators
- Pakihi populations in fernland or shrubland are at risk to wild fires
- Competition from vespulid wasps for invertebrates, nectar and honeydew (Whitaker 1997). Perhaps also at risk to predation by wasps (Thomas 1987)

4.10.7 Research needs

- Further investigate the genetic and morphometric status of the Lewis Pass populations compared to populations further west.
- Investigate the genetic and morphometric status of animals along the boundaries with the Nelson green gecko and the rough gecko in order to establish the extent of hybridisation zones (if they occur) (Hitchmough 1997).

Understanding what happens where the species meet is important for interpreting the taxonomic relationships and status.

- Assess the population density and dynamics at one or more sites to determine the seriousness of introduced predators and competitors, and whether management intervention is required.

4.10.8 Survey needs

- South Westland—The 'green geckos' reported from South Westland are assumed to be West Coast green geckos, but their identity is presently unverified and the southern limit of range needs to be determined, as does the western limit and boundary with the jewelled gecko (*Naultinus gemmeus*).
- North Westland—West Coast green geckos have been recorded as far north as Denniston, Inangahua and the Maruia Saddle but the northern limit of range and boundary with the Nelson green gecko in the Karamea and Buller districts is unknown.
- Unconfirmed reports of 'green geckos' from various sites (e.g. Cape Foulwind, Lake Kaniere) require follow-up searches.

4.10.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

To verify that the habitat of key populations is protected—especially at the limits of distribution.

Action—All Areas.

4.10.10 ley Literature

Robb 1980; Bauer 1990; Bauer & Henle 1994; Hitchmough 1997; Pringle 1998.

4.11 SPECKLED SKINK

4.11.1 Taxonomic status

Oligosoma infrapunctatum (Boulenger 1887)—see Hardy 1977 and Miller 1999.

Speckled skinks show extremely wide morphometric variation throughout their range—with those from Westland the smallest and most slender—yet clear specific separation is not supported by genetic data from electrophoresis of haemoglobin compounds (Hardy 1977) or allozymes (Daugherty et al. 1994; Miller 1999). Also, the suggestion that skinks from the Chesterfield area, north of Hokitika, should be regarded as a distinct sub-species of *O. infrapunctatum* on the basis of preliminary allozyme tests and minor morphological differences (Aviss & Lyall 1995) did not withstand further scrutiny and they are now regarded as speckled skinks (Miller 1999).

Nonetheless, speckled skinks from Westland populations did differ from all other populations tested in the frequency of some alleles so—although not taxonomically distinct—should be treated as a discrete management unit (Miller 1999), and the variation in colour and form exhibited between some Westland populations indicates more sensitive genetic testing may reveal hitherto unrecognised diversity (Hitchmough 2002c).

4.11.2 Description and habitat

Large skink (SVL to 80 mm in Westland, longer elsewhere) characterised by a speckled dorsal surface, a crenated, dark lateral band, and a yellow or pinkish belly often densely speckled with black. Diurnal; terrestrial. In Westland most frequently inhabits boulder beaches, but away from the coast occupies densely-vegetated habitats, shrubland, fernland or open coastal forest (Efford et al. 1997). Occasionally present in modified habitats such as farmland. Possibly present in subalpine tussock grassland in Kahurangi NP (Whitaker & Gaze 1999).

4.11.3 Distribution

Nation-wide—Localised and patchy distribution from Waikato and Bay of Plenty, through the central North Island (Volcanic Plateau, Taupo Basin, Wanganui, Rangitikei, Wairarapa) to Cook Strait, Nelson and Westland (Hardy 1977, Pickard & Towns 1988, ARDS).

West Coast/Tai Poutini Conservancy—Scattered localities as far south as Okarito: Karamea and Gentle Annie Point (Karamea ED); Waimaire (Ngakawau ED); Hector, Ngakawau, Birchfield, Westport, and Charleston (Foulwind ED); Reefton[6] (Totara Flat ED); Cobden (Greymouth ED); Chesterfield, Kaihinu, and Hokitika (Hokitika ED); and Okarito (Waiho ED) (van Mierlo 1998, Miller et al. 1999, ARDS). Most sites are on or immediately adjacent to the coast, but it is known inland at Reefton (and on mountain tops in Kahurangi NP in the adjacent Nelson/Marlborough Conservancy). Locally abundant in some cobble beach habitats (e.g. Cobden beach).

Present in Buller/Kawatiri, Greymouth/Mawheranui, Hokitika and Franz Josef/Waiau areas.

4.11.4 Conservation status

DOC threat category is Gradual Decline (hi) (Hitchmough 2002a); IUCN 'Red List', classification is Lower Risk (nt) (Hilton-Taylor 2000); not listed by DOC for conservation priority[7] (Molly & Davis 1994).

Conservation status within WC/TP—Moderate.

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[6] Skinks from this site were erroneously listed as the cryptic skink (*Oligosoma inconspicuum*) following identification by Dr Geoff Patterson (pers. comm. 26 July 1993; Whitaker & Meads 1993).

[7] *Oligosoma infrapunctatum* is not listed by Molloy & Davis (1994). However, at the time the DOC conservation priority list was compiled speckled skinks in the Hokitika district were believed to be an undescribed taxon—the so-called 'Chesterfield skink'—and were included under '*Leiolopisma* 'West Coast skink(s)'' with a ranking of Category B (Molloy & Davis 1994; Aviss & Lyall 1995).

4.11.5 Vulnerability

Risk factors

- Few remaining populations
- Populations very isolated and localised leaving them at risk to stochastic events
- All known populations are on unprotected land (except for possible shoreline reserve status at some sites)
- Large body size increases risk of predation (Whitaker 1978)

Positive factors

- Very wide distribution
- Present on some boulder beach habitats, which confer a degree of protection from introduced mammalian predators
- Able to occupy modified habitats on farmland when suitable cover is present

4.11.6 Threats

- Exposure to full suite of introduced mammalian predators
- Modification or loss of habitat to exotic forestry and agricultural development. This is a greater risk on the coastal plains
- Loss of habitat to weed encroachment. Greatest risk is the colonisation of skink habitats by gorse (*Ulex europaeus*), which can form a dense canopy and eliminate basking sites
- Some pakihi populations (e.g. Charleston) are at risk to wild fires
- Some littoral populations are at risk to physical damage of the habitat by 4WD vehicles and motorbikes
- Local populations are at some risk to urban expansion (e.g. Orowaiti Lagoon, Hokitika)

4.11.7 Research needs

- Use new genetic techniques (DNA) to re-evaluate the genetic and taxonomic status of representative populations of speckled skinks in WC/TP, compared with key populations in the North Island and Nelson/Marlborough and in the light of the minor allozyme and morphometric variations already noted. Depending on the outcome, follow this with further morphometric analysis and formal description(s).
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it faces.
- Assess population dynamics and density at one or more sites to determine whether conservation management intervention is needed.

4.11.8 Survey needs

- Hokitika district and southward—Populations of speckled skinks are well known from the immediate vicinity of Hokitika and there is a single record from Okarito, but the southern limit of distribution has not been clearly defined.

- Punakaiki coastline—There is a significant gap in distribution between Charleston and Cobden within which there are areas of apparently suitable habitat both on the beaches and on the coastal plain. 'Skinks' have been reported from this area, but the identity is not known (van Mierlo 1998).
- Kahurangi NP—Skinks found on Mount Perry and Mount White, just north of the conservancy boundary in western Kahurangi NP, are believed to be speckled skinks (Whitaker & Gaze 1999). Other subalpine tussock and herbfield habitats should be searched to determine the occurrence and extent of new populations.

4.11.9 Management actions

Objectives

To ensure the survival of populations that secure the full genetic and morphometric variation shown by this species within the WC/TP.

To ensure the continued survival of populations at sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

To investigate the ownership status of the habitat of key populations—especially at the limits of distribution—and, if required, seek some type of formal protection.

Monitor one (or more) populations in the Karamea–Westport district and in the vicinity of Hokitika to determine population trends.

Action—Buller/Kawatiri, Greymouth/Mawheranui and Hokitika Areas.

4.11.10 Key literature

Hardy 1977; van Mierlo 1998; Miller 1999; Miller et al. 1999.

4.12 OPEN BAY ISLAND SKINK

4.12.1 Taxonomic status

Oligosoma sp. 'Open Bay Island'—see Daugherty et al. 1994; Molloy & Davis 1994; Hitchmough 2002c.

An undescribed taxon with unresolved relationships. Despite a very strong superficial resemblance to the speckled skink—and similar habitat and behaviour—genetic (allozyme) studies based on a single specimen show a relationship with the scree skink (*Oligosoma waimatense*) of the eastern South Island (Miskelly 1993; Miller 1999; Daugherty 2000), and more distantly with the Otago skink (*Oligosoma otagense*), spotted skink (*Oligosoma lineoocellatum*) and brown skink (Miller 1999). This clearly requires further investigation as it would be hard to find two more disparate species within *Oligosoma* than the Open Bay Islands skink and the scree skink—not just in form, but also in habitat and behaviour.

4.12.2 Description and habitat

Large (SVL up to 92 mm) skink; very difficult to distinguish from the speckled skink. Dorsal surface lacks mid-dorsal stripe and has only indistinct speckling; belly colouration yellow, occasionally with black speckling Diurnal; terrestrial. Inhabits coastal forest, shrubland and supralittoral vegetation (sedges, tussock and ferns).

4.12.3 Distribution

Nation-wide—Known only from Open Bay Islands off the South Westland coast at Haast.

West Coast/Tai Poutini Conservancy—Known only from Taumaka Island, Open Bay Island group (Haast ED).

Endemic to WC/TP; occurs only in South Westland/Weheka Area.

4.12.4 Conservation status

DOC threat category is Nationally Critical (ol, dp) (Hitchmough 2002a); not listed by IUCN; Category A ranking for conservation priority (Molloy & Davis 1994) and a highest priority listing by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.12.5 Vulnerability

Risk factors

- Single known population
- Extremely restricted range (single island, 20 ha)
- Apparently low population density
- Island is in private ownership
- Large body size means they are less able to evade predators than small lizard species (Whitaker 1978)
- Terrestrial habit means they are exposed to weka predation

Positive factors

- Present on an island > 2 km from coast (i.e. beyond swimming range of mammalian predators)
- Island has protected status (Wildlife Refuge)

4.12.6 Threats

- Exposure to predation by very high population density of weka (*Gallirallus australis*)
- Colonisation of island by rodents
- Accidental destruction of habitat by fire

4.12.7 Research needs

- Formal taxonomic description

- Genetic studies to determine the relationships of the Open Bay Island skink to sibling taxa
- Investigate the population density and dynamics to determine the seriousness of weka predation and whether management intervention is required

4.12.8 Survey needs

- Popotai Island—Thus far Open Bay Island skinks have been recorded only on Taumaka Island, but only one fleeting survey has been undertaken on Popotai Island, the other island in the Open Bay Islands group. Although the vegetated area on Popotai Island is very limited, it is easily large enough to support a skink population, particularly if weka are absent.
- Barn Islands—The two islands in Barn Bay are the only other sizeable islands off South Westland with good vegetation cover. Although only 1 km from the coast, the very exposed South Westland coastline and the cliff-bound nature of the islands means stoats or rats may not have colonised them.
- The larger, scrub-covered islands north and south of Haast (including Hanata Island to the north, and Cascade Island, Browne Island, and Gorge Island to the south) are all potential island habitats for these skinks.
- Coastal and open lowland habitats between the Paringa River and the Cascade River. The Open Bay Island skink is not likely to be a primary island endemic because the shallowness of the water between the mainland and the islands implies geologically recent isolation. Its similarity to the speckled skink suggests it is most likely to occur in habitats on the adjacent mainland that are like those occupied by the speckled skink further north in Westland.

4.12.9 Management actions

Objectives

To ensure the security and continued survival of sole known population of the Open Bay Island skink.

To enhance the security of the species, if need be, by establishing one (or more) new populations.

To further enhance the security of the species by removing weka from the Open Bay Islands group.

Tasks

Maintain a strong, pro-active approach to rodent (and other introduced predators) quarantine on the Open Bay Islands, including measures to prevent rodents from establishing should they get ashore and monitoring to detect if they do so.

Maintain a contingency plan for the removal of rodents if they are detected on the Open Bay Islands.

Maintain a strong, pro-active approach to limiting the wild-fire risk on Taumaka Island, and a contingency plan to control a fire in the unfortunate event one should occur.

Maintain a strong, pro-active approach to quarantine to prevent pathogens and parasites reaching the naïve skink population on the island via equipment used for reptile research or via [re-]introduced lizards.

Monitor the Open Bay Island skink population, with a view to management intervention if necessary.

Following a feasibility study and impact review, establish at least one new population of Open Bay Islands skinks on a predator-free island on the South Westland coast. This task is dependent upon the outcome of the survey needs identified above, but in the first instance consideration should be given to Popotai Island.

Negotiate for the removal of weka with the iwi owners of the Open Bay Islands and—if successful—plan for and undertake such action [if weka can not be removed, or even as a short-term solution, consideration should be given to providing weka-proof cover or weka exclosures for the skinks].

Action—South Westland/Weheka area

4.12.10 Key literature

Miskelly 1993; Miller 1999; Daugherty 2000; Hitchmough 2002c.

4.13 COMMON SKINK

4.13.1 Taxonomic status

Oligosoma nigriplantare polychroma (Patterson & Daugherty 1990)—see Hardy 1977 and Patterson & Daugherty 1990

The level of variation revealed by a genetic study of 19 populations of common skink from throughout its very wide geographic range suggested that more detailed genetic analysis might lead to the recognition of further cryptic species within the *nigriplantare* complex (Daugherty et al. 1990). Unfortunately this study did not include any material from Westland so could not comment on the relationship of the populations there to the more abundant populations in neighbouring Nelson, Canterbury, and Otago. All that can be said is that the original description of *O. n. polychroma*, based in part on this research, did include one specimen from Westland—from Harihari (Harihari ED) (Patterson & Daugherty 1990).

More recent genetic research which compared two Westland populations—Springs Junction (Rotoroa ED) and Oneone River (Harihari ED)—with one from Motueka and one from the Mackenzie Basin revealed a level of divergence for the Oneone population that suggested, at the very least, it should be treated as a separate management unit (Miller 1999).

Prior to 1977 the cryptic-species complex containing the taxon now known as *O. n. polychroma* was called '*Leiolopisma zelandica*', and from 1977–90 was '*L. nigriplantare maccanni*' (Hardy 1977; Patterson & Daugherty 1990). *O. n. polychroma*—the common skink—is the only species in this complex that occurs in WC/TP. Many of the literature references and ARDS database records to this species in Westland record it as '*L. zelandica*', thus leading to potential

confusion with the brown skink *O. zelandicum*, which is also present in the region (see Section 4.15). Any records of *L. n. maccanni* will refer to *O. n. polychroma*.

4.13.2 Description and habitat

Small (SVL to 76 mm), brown, striped skink characterised by a blunt snout and unmarked, (usually) yellow underside. Diurnal; terrestrial. Occupies a very wide range of (generally) open habitats, including littoral and supralittoral zones on rocky or sandy beaches, grasslands, and open shrublands, up to subalpine grasslands and herbfields. In forested districts it occurs in riparian vegetation along rivers; it is also one of the few lizard species to adapt to urban and farmland environments. In Westland common skinks occur in fernland or sphagnum swamps on pakihi terraces.

4.13.3 Distribution

Nation-wide—From Central North Island (roughly south of a line from Gisborne to Turangi to southern Taranaki) to Stewart Island (Pickard & Towns 1988, Patterson & Daugherty 1990).

West Coast/Tai Poutini Conservancy—Known from very few, widely scattered localities in Westland including Springs Junction/upper Maruia River district (Rotoroa ED), Kowhitirangi (Hokitika ED), Harihari and Oneone River (Harihari ED) (Patterson & Daugherty 1990; Miller et al. 1999; ARDS). Unconfirmed report from Kaihinu (Hokitika ED) (ARDS).

Present in Greymouth/Mawheranui, Hokitika and Franz Josef/Waiau Areas.

4.13.4 Conservation status

DOC threat category Not Threatened (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Moderate.

4.13.5 Vulnerability

Risk factors

- Few known populations
- Populations appear to be small and isolated leaving them at risk to stochastic events
- Not known to occur on protected land

Positive factors

- Relatively widespread in WC/TP
- Able to occupy highly modified habitats (e.g. farmland, urban environments)

4.13.6 Threats

- Exposure to the full suite of introduced mammalian predators
- Loss of habitat to exotic forestry and through some kinds of agricultural development

- Pakihi populations at risk to wild fires.

4.13.7 Research needs

- More detailed genetic and morphometric studies to determine the taxonomic status of the populations in WC/TP with respect to other parts of New Zealand (Hitchmough 2002c). This would require broader sampling coverage than has already been undertaken.
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it faces.
- Assess population dynamics and density at one or more sites in the southern part of its range to determine whether conservation management intervention is needed.

4.13.8 Survey needs

- Buller/Kawatiri Area: Common skinks have not been recorded in this Area yet occur to the north (Kahurangi coastline), east (Murchison, Springs Junction), and south (south of Hokitika) (Whitaker & Gaze 1999; ARDS). There are unconfirmed reports of common skinks from within the area, e.g. Paparoa Range (Punakaiki ED) (Hardy 1977), and also indeterminate material that might be this species (see Section 4.18).
- South Westland: The southern limit of distribution needs to be defined. At present the southernmost confirmed locality is in the Harihari district but there are records of similar skinks being found further south (e.g. Okuru (Haast ED)).
- All Areas, Southern Alps: Common skinks are relatively numerous right along the eastern side of the Southern Alps from Nelson to Fiordland (Pickard & Towns 1988, ARDS), where they occur in subalpine tussock and herbfields up to approximately 1,800 m elevation. It is not known if any of these populations extend into WC/TP on the western side of the main divide but suitable subalpine habitats should be searched.

4.13.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range of the species.

Tasks

To investigate the ownership status of the habitat of key populations—especially at the limits of distribution—and, if required, seek some form of protection.

Monitor one (or more) populations in the Hokitika—Franz Josef district to determine population trends.

Action—Greymouth/Mawheranui, Hokitika and Franz Josef/Waiau areas.

4.13.10 Key literature

Barwick 1959; Hardy 1977; Patterson 1992; Patterson & Daugherty 1990; Spencer et al. 1998.

4.14 GREY VALLEY SKINK

4.14.1 Taxonomic status

Oligosoma sp. 'Grey Valley'—see Miller 1999.

An undescribed taxon in the *Oligosoma nigriplantare* species complex that is most closely related to, but nonetheless genetically very distinct from, the common skink and McCann's skink (*Oligosoma maccanni*) (Miller 1999). Comparison of the three known populations of the Grey Valley skink showed no genetic variation between them.

4.14.2 Description and habitat

Small (up to 67 mm SVL), brown, striped skink. Virtually indistinguishable from the common skink, even occupying similar habitats (on present data the range of the common skink surrounds that of the Grey Valley skink but the two species have not been found sympatrically). Diurnal; terrestrial. Inhabits rough pasture with logs or rocks in farmland or along rivers; also on cobble strand.

4.14.3 Distribution

Nation-wide—Presently known only from the Grey River catchment in Westland (Miller 1999).

West Coast/Tai Poutini Conservancy—Recorded from just three localities—Blaketown (Greymouth ED), Kangaroo Ck (Hochstetter ED), and Mawheraiti (Maimai ED) (Miller 1999). Possibly present at Kaihinu (Hokitika ED) (Hitchmough 2002c).

Endemic to WC/TP; only recorded in Greymouth/Mawheranui area.

4.14.4 Conservation status

DOC threat category is Range Restricted (dp) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994), but given highest priority by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.14.5 Vulnerability

Risk factors

- Restricted range
- Only three known populations
- Populations appear to be very small and isolated leaving them at serious risk to stochastic events
- Not known to occur on protected land (except for possible shoreline reserve status at Blaketown)

Positive factors

- Present in cobble strand habitat at Blaketown, which confers a degree of protection from introduced mammalian predators
- Able to occupy modified habitats on farmland when suitable cover is present

4.14.6 Threats

- Exposure to the full suite of introduced mammalian predators
- Modification or loss of habitat to exotic forestry and agricultural development
- Loss of habitat to weed encroachment. Greatest risk is the colonisation of skink habitats by gorse or broom (*Cytisus scoparius*), which can form a dense canopy and eliminate basking sites
- Coastal population at Blaketown is at risk to physical damage of the habitat by 4WD vehicles and motorbikes, and disturbance from a close urban population

4.14.7 Research needs

- Formal taxonomic description
- Taxonomic studies—including more detailed genetic examination—to determine the relationship of the Grey Valley skink to the other taxa in the *nigriplantare* complex
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it is facing (Hitchmough 2002c)
- Assess population dynamics and density at the coastal site and at least one inland site to determine whether conservation management intervention is needed

4.14.8 Survey needs

- Localised surveys to more accurately determine the size and extent of the known populations
- Grey Valley: Broader-scale surveys to better understand the local distribution and frequency of populations within their known range

4.14.9 Management actions

Objectives

To maintain and enhance representative populations of the Grey Valley skink in order to secure the full geographic range of the species and the variety of habitats it occupies.

Tasks

Seek protected status for key sites for Grey Valley skink populations (subject to the results of the survey recommendations)

Monitor the three known populations, with a view to management intervention if necessary

Develop a weed control plan for each site where Grey Valley skinks occur

Action—Greymouth/Mawheranui area

4.14.10 Key literature

Whitaker 1998; van Mierlo 1998; Miller et al. 1999; Miller 1999; Hitchmough 2002c.

4.15 BROWN SKINK

4.15.1 Taxonomic status

Oligosoma zelandicum (Gray 1843)—see Gill 1976 and Hardy 1977.

Allozyme data from the two Westland populations of brown skink examined (Scotts Beach and Gentle Annie Point) showed they were virtually identical genetically, and indistinguishable from the Stephens Island population in Cook Strait (Miller 1999).

Changes to skink nomenclature mean there is potential confusion surrounding the name *O. zelandicum*. Before 1977 the brown skink was known by the name *Leiolopisma ornata*, and the combination *Leiolopisma zelandica* was applied to the species now called *O. n. polychroma* (Hardy 1977; Patterson & Daugherty 1990) (see also comments under Section 4.13.1).

4.15.2 Description and habitat

Small (SVL to 72 mm), brown, striped skink superficially similar to the common skink from which it can most easily be distinguished by denticulate markings on the jaws. Diurnal; terrestrial, somewhat cryptozoic. Occupies densely-vegetated—usually damp—habitats from supra-littoral scrub and grasslands to open lowland forest (Gill 1976); occasionally on boulder beaches or within dense coastal forest. In the North Island to 1,000 m on Mount Taranaki but all South Island records are at low elevation. In Westland known only beneath logs close to the shoreline.

4.15.3 Distribution

Nation-wide—Western North Island from Taranaki to Wellington, Marlborough Sounds, Nelson and north Westland (Hardy 1977, Pickard & Towns 1988). Southern limit of distribution appears to be at Birchfield.

West Coast/Tai Poutini Conservancy—Known from just four coastal sites in north Westland—Scotts Beach (Heaphy ED), Gentle Annie Point (Karamea ED), Waimarie (Ngakawau ED) and Birchfield (Foulwind ED) (van Mierlo 1998, ARDS)[8].

Present in Buller/Kawatiri Area.

4.15.4 Conservation status

DOC threat category Not Threatened (Hitchmough 2002a); unlisted by IUCN; not given DOC priority ranking for conservation action (Molloy & Davis 1994).

Conservation status within WC/TP—Moderate.

4.15.5 Vulnerability

Risk factors

- Only three known populations

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[8] ARDS record # 30252 by Ron van Mierlo, for brown skinks at Chesterfield (Hokitika ED) on 2 October 1997 appears to have been an error of identification, because it is not listed in his later report for the site (van Mierlo 1998).

- Populations appear to be very small and isolated leaving them at serious risk to stochastic events

Positive factors

- At least one population (Scotts Beach) is on protected land (Kahurangi NP)
- In the North Island has survived in highly modified environments (e.g. urban sites in Wellington city, pastoral farmland in Taranaki, Rangitikei and Horowhenua) where it is exposed to the full suite of introduced predators

4.15.6 Threats

- Exposure to the full suite of introduced mammalian predators
- Loss of habitat to weed encroachment. Greatest risk is the colonisation of skink habitats by gorse, which can form a dense canopy and eliminate basking sites

4.15.7 Research needs

- More detailed genetic and morphometric studies to determine the taxonomic status of the populations in WC/TP with respect to other parts of New Zealand. This would require broader sampling coverage than has already been undertaken.
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it faces.
- Assess population dynamics and density at one (or more) sites to determine whether conservation management intervention is needed.

4.15.8 Survey needs

- Westport district—To determine the southernmost limit of range. At present the southernmost known record for brown skinks is at Birchfield, but semi-continuous, similar habitat extends well to the south of there.
- Karamea district—The known populations of brown skinks are widely scattered and extremely localised. More detailed surveys need to be made of the Karamea district to understand local distribution, and to determine the extent and status of the populations. These surveys should also consider habitats away from the immediate coast. In the North Island brown skinks occur well away from the coast in Taranaki, Manawatu and Wellington, and in Taranaki extend to high elevations on Mount Taranaki.

4.15.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the southern limit of distribution for the species.

Tasks

If needed, seek protection for key sites that secure the southern limit of distribution (subject to the results of the survey recommendations).

Monitor one or more key populations, with a view to management intervention if necessary.

Develop a contingency plan for weed control should it become an issue at protected coastal sites.

Action—Buller/Kawatiri area

4.15.10 Key literature

Gill 1976; Hardy 1977.

4.16 BIG BAY SKINK

4.16.1 Taxonomic status

Oligosoma sp. 'Big Bay'—see Tocher 1999 and Miller 1999.

Undescribed species in the *nigriplantare* species complex (Tocher 1999; Miller 1999). Allozyme data has variously shown that it is related—though not closely—to the southern skink (*Oligosoma notosaurus*) (Tocher 1999) or to McCann's skink (*Oligosoma maccanni*) and the cryptic skink (*Oligosoma inconspicuum*) (Miller 1999).

No significant genetic variation was detected between four populations at Big Bay, but no population in WC/TP were examined (Miller 1999).

4.16.2 Description and habitat

A small (to 74 mm SVL) brown, striped skink. Superficially similar to the common skink or the cryptic skink (*Oligosoma inconspicuum*), but the general colouration is a dark, 'chestnut' brown with a characteristic bronze-coloured underside. Diurnal; terrestrial. At Big Bay and Barn Bay they inhabit the supralittoral zone on deep, stable, cobble beaches where there is a range of prostate native plants (e.g. *Muehlenbeckia*, *Coprosma*) or flax (*Phormium tenax*), and driftwood (van Mierlo 1998; Tocher 1999). Skinks believed to be this species were common in stunted shrubland and fernland on the Cascade Plateau (Miller et al. 1999).

4.16.3 Distribution

Nation-wide—Apparently restricted from South Westland, between Cascade Plateau and Big Bay (Tocher 1999, Miller 1999).

West Coast/Tai Poutini Conservancy—Known from just two localities within WC/TP—Barn Bay (Cascade ED) and Awarua Point (Pyke ED) (van Mierlo 1998; Tocher 1999; Miller et al. 1999; Miller 1999; ARDS). Also believed to be present on the Cascade Plateau (Cascade ED) (Miller et al. 1999). None of the populations in WC/TP have had their identity confirmed using genetic techniques (Hitchmough 2002a).

Present in South Westland/Weheka area.

4.16.4 Conservation status

DOC threat category is Range Restricted (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994), but given highest priority by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.16.5 Vulnerability

Risk factors

- Apparently restricted range
- Known from just 2–3 localities
- Most populations appear to be small and isolated leaving them at risk to stochastic events

Positive factors

- Cobble strand habitat provides a relatively high level of protection from introduced predators (it probably represents a refuge habitat)
- At some sites local population densities are high (Tocher 1999; Clare Miller, pers. comm.)

4.16.6 Threats

- Exposure to full suite of introduced mammalian predators
- Loss of habitat to weed encroachment. Greatest risk is the colonisation of littoral habitats by gorse, which can form a dense canopy and eliminate basking sites
- Some littoral populations are at risk to physical damage of the habitat by 4WD vehicles and motorbikes
- Skink population in fernland and shrubland on Cascade Plateau is at risk to wild fires

4.16.7 Research needs

- Formal taxonomic description
- Taxonomic studies—including more detailed genetic examination—to determine the relationship of the Big Bay skink to the other taxa in the *nigriplantare* complex
- Confirmation of the identity of all populations to confirm they are conspecific with the skinks from Big Bay, Fiordland
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it is facing
- Assess population dynamics and density at the Cascade Plateau site and at least one coastal site to determine whether conservation management intervention is needed

4.16.8 Survey needs

- Cascade Plateau: Localised surveys to more accurately determine the size, extent and status of the known population(s) there

- Barn Bay–Jacksons Bay coastline: To determine the northernmost limit of range. The northernmost coastal locality known is Barn Bay yet apparently suitable boulder beach and cobble strand habitat is present at scattered sites further north along the coast

4.16.9 Management actions

Objectives

To ensure the continued survival of populations at sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

Seek protection for key sites for Big Bay skink populations (if needed and subject to the results of the survey recommendations).

Monitor the key populations, with a view to management intervention if necessary.

Continue weed (gorse) control at Barn Bay and develop a weed control plan for each site where Big Bay skinks occur.

Action—South Westland/Weheka.

4.16.10 Key literature

van Mierlo 1998; Tocher 1999; Miller et al. 1999; Miller 1999; Hitchmough 2002c.

4.17 PAPAROA SKINK

4.17.1 Taxonomic status

Oligosoma sp. 'Paparoa'—see Miller et al. 1999.

A highly distinctive skink that is presumed to be a new taxon. The sole specimen[9] has not been subjected to genetic investigation, or examined in detail, so its taxonomic status and affinities are unknown. However, it shows similarities to the *Oligosoma lineoocellatum / chloronoton* complex (Hitchmough 2002c).

4.17.2 Description and habitat

Large (79 mm SVL), heavy-bodied skink; characterised by a distinctive striped dorsal colouration comprising three narrow black stripes (two ½ scales wide) between pale, black-edged dorso-lateral stripes; a chestnut-brown, smooth-edged lateral band; a relatively broad, pale, smooth-edged lateral stripe; a bright yellow, unmarked underside, and black soles to the feet. Diurnal; terrestrial. Known only from rock outcrops in subalpine tussock grassland and herbfields at 1400 m (Miller et al. 1999).

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[9] MONZ RE 5258.

4.17.3 Distribution

Nation-wide—Known only from the Paparoa Range, Westland.

West Coast/Tai Poutini Conservancy—Known from a single specimen collected about 50 m below the summit of Mount Micawber in the eastern Paparoa Range (on the boundary of Buller ED and Maimai ED).

Endemic; present in Buller/Kawatiri and Greymouth/Mawheranui Areas (present right on the boundary of the two areas).

4.17.4 Conservation status

DOC threat category is Data Deficient (ol) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994), but given secondary priority by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.17.5 Vulnerability

Risk factors

- Only known from a single site
- Possibly restricted range
- Apparently low population density
- Large body size means they are less able to evade predators than small lizard species (Whitaker 1978)

Positive factors

- Only known population is on protected land (Paparoa NP)
- Total extent of potential habitat in the Paparoa Range is extensive
- The habitat at higher elevations on the Paparoa Range appears to be stable
- Rock outcrop habitat and high altitude may confer some level of protection from predators

4.17.6 Threats

- Exposure to the full suite of introduced mammalian predators

4.17.7 Research needs

- Taxonomic studies—including genetic examination—to determine the taxonomic status and relationships of the Paparoa skink (this will require collecting more specimens)
- Formal taxonomic description (if needed)
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it is facing
- Assess population dynamics and density to determine whether conservation management intervention is needed

4.17.8 Survey needs

- Mount Micawber—Localised surveys to more accurately determine the size and extent of populations immediately around the original capture site

- Paparoa Range—Broad-scale survey, above the bush line, to determine the distribution and frequency of Paparoa skink populations in the Paparoa NP

4.17.9 Management actions

Objectives

To ensure the continued survival of the known population(s) of Paparoa skinks in order to secure the full geographic range of the species and the variety of habitats it occupies.

Tasks

Monitor the population at the known site, with a view to management intervention if necessary (subject to the results of survey and research recommendations above).

Action—Buller/Kawatiri and Greymouth/Mawheranui areas.

4.17.10 Key literature

Miller et al. 1999.

4.18 DENNISTON SKINK

4.18.1 Taxonomic status

Oligosoma indet sp. 'Denniston'—see Miller et al. 1999.

Two skinks of indeterminate taxonomic status have been captured at Denniston. It was thought the first (which was not retained) might represent a new species (Miller et al. 1999), but the second—although clearly the same taxon—shows strong similarities to Westland populations of the speckled skink. The second specimen was collected (FT6272), but it has not yet been subjected to genetic testing or examined in detail so its status and relationships remain unknown. Pending resolution of the taxonomy, the skinks from Denniston are being treated as a separate management unit (Hitchmough 2002c).

4.18.2 Description and habitat

Small (SVL 83 mm) brown, striped skink. Difficult to distinguish from the speckled skink and from taxa in the *nigriplantare* complex. Broad, brown lateral band and lower lateral surface with light flecking; underside with indistinct darker stripes. Diurnal; terrestrial. Only known from modified habitat within the old township of Denniston, but elsewhere on the Denniston Plateau there is montane tussock grassland, sparse low shrubland, and extensive rocky areas. Both specimens found beneath debris within the old Denniston township.

4.18.3 Distribution

Nation-wide—Only known from Denniston Plateau, north Westland.

West Coast/Tai Poutini Conservancy—Known from two specimens collected at Denniston, at the western edge of the Denniston Plateau (Ngakawau ED).

Endemic; present in Buller/Kawatiri Area.

4.18.4 Conservation status

DOC threat category is Data Deficient (ol) (Hitchmough 2002a); unlisted by IUCN; not listed for conservation priority by Molloy & Davis (1994) but given secondary priority by Hitchmough (2002c).

Conservation status within WC/TP—High.

4.18.5 Vulnerability

Risk factors

- Only known from a single site
- Possibly restricted range
- Apparently low population density
- Not known to occur on protected land

Positive factors

- The total area of potential habitat on the Denniston Plateau and adjoining coal measures seems to be relatively extensive

4.18.6 Threats

- Exposure to the full suite of introduced mammalian predators
- Urban development (local threat at only known site)
- Expansion of the open cast coal mining industry
- Weed encroachment, primarily by gorse, broom, or wildling conifers—pines (*Pinus* spp.), larches (*Larix* spp.), and Douglas fir (*Pseudotsuga menziesii*) —could destroy open habitats by shading and eventually total re-vegetation

4.18.7 Research needs

- Taxonomic studies—including more detailed genetic examination—to determine the taxonomic status and relationships of the Denniston skink
- Formal taxonomic description (if needed)
- Determine the species' precise habitat requirements and habitat to better assess its vulnerability and the threats it faces
- Assess population dynamics and density to determine whether conservation management intervention is required

4.18.8 Survey needs

- Denniston area—Localised surveys to more accurately determine the size and extent of populations immediately around the original capture site
- Area between Buller River and Mokihinui River: Broad-scale survey, from vicinity of Denniston to Stockton, to determine the distribution and frequency of Denniston skinks on the 'coal measures' plateaux

4.18.9 Management actions

Objectives

To ensure the survival of the known population of Denniston skinks until such time as their taxonomic and conservation status is known.

[If needed] to ensure the continued survival of populations at key sites that secure the full geographic range and are representative of the major habitats occupied by the species.

Tasks

Monitor the population at the known site, with a view to management intervention if necessary (subject to the results of survey and research recommendations above).

Action—Buller/Kawatiri area.

4.18.10 Key literature

Miller et al. 1999.

5. Conclusions

Research and survey in the past decade or so has uncovered a remarkable diversity in the lizard fauna of West Coast/Tai Poutini Conservancy. The belief had been that, apart from 'forest geckos', lizards—and especially skinks—were very scarce, and at best comprised small isolated populations of widespread species. Recent taxonomic studies, in particular using sophisticated genetic techniques, have revealed this is far from the case, and the fauna comprises a number of cryptic taxa within or related to *Hoplodactylus granulatus*, *H. maculatus*, *Oligosoma nigriplantare,* and *O. infrapunctatum*. There are also a few taxa that must still be regarded as indeterminate. What is also noteworthy is that a significant number of these taxa are confined to Westland. Two other features of this fauna must also be noted—many of the taxa are morphologically so similar they are extremely difficult to identify with certainty without recourse to genetic techniques, and many of the taxa have extremely restricted ranges or are known from very few localities. Good data is mostly lacking for even the better-known species, so further research and/or survey work is required to establish their true conservation status and the need for management action.

Taumaka Island is the only Westland island from which lizards have been recorded—two apparently endemic species—but unfortunately they are threatened by an introduced population of weka. Conservation of these lizard species would benefit immensely from the removal of the weka, but if that is not possible, habitat enhancement may provide some relief from predation. Whatever happens with weka, WC/TP must develop a co-management agreement with the iwi owners of the islands to ensure the islands receive the best conservation management. In particular it is important that introduced predators, pests, or lizard pathogens do not become established, and contingency plans must be maintained and staff prepared for action in the unlikely event that they do.

On the mainland, conservation management for most lizard taxa within WC/TP is presently restricted by a lack of good data on the identity, distribution, population status, and so on. Fortunately, a significant portion (c. 84%) of the land in Westland is publicly managed conservation land. This means that the habitat of lizards is relatively safe from destruction or modification (except perhaps from browsing mammals). However, irrespective of land tenure all mainland lizard populations are exposed to introduced predators and—especially in the north—to severe competition from vespulid wasps. A very few lizard taxa in WC/TP are presently known only from habitats which are at risk (e.g. Grey Valley skink) and these will require a level of management intervention. For most, however, the greatest need is the collection of much more detailed information on distribution and conservation status, so that appropriate action can be taken when needed.

This action plan sets out a number of actions that are regarded as essential for determining the status of, and safeguarding the lizard fauna in Westland. These include:

- Research crucial to understanding the lizard fauna and those facets of the species' biology and ecology critical to their conservation
- Surveys to determine distribution and relative abundance
- Monitoring and management activities to determine population trends and secure those species that require intervention

The most important actions within the WC/TP Conservancy are listed in priority order (within each category):

A. RESEARCH

1. Resolution of the taxonomy and formal description of the lizard fauna. Without a clear understanding of the taxa—'conservation units' (Miller & Daugherty 2000)—informed conservation management is not possible
2. Habitat and population studies of high- and moderate-priority species.
3. Determine the impacts of weka on the endemic gecko and skink species on the Open Bay Islands
4. Use genetic techniques to re-assess the taxonomic status of different populations of widespread, variable species and to interpret hybridisation zones of closely-related, parapatric taxa
5. Investigate the impacts of predation and competition by introduced species on mainland lizard populations

B. SURVEY

1. The local distribution of high-priority species, or those known to be rare or threatened
2. Major habitats for which there is inadequate data (e.g. all islands, subalpine habitats along the Southern Alps, coastal habitats in South Westland)
3. Districts for which there is clearly inadequate data (e.g. Franz Josef/Waiau Area, South Westland/Weheka Area)
4. To establish the geographical limits of range for taxa confined to, or extending to, the conservancy
5. To determine boundary zones between allo- or parapatric taxa

C. MANAGEMENT

1. Develop management protocols with the iwi owners of the Open Bay Islands to ensure long-term protection of the endemic lizard species. Maintain rigorous quarantine and contingency plans (including fire control) for the Open Bay Islands and advocate for removal of weka
2. Secure representative sites for species that do not have habitat already covered by formal protection
3. Monitor the populations of key species at key sites and develop contingency plans for a reactionary response
4. Undertake staff training and advocacy, and promote conservation of the lizard fauna with the public and all other stakeholders
5. Legally secure sites to secure species' limits of range where these occur within WC/TP and are not already covered by formal protection

6. Acknowledgements

This report is the fourth publication that addresses the conservation status and management of the lizard fauna on a Conservancy-wide basis—a series which originated from a concept developed by Andy Roberts (Roberts 1999; Whitaker & Gaze 1999; Whitaker et al. 2002). As a result, it is clearly modelled on those earlier documents, and benefits from the input of all who helped with them. We are grateful to Lynn Adams, Rod Hitchmough, Clare Miller, and Mandy Tocher for their constructive comments. Rod and Clare kindly provided invaluable advice on geckos and skinks, respectively. We also thank Gary Eason for producing the maps.

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8. Glossary and abbreviations

8.1 GLOSSARY

allopatric	having distributions that do not overlap
crenated	having a notched edge
cryptozoic	active under cover or in darkened places
denticulate	tooth-like markings
ectotherm	'cold-blooded' animal in which body temperature is largely determined by external temperature sources and controlled by behavioural means
herpetofauna	amphibian and reptile fauna
herpetology(ist)	study of (person studying) amphibians and reptiles
morphocline	quantitative change in a species' morphology across its range associated with geographical, ecological or other factors
parapatric	having distributions that abut, but do **not** overlap
saxicolous	rock-dwelling
sensu	as defined by
sensu lato	in the broadest sense
sensu stricto	in the strictest sense
sympatric	having distributions that overlap, occurring in the same place
syntopic	occurring in the same place **and** in the same microhabitat

8.2 ABBREVIATIONS

ARDS	Amphibian and Reptile Distribution Scheme database
BRU	Biodiversity Recovery Unit, Department of Conservation
CAS	Conservancy Advisory Scientist
CRI	Crown Research Institute
DOC	Department of Conservation
ED	Ecological District
ER	Ecological Region
FT	National Frozen Tissue Collection
GIS	geographical information system
indet.	Indeterminate
IUCN	International Union for the Conservation of Nature and Natural Resources

MONZ	Museum of New Zealand—Te Papa Tongarewa
N/A	not applicable
NP	National Park
NZHS	New Zealand Herpetological Society
NZMG	New Zealand mapping grid
PMB	Programme Manager Biodiversity
s.	section
s.l.	sensu lato
SOP	Standard Operating Procedure
SRARNZ	Society for Research on Amphibians and Reptiles in New Zealand
SRP	Species Recovery Plan
s.s.	sensu stricto
SRU	Science Research Unit, DOC
SVL	snout–vent length
TSO	Technical Support Officer
WC/TP	West Coast/Tai Poutini Conservancy
ybp	years before present

8.3 DEFINITIONS AND CONVENTIONS

monitoring	systematic recording of population parameters over time to determine change
survey	once-off field work over a relatively short time to obtain knowledge of distribution, habitat use and population parameters
scientific names	where a taxon has not been formally described it has been given an interim 'tag name' in single quotes that reflects its distribution or where it was first found, e.g. *Hoplodactylus* sp. 'Open Bay Islands', *Oligosoma* sp. 'Paparoa'.
common names	where well-established and widely adopted common names for taxa do not exist, an interim common name is given for convenience, e.g. Grey Valley skink, Okarito forest gecko.

9. Distribution maps

The following maps show the distribution of the lizard species in the West Coast Conservancy in relation to the and main geographic features. These maps, derived largely from the *HERPETOFAUNA* database (see Appendix 3), are **indicative of distribution** only, and are **not comprehensive**. As such they reveal inadequacies in the quality, quantity and coverage of the records held in the database, thus hopefully prompting the contribution of further field records and leading eventually to a much better understanding of the lizard fauna.

When using these maps key points to note are:

- The statements on distribution given in the species accounts (see Section 4) are based on a wide variety of sources, many of which are not in the *HERPETOFAUNA* database. Thus they complement the data shown in the maps.
- The precision of records shown on the maps is dependent on the quality of the original data submitted to *HERPETOFAUNA*. Further loss of precision has resulted from the conversion of records, mostly the earlier ones, from the imperial grid to the metric NZMG, or when records were located only to grid square (which for mapping is always taken as the co-ordinates of the SW corner). Thus, in extreme cases, conversion of records originally based on the imperial 10 000-yard grid can result in the position of the map symbols being displaced by as much as 10 km—though usually precision will be <1 km.
- The species mapped together were selected to minimise the chance of an overlap at any one location. However, where this occurred the symbols were moved apart slightly so that each can be clearly seen. This will have resulted in a minimal loss of accuracy.

In the following maps the broad distribution of the lizard species on the West Coast is shown in relation to the Conservancy boundaries (area boundaries are shown by black lines on Fig. 1).

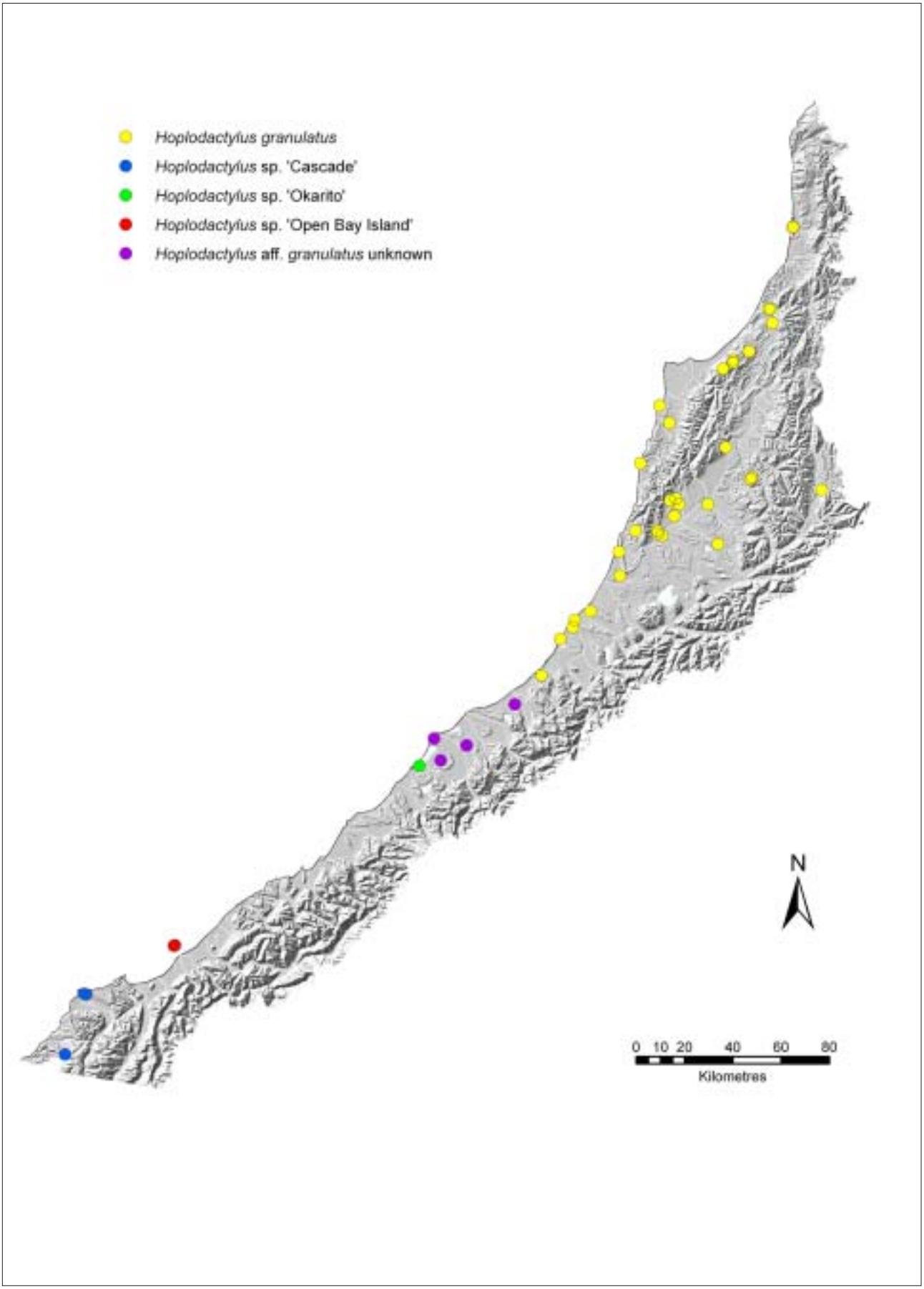

Figure 2. Distribution of *Hoplodactylus granulatus, Hoplodactylus* sp. 'Cascade', *Hoplodactylus* sp. 'Okarito', *Hoplodactylus* sp. 'Open Bay Island', and *Hoplodactylus* aff. *granulatus* unknown.

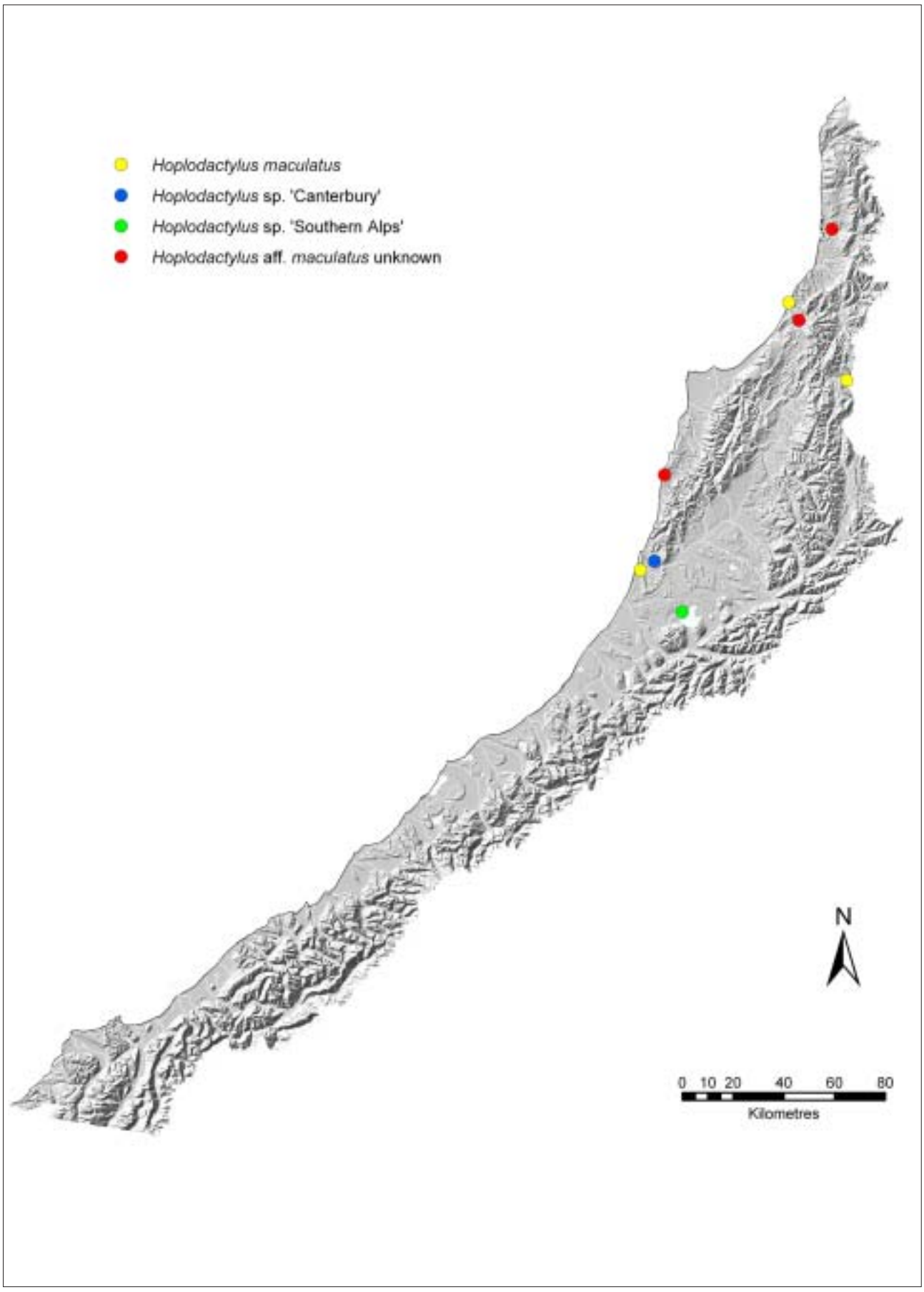

Figure 3. Distribution of *Hoplodactylus maculatus, Hoplodactylus* sp. 'Canterbury', *Hoplodactylus* sp. 'Southern Alps', and *Hoplodactylus* aff. *maculatus* unknown.

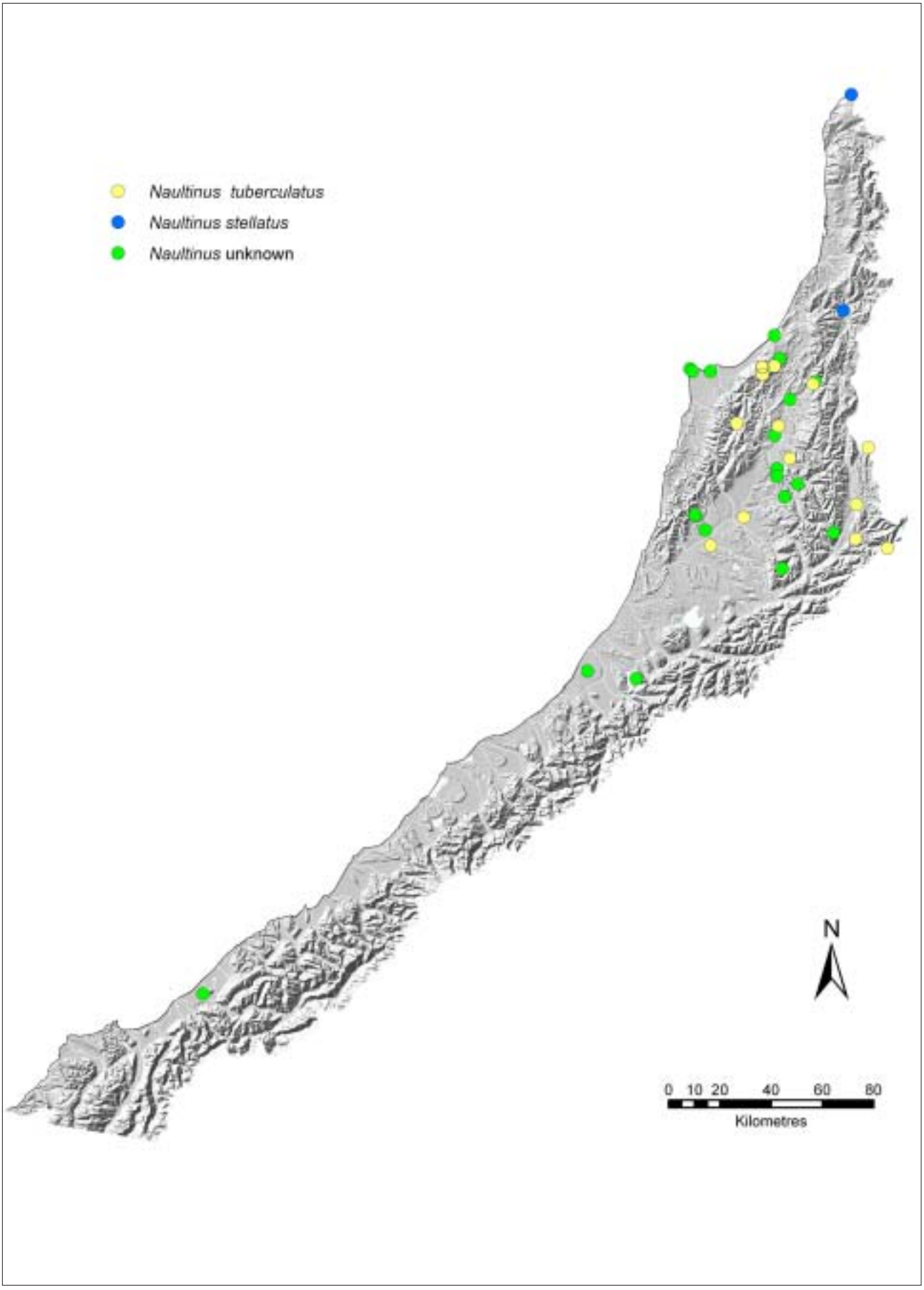

Figure 4. Distribution of *Naultinus tuberculatus, Naultinus stellatus*, and *Naultinus* unknown.

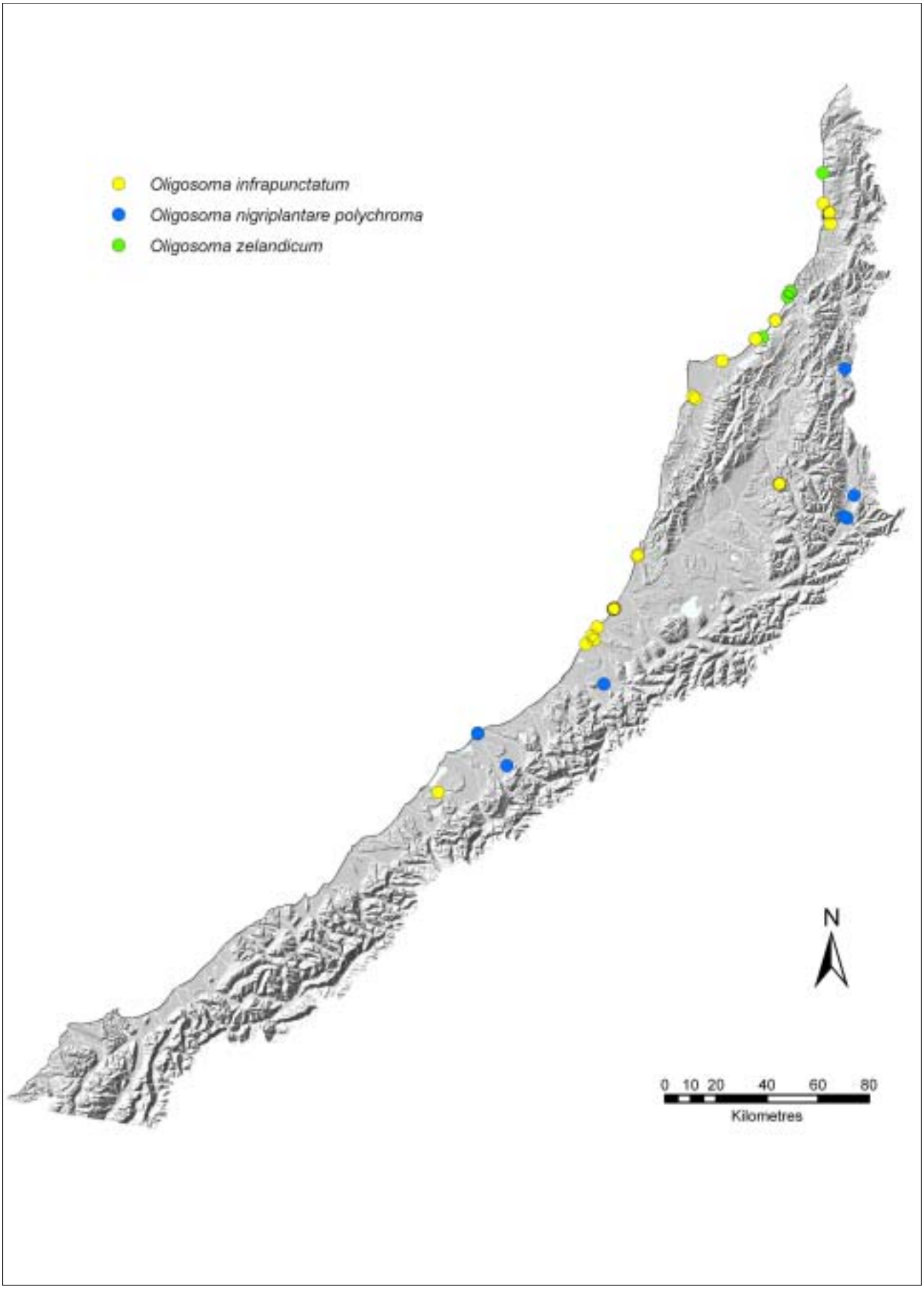

Figure 5. Distribution of *Oligosoma infrapunctatum*, *Oligosoma nigriplantare polychroma*, and *Oligosoma zelandicum*.

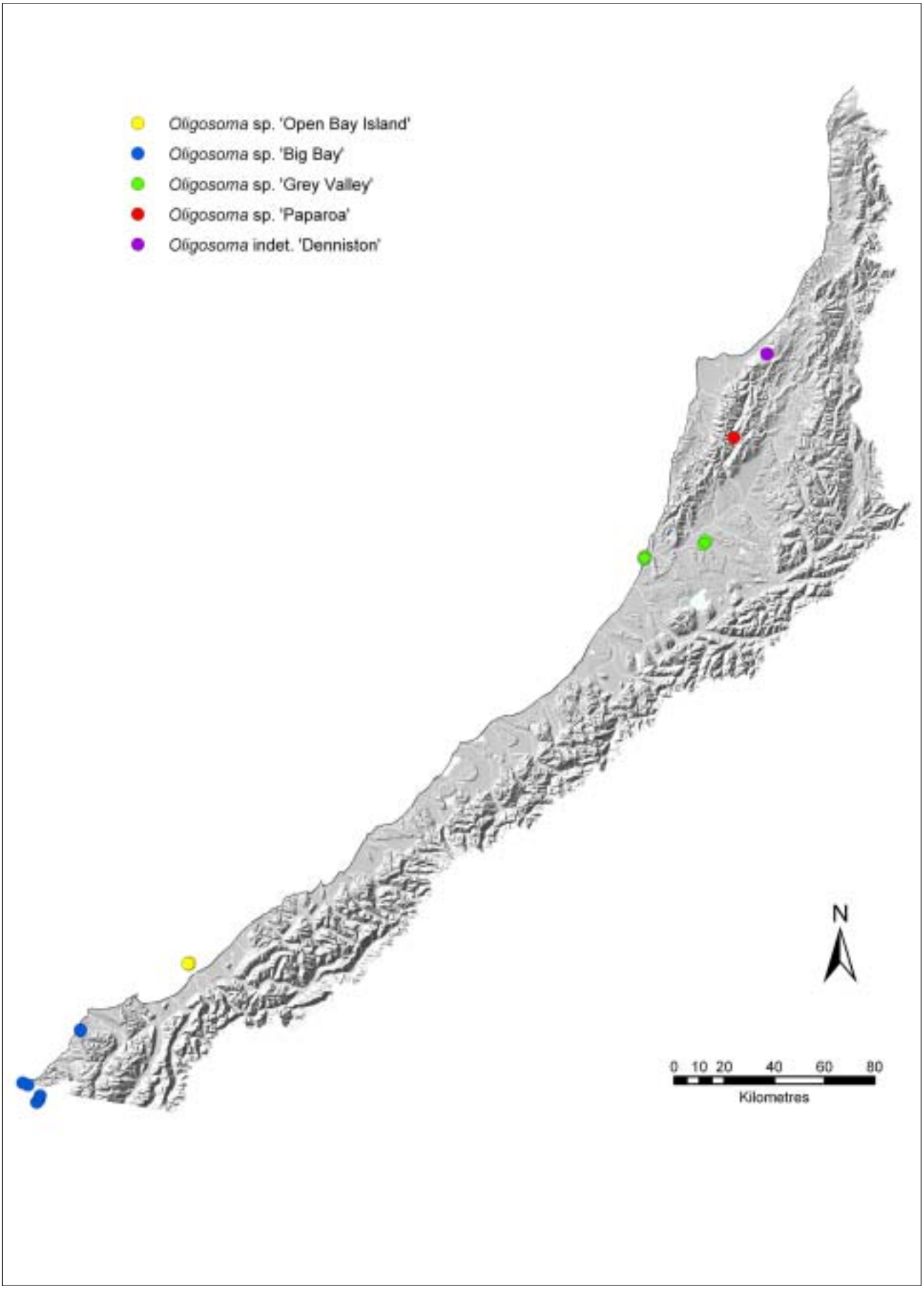

Figure 6. Distribution of *Oligosoma* sp. 'Open Bay Island', *Oligosoma* sp. 'Big Bay', *Oligosoma* sp. 'Grey Valley', *Oligosoma* sp. 'Paparoa', and *Oligosoma* indet. 'Denniston'.

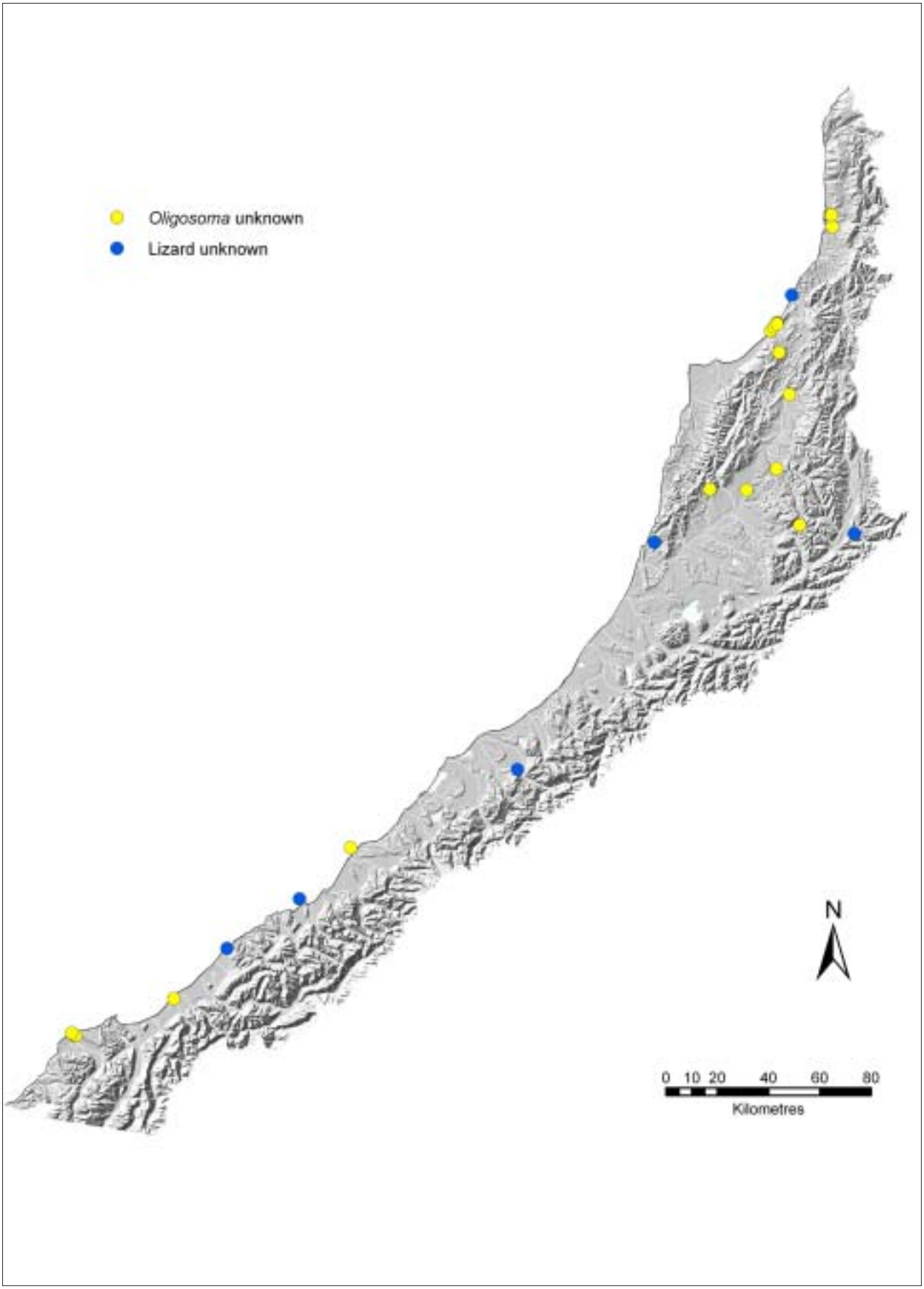

Figure 7. Distribution of *Oligosoma* unknown, and Lizard unknown.

Appendix 1

CONTEXT OF THE HERPETOFAUNA

A tabulated summary of the New Zealand herpetofauna in relation to Department of Conservation conservancies (as at October 2002).

Notes to the Table (on next page).

A. Species richness—number of species in each conservancy where *n* is the total fauna. The total herpetofauna is determined from Daugherty et al. (1994), with additions from Patterson & Daugherty (1994), Hitchmough (1997, 2002a), Patterson (1997), Bell et al. (1998), and Rod Hitchmough (pers. com.).

B. Endemism—number of species with an extant distribution confined to a single conservancy.

C. Distribution—number of species with an extant distribution confined to the mainland (North Island and/or South Island, excluding Stewart Island) or to islands (including lake islands).

D. Conservation status—the DOC conservation priority ranking (Molloy & Davis 1994), DOC threat ranking (Hitchmough 2002a) and the IUCN '*Red List*' threat category (IUCN 1996, 2000; Bell 1997). The DOC threat categories are: Acute Threatened (Nationally Critical, Nationally Endangered, and Nationally Vulnerable), Chronically Threatened (Serious Decline and Gradual Decline), At Risk (Range Restricted and Sparse), Data Deficient, and Not Threatened (Molloy et al. 2002).

Bold numerals indicate row maxima.

		Northland	Auckland	Waikato	Bay of Plenty	Tongariro / Taupo	East Coast / Hawkes Bay	Wanganui	Wellington	Nelson / Marlborough	West Coast / Tai Poutini	Canterbury	Otago	Southland
A. Species richness														
Total herpetofauna	(*n* = 79)	**24**	18	19	14	7	10	12	14	23	17	13	15	17
Frogs	(*n* = 4)	1	1	**2**	1	–	1	–	–	**2**	–	–	–	–
Tuatara	(*n* = 2)	1	1	1	1	–	–	–	–	**2**	–	–	–	–
Lizards	(*n* = 73)	**22**	16	16	12	7	9	12	14	19	17	13	15	17
Geckos	(*n* = 38)	11	6	6	5	2	3	5	6	**13**	9	7	8	7
Hoplodactylus	(*n* = 30)	8	5	5	4	1	2	4	5	**9**	7	4	7	6
Naultinus	(*n* = 8)	3	1	1	1	1	1	1	1	**4**	2	3	1	1
Skinks	(*n* = 35)	**11**	10	10	7	5	6	7	8	6	8	6	7	10
Cyclodina	(*n* = 8)	**7**	5	5	2	1	2	2	4	–	–	–	–	–
Oligosoma	(*n* = 27)	4	5	5	**5**	4	4	5	4	6	8	6	7	**10**
B. Lizard endemism														
Lizards		**8**	2	–	–	–	–	–	1	4	7	1	4	7
Geckos		**6**	1	–	–	–	–	–	1	4	3	1	3	3
Hoplodactylus		**4**	1	–	–	–	–	–	1	3	3	1	3	3
Naultinus		**2**	–	–	–	–	–	–	–	1	–	–	–	–
Skinks		2	1	–	–	–	–	–	–	–	**4**	–	1	**4**
Cyclodina		**1**	–	–	–	–	–	–	–	–	–	–	–	–
Oligosoma		1	1	–	–	–	–	–	–	–	**4**	–	1	**4**
C. Lizard distribution														
Lizard spp. only mainland		2	–	–	–	–	–	–	1	**7**	**7**	5	**7**	6
Endemic spp. only on mainland		2	–	–	–	–	–	–	–	3	**5**	–	3	2
Lizard spp. only on islands		**9**	6	3	1	–	–	–	1	1	2	–	–	3
Endemic spp. only on islands		**4**	2	–	–	–	–	–	–	–	2	–	–	3
D. Lizard conservation status														
DOC Conservation Priority														
Category A	(n = 8)	1	**3**	1	2	2	1	2	–	–	1	–	2	2
Category B	(n = 11)	3	1	3	–	–	–	–	2	**5**	0	2	1	2
Category C	(n = 4)	**2**	–	–	–	–	–	1	1	–	–	–	–	1
DOC Threat Ranking														
Acutely Threatened	(*n* = 7)	–	1	–	–	–	–	–	–	–	2	–	**3**	2
Chronically Threatened	(*n* = 16)	3	2	3	4	4	3	4	4	5	2	**6**	**6**	5
At Risk	(*n* = 31)	**13**	6	6	2	–	–	1	3	8	3	2	1	7
Data Deficient	(*n* = 6)	–	1	1	1	1	–	1	–	–	**4**	–	–	1
Not Threatened	(*n* = 14)	6	6	6	**5**	3	6	6	**8**	6	5	5	5	2
IUCN '*Red List*' Threat Ranking														
Vulnerable (VU)	(n = 13)	3	3	**4**	2	2	1	2	2	**4**	–	2	3	1
Lower Risk (LR)	(n = 12)	3	2	3	2	1	–	2	2	**5**	2	2	–	4

Appendix 2

DISTRIBUTION OF LIZARDS IN ECOLOGICAL DISTRICTS

Distribution of lizard species in the 6 Ecological Regions and 34 Ecological Districts which lie wholly or partly in the West Coast/Tai Poutini Conservancy (McEwen 1987).

		H. maculatus	*H.* sp. 'Canterbury'	*H.* sp. 'Southern Alps'	*H. gramulatus* s.l.	*H. gramulatus*	*H.* sp. 'Cascade'	*H.* sp. 'Okarito'	*H.* sp. 'Open Bay Island'	*N. stellatus*	*N. tuberculatus*	*O. infrapunctatum*	*O.* sp. 'Open Bay Island'	*O. nigriplantare polychroma*	*O.* sp. 'Grey Valley'	*O. zelandicum*	*O.* sp. 'Big Bay'	*O.* sp. 'Paparoa'	*O.* indet. 'Denniston'
North-west Nelson																			
46.05	Heaphy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–	–
46.06	Wangapeka	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–	–	–	–
46.08	Karamea	O	–	–	–	O	–	–	–	–	–	O	–	–	–	O	–	–	–
46.09	Matiri	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
North Westland																			
48.01	Ngakawau	–	–	–	–	O	–	–	–	–	O	–	–	–	–	O	–	–	O
48.02	Foulwind	–	–	–	–	O	–	–	–	–	O	O	–	–	–	–	–	–	–
48.03	Buller	–	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–	–	–
48.04	Reefton	O	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–	–	–
48.05	Punakaiki	–	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–	–	–
48.06	Maimai	–	–	–	–	O	–	–	–	–	O	–	–	–	O	–	–	O	–
48.07	Totara Flat	–	–	–	–	O	–	–	–	–	O	O	–	–	–	–	–	–	–
48.08	Blackball	–	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–	–	–
48.09	Hochstetter	–	–	–	–	O	–	–	–	–	O	–	–	–	O	–	–	–	–
48.10	Greymouth	O	?	–	–	O	–	–	–	–	–	O	–	–	O	–	–	–	–
48.11	Brunner	–	–	O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Spenser																			
49.01	Rotoroa	–	–	–	–	–	–	–	–	–	O	–	–	O	–	–	–	–	–
49.03	Ella	–	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–	–	–
49.05	Hope	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Whataroa																			
50.01	Hokitika	–	–	–	–	O	–	–	–	–	–	O	–	O	–	–	–	–	–
50.02	Whitcombe	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.03	Harihari	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.04	Wilberg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.05	Waiho	–	–	–	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–
50.06	Glaciers	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.07	Karangarua	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.08	Mahitahi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

		H. maculatus	*H.* sp. 'Canterbury'	*H.* sp. 'Southern Alps'	*H. granulatus* s.l.	*H. granulatus*	*H.* sp. 'Cascade'	*H.* sp. 'Okarito'	*H.* sp. 'Open Bay Island'	*N. stellatus*	*N. tuberculatus*	*O. infrapunctatum*	*O.* sp. 'Open Bay Island'	*O. nigriplantare polychroma*	*O.* sp. 'Grey Valley'	*O. zelandicum*	*O.* sp. 'Big Bay'	*O.* sp. 'Paparoa'	*O.* indet. 'Denniston'
Aspiring																			
51.01	Paringa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51.02	Mataketake	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51.03	Landsborough	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51.04	Haast	–	–	–	–	–	–	–	O	–	–	–	O	–	–	–	–	–	–
51.05	Okuru	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51.06	Arawata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Olivine																			
71.01	Cascade	–	–	–	–	–	O	–	–	–	–	–	–	–	–	–	O	–	–
71.02	Pyke	–	–	–	–	–	O	–	–	–	–	–	–	–	–	–	O	–	–

Appendix 3

HERPETOFAUNA DATABASE

HERPETOFAUNA, formerly known as ARDS (the Amphibian and Reptile Distribution Scheme), is the national database for all herpetological distribution records. It is an essential resource for determining the distribution of lizard species and hence for making decisions on the conservation actions required to prevent losses and to restore biodiversity.

The database was originally established by Ecology Division, DSIR, in the early 1970s, passed to the NZ Wildlife Service in 1983—where it was computerised—and thence to DOC. It is currently managed by SRU through the Southern Regional Office, and operates from the Otago Conservancy offices in Dunedin.

Records stored in the database contain the standard data-fields, including date, observer, locality, grid reference, altitude, species, weather, habitat, and so on. All grid references have been converted to—and are stored in—NZMG format.

Data from *HERPETOFAUNA* is available from *BIOWEB* on the DOC intranet or directly from the database manager, Benno Kappers (bkappers@doc.govt.nz). It is possible to extract records and report on a wide range of parameters such as species, location, grid reference, date, observer, and conservancy. Output can be supplied in Access™ or Excel™ format or printed directly to distribution maps through GIS software (e.g. ArcView™). Note, however, that changing nomenclature since the database was established means the species parameters must be carefully defined and the output interpreted with caution. Data to 1988 has been published in atlas form (Pickard & Towns 1988).

For the *HERPETOFAUNA* database to remain effective it is important that it is kept right up to date. To achieve this, it is essential that all people working with or making observations on lizards in WC/TP should submit records, preferably on the ARDS form. Blank copies of the record form are available from the TSO at the conservancy office or can be photocopied. Completed record forms should be sent to the TSO for submission to the database manager, and copied to the relevant area office files.

When completing ARDS forms it is important to strive for correct identification. Unfortunately, this is not always easy or possible—particularly in WC/TP, where many of the taxa are poorly-known, ill-defined, or morphometrically very similar. Any record is better than none, so contributors are urged to include detailed notes on the identifying features they use for any animals they are in the slightest bit unsure about. It is also important to note whether specimens or photographs were taken, and where they are now held, and whether expert assistance was used with the identification.

Appendix 4

HOLDING AND TRANSPORTING LIZARDS

Because of the problems with identification that are likely to be encountered in WC/TP in very many cases it will be necessary to hold lizards for a short period, or bring them in from the field while identification is confirmed. Some may even need to be shipped alive to specialists.

By far the most practical field containers for lizards are cloth bags. Light, soft cloth—such as calico—provides adequate ventilation, is light to carry, and bags take up very little space when not in use, but they do require care to ensure that any lizards they contain are not crushed. Bags should be sewn carefully to ensure there are no loose threads to entangle or damage the lizards. They should be tightly fastened with a tie around the outside—**NOT with a drawstring** or lizards will escape through the narrow opening. Alternative field containers are small **well-ventilated** wooden or plastic boxes (e.g. 2 litre ice-cream tubs).

Several lizards (2–4) can safely be held together in a cloth bag without packaging. If more lizards are held in a bag, or if a box is being used, it is better to provide loose packing material (such as grass or leaves). This allows the lizards to keep away from each other and prevents them getting knocked around when the container is moved. Be careful not to put large predatory species (usually big skinks) into the same container as smaller animals!

Bags or boxes containing lizards **must be kept in a cool place**. Lizards are ectotherms and use behavioural means to maintain their body temperature below a critical threshold. They will quickly become stressed and die if they are unable to do so. Take particular care to avoid leaving lizard containers in direct sunlight or in a hot place (e.g. inside a closed vehicle).

It will not be necessary to feed captive lizards if they are being held for only a short period (e.g. less than a week), especially if this is during winter. However, it is very important that they do not dehydrate and in hot, dry weather bags or boxes should be regularly moistened. A shallow water dish should be provided in temporary housing.

If animals are to be kept in captivity for extended periods (i.e. longer than 3–4 weeks) it is important that proper guidance on housing and husbandry is sought. DOC has protocols on captive maintenance of lizards and the TSO can arrange for introductions to experienced herpetoculturists if need be. Additional information on husbandry is available from the NZHS or from the society's publications by Porter (1989) and Rowlands (1999).

The best way to send live lizards for specialist identification is by courier. The lizards should be packed into a relatively small, robust container, with a tightly-fitting lid and adequate ventilation, e.g. a 2-litre plastic ice-cream tub with numerous small (3–4 mm) holes drilled or punched into it. For additional security and safety the lizards should be tied into a cloth bag inside this container (or if this is not possible the container should be loosely filled with

grass or leaves to prevent the lizard(s) being tossed around during transit). The bag or packing material should be lightly moistened, but **not** sodden. The lid should be securely taped shut to prevent it being dislodged then the container loosely wrapped in paper. Clearly mark the package 'LIVE ANIMALS—KEEP FROM HEAT', and include **full addresses and contact phone numbers** for both the recipient and sender. **Before** sending the package, advise the intended recipient to expect and to confirm someone is there to receive it—this is especially important with shipments to places such as universities, where the courier will deliver only to the institution, not to the addressee. Provided weekends and public holidays are avoided, an over-night service is available between most parts of New Zealand and properly packaged lizards will comfortably survive for well over a week.

In the unfortunate circumstance that a lizard is killed during capture or dies in captivity—or if a lizard is found dead—keep in mind that in nearly all cases it has a scientific value. The preferred preservative is 70% ethanol, but formalin can be used or for temporary storage the specimen can be frozen. Either inject some preservative or open the body cavity (not along the mid-line) to ensure rapid and complete preservation. Note that even decomposed or dehydrated specimens are of value if they are rare species or from an unusual locality, or if they can be converted to skeletal specimens. The Museum of New Zealand—Te Papa Tongarewa, in Wellington, is the national repository for all indigenous reptile specimens.

Appendix 5

INFORMATION SOURCES

Identification

Currently two field guides to the New Zealand lizards are available. '*New Zealand Frogs and Reptiles'* (Gill & Whitaker 2001, available through bookshops) has keys to all species as well as colour photographs and brief accounts of the morphology, colour, distribution, habits and habitats of each. '*A field guide to the lizards of New Zealand'* (Towns 1988, available only from DOC) only has keys to the species. Other recent popular guides that cover the entire lizard fauna are '*The Penguin guide to New Zealand wildlife: native and introduced birds, mammals, reptiles and amphibians*' (DOC 2002, available from DOC and bookshops) and *'New Zealand amphibians and reptiles in colour*' (Robb 1986, available in most libraries). Timberlands West Coast Ltd produced a field guide to the fauna of their forests that includes the lizard taxa of north Westland (Christian 1999).

Taxonomic reviews, including keys for identification, are available for skinks (Hardy 1977) and geckos (Bauer 1990), the latter also summarising biological data and the literature. Bauer & Henle (1994) has keys to the gecko fauna and Hitchmough (1997) provides a more up-to-date review of the genus *Hoplodactylus,* but as yet is unpublished. Additional papers relevant to the taxonomy and identification of South Island skinks are Patterson & Daugherty (1990, 1995) and Patterson (1997).

Interest in and research on the lizard fauna has increased dramatically since the 1960s. As a consequence of this, the taxonomy seems to be ever-changing as field workers discover new taxa and increasingly sophisticated laboratory techniques identify cryptic species within what were earlier thought to be widespread taxa. Many of these new taxa are yet to be formally described and named. Correct specific identification is the cornerstone of conservation decision-making and management yet many of the lizard species—especially in Westland—are well nigh impossible to distinguish on morphological characters alone. The TSO can provide advice on the latest taxonomic developments or on which specialists should be consulted for assistance with identifications.

Distribution

The basic source of distribution data on lizards is the *HERPETOFAUNA* database (formerly ARDS) (see Appendix 3). Data from this database to 1988 was published in map form in the '*Atlas of the amphibians and reptiles of New Zealand*' (Pickard & Towns 1988, now out of print—consult your library). Distribution maps for New Zealand geckos, based on a slightly different dataset (i.e. literature records and museum specimens), were published by Bauer (1990) and Bauer & Henle (1994). Furthermore, distribution maps or detailed summaries of locality data are included in most taxonomic or review papers (e.g. Hardy 1977).

Literature

The most comprehensive literature source for New Zealand lizards is '*New Zealand lizards: an annotated bibliography*' (Whitaker & Thomas 1989, available from Landcare Research, Private Bag 6, Nelson). This all-inclusive list of published and unpublished references to 1988 includes a brief summary of each entry plus comprehensive indices under species, geographical area and subject. Bauer (1990) and Bauer & Henle (1994) both contain detailed literature reviews for each gecko species and exhaustive reference lists, and most other review papers (e.g. Hardy 1977) also provide good access to the literature. '*SRARNZ notes*' (see below), contains lists of New Zealand herpetological literature—published and unpublished—since 1992.

Current contacts (as at 2004)

For any herpetological enquiry the first point of contact should be the TSO, who will be able to provide up-to-date advice on where to obtain further information.

DOC presently employs three full-time herpetologists in SRU (Dave Towns, Auckland; Keri Neilson, Hamilton; and Mandy Tocher, Dunedin). In addition Don Newman (SRU) and Rod Hitchmough (BRU), both in Wellington, have considerable herpetological expertise. Beyond them, a number of other DOC staff in various parts of the country have detailed local or regional knowledge of the lizard fauna. There are also three Recovery Groups to manage Species Recovery Plans for lizards—the *Cyclodina* spp. plan (SRG leader Leigh Marshall), North Island *Oligosoma* spp. plan (SRG leader Nick Peet, Wanganui), and the Otago skink (*Oligosoma otagense*) and grand skink (*O. grande*) plan (SRG leader Dave Houston, Oamaru) (Whitaker & Loh 1995, Towns 1999, Towns et al. 2002). The *HERPETOFAUNA* database is managed by Benno Kappers (Napier).

Two New Zealand museums take an active role in herpetology. The Museum of New Zealand—Te Papa Tongarewa, in Wellington, is the national repository for all specimens of native amphibians and reptiles (current curator Raymond Coory); the Auckland Museum has a regional interest in New Zealand species and is the national repository for Pacific species (current curator Brian Gill).

Several universities have staff with special interests in herpetology or promote herpetological studies amongst students. At present those with the greatest interest in lizards are Massey University, Palmerston North (current contact Doug Armstrong), Victoria University of Wellington (current contacts Charlie Daugherty and Ben Bell), and Otago University, Dunedin (current contact Alison Cree).

The Society for Research on Amphibians and Reptiles in New Zealand (SRARNZ), formed in 1987 to promote the scientific study and conservation of the indigenous herpetofauna, has an active and well-informed membership of over 100. A society newsletter—*SRARNZ notes*—produced for members at irregular intervals provides information on discoveries, research, and people involved with herpetology in New Zealand. Current contact for SRARNZ is through the secretary, Kelly Hare, at the School of Biological Sciences, Victoria University, PO Box 600, Wellington, New Zealand, or via the SRARNZ website at: http://www.vuw.ac.nz/srarnz [sighted 2 March 2004]