4.1.2 Geckos

The two geckos found at Barrier Knob were Cascades geckos (*H.* aff. *granulatus*), as might be expected from the earlier findings of M. Judge and B. Judge in 2005 and Bell & Patterson (2006). This is a rock-dwelling, thigmothermic species that is sympatric with the skinks on Barrier Knob, sharing the same crevices or snow tussock vegetation. Some animals were captured while sunbasking, but we have no evidence whether this is a diurnal or nocturnal species.

4.2 SINBAD GULLY

4.2.1 Skinks

One adult male Sinbad skink was captured at 1200 m a.s.l. in Sinbad Gully on 10 March 2007. This specimen was medium to large, but slender (reaching up to 82 mm SVL, 188 mm TL, with a weight of 10 g; Fig. 5). The male was brightly coloured, with large green dorsal speckles against a black dorsal base colour, a black dorso-lateral band with large salmon-pink lateral speckles, pale grey chin and a belly flushed with vivid orange. It had a shiny, glossy appearance, and was characterised by long toes and a long tail. Genetic analysis by D. Chapple (pers. comm. 2007) on both the original animal captured by T. Jewell (RE 5315) and this adult, placed this species in the Fiordland skink group, which includes the Barrier skink.

A distinctive looking skink was found only 10 m away from the capture site of the Sinbad skink. This skink was a small male (59 mm SVL, 121 mm TL, weight 3 g; Fig. 6). It was a deep and dark mahogany colour, with large eyes, a flat, wedge-shaped head and long toes. There were no dorsal stripes or markings, but very faint yellow dorso-lateral stripes and lateral speckles were present. This skink had a heavily black mottled chin, a dark yellow belly and a very glossy appearance.

Despite looking highly distinctive, genetic analysis of a tail sample from this skink (D. Chapple, pers. comm. 2007) indicated that it was genetically identical to the cryptic skink (*O. inconspicuum*) and, therefore, a part of this species complex. Its taxonomic status must remain unresolved until more specimens are examined. We recommend assigning the tag name 'mahogany skink' for this taxonomically indeterminate animal until more evidence is available on its taxonomic status.

Both skink species are likely to occupy cirque basin walls and similar steep rock terrain, foraging on ledges amongst vegetation and utilising crevices in the rock as refugia. Both skinks are also diurnal heliotherms. The striking green colouration of the Sinbad skink also suggests it has a strong association with the vegetation of the area. The live adult Sinbad skink discovered in this study was found among snow tussock vegetation on the cirque wall. The juvenile Sinbad skink discovered by T. Jewell in 2004 was found under loose rocks at the foot of the cirque wall.

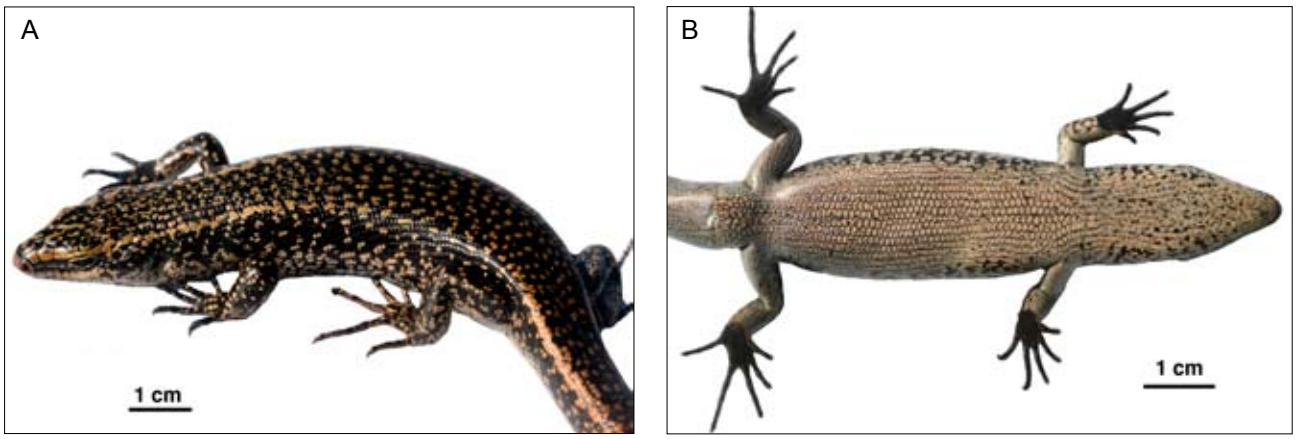

Figure 4. A. Dorsal and B. ventral views of the Barrier skink (*Oligosoma* sp. 'Barrier') from Barrier Knob, Darran Mountains, March 2007. *Photos: Trent Bell.*

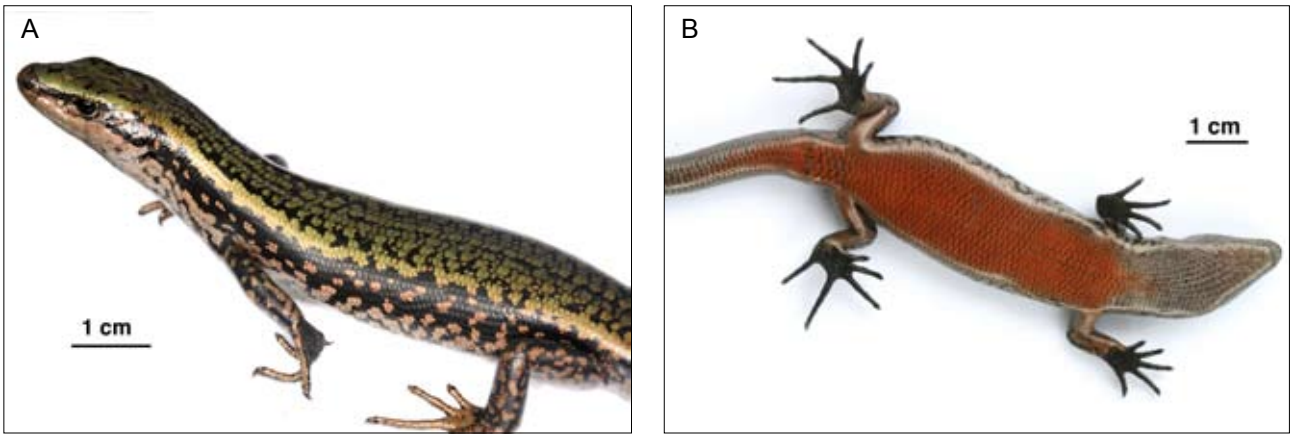

Figure 5. A. Dorsal and B. ventral views of the Sinbad skink (*Oligosoma* sp. 'Sinbad Valley') from the head of Sinbad Gully, March 2007. *Photos: Trent Bell.*

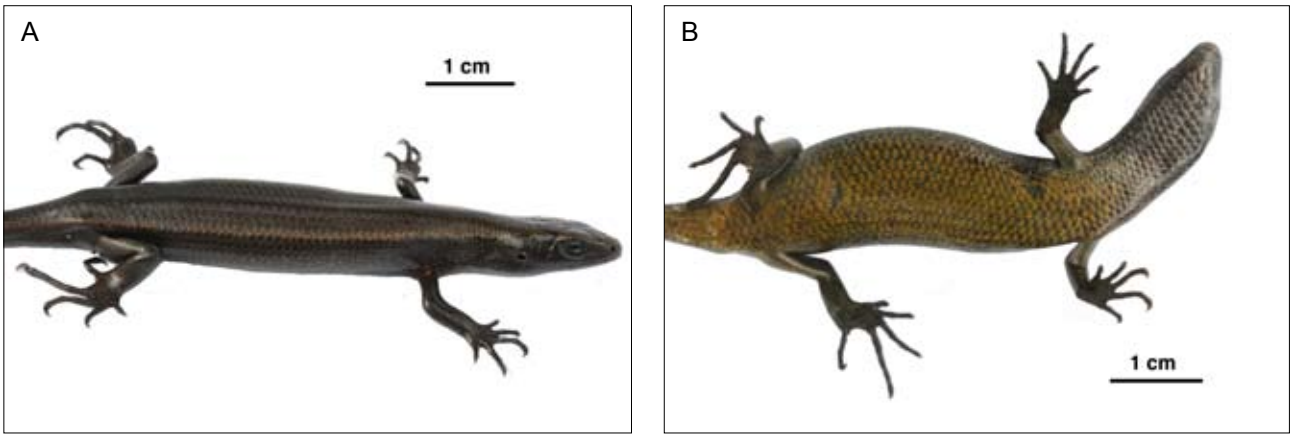

Figure 6. A. Dorsal and B. ventral views of the mahogany skink (*Oligosoma* sp. 'mahogany skink') from the head of Sinbad Gully, March 2007. *Photos: Trent Bell.*

4.2.2 Geckos

Three Cascades geckos were also captured at Sinbad Gully, confirming the presence of the species in this area. Previous accounts and blurry photographs taken by C. Jefferies (rock climber, pers. comm. 2007) and other rock climbers had indicated the presence of an unidentified gecko species in the Sinbad Gully.

The Cascades geckos are sympatric with the skinks, but their known range also extends to clean cliffs of the 'Shadowland' rock climbing wall (C. Jefferies, pers. comm. 2007). Activity and behaviour are as described for the same species on Barrier Knob (see section 5.1.2).

4.3 PREDATION RISKS

The survey reported here identified the recent presence of mice (*Mus musculus*) and possums (*Trichosurus vulpecula*) in the area. Weka (*Gallirallus australis*) are also present in the Sinbad Gully area.

5. Discussion

During this field expedition, 11 lizards were found over 5 days at the two Fiordland alpine survey sites. The study achieved its aim of obtaining sufficient data and material for the taxonomic description of the Sinbad skink (along with the juvenile assigned as the potential holotype specimen in Te Papa).

The unexpected discovery of one, and potentially two, new species of skink during our 2007 research on the Sinbad skink suggests that Fiordland is a potential 'hotspot' for lizard diversity (and especially for skinks in alpine areas). Lizards were not known in Fiordland until 1966, and the several new species of lizards discovered since, along with as-yet unidentified animals in the Tahake Valley (B. Lee, Landcare Research, pers. comm. 2008), Mt Titiroa (R. Heyward, Real Journeys, pers. comm. 2008), Command Peak (R. Jongens, Geological and Nuclear Sciences, pers. comm. 2007), and Halls Arm and Jane Burn areas (A.H. Whitaker, Whitaker Consultants, pers. comm. 2007), have been found comparatively recently.

At the same time, there is mounting evidence of lizard predators being recorded at higher altitudes, with mice and possums of particular note. Rock climbers now complain of mice stealing their lunch in Sinbad Gully (Jewell & Morris 2007), whereas mice were previously unheard of in this area. Similarly, in 1975 a botanical survey near the gully found no evidence of possums (Atkinson & Merton 1975), and subsequent fieldwork in the gully in 2004 by M. Tocher, T. Jewell and R. Morris further confirmed this situation (Jewell & Morris 2007); however, during this 2007 study, extensive possum sign was seen (severely browsed ferns, scats and even three dead bodies). This means there is now a need to determine the necessity of, and possible techniques for, controlling problem mammalian species in alpine areas of Fiordland.

5.1 SINBAD SKINK

Only two Sinbad skinks have ever been found in the Fiordland area, and the species is listed as 'Data Deficient' by Hitchmough et al. (2007). Further surveys at nearby sites and at higher elevations are required in Sinbad Gully with the aim of identifying the extent of this species' range and the habitat and microhabitats it occupies.

Potential predation pressure from mice and possums, combined with the presence of weka, could be a serious issue for this skink—and for all other alpine lizards. While there is currently no evidence of predation on alpine lizards, predation by mice on lowland lizard populations has been reported by several authors (Pickard 1984; Newman 1994; Towns & Elliott 1996; Lettink & Cree 2006). Possums have been recorded predating birds' eggs, birds and mammals (Brown et al. 1993), so it is likely that they will also eat lizards (Montague 2000). Therefore, we suggest either including the Sinbad Valley area in Operation ARK (a rodent and stoat knock-down programme in response to beech masting years to prevent irruptions), or resurrecting the 'mainland island' idea for the entire Sinbad Valley area, which was first mooted by Don Merton in 1975 for kakapo (*Strigops habroptilus*). Either programme is likely to be effective, as the area's sheer mountains form a natural physical barrier against introduced mammalian predators.

5.2 BARRIER SKINK

The Barrier skink now needs to be formally described[3]. Surveys will also be needed to establish the range and conservation status of this species. The altitude these skinks inhabit probably provides them with some degree of protection from introduced mammalian predators.

The discovery of the Barrier skinks in this study has led to the re-evaluation of the skink from Students Peak, collected by Choate in 1966. It was initially thought to be a Sinbad skink (Bell & Patterson 2006), but has now been confirmed by us as belonging to the Barrier skink taxon. Further surveys are needed to identify the location of the skinks on Students Peak.

5.3 POSSIBLE NEW SKINK SPECIES FROM SINBAD GULLY

The status of the 'mahogany skink' that was found in Sinbad Gully (Fig. 6) and its relationship to *O. inconspicuum* remains to be determined[3]. Further surveys and monitoring will be necessary to establish its range, population size and trends, and conservation status. This taxon is likely to face the same threats as the Sinbad skink; therefore, the same conservation and research actions will be required for both taxa.

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[3] Further field trips to the study areas have since been undertaken by the authors in February and March 2008, as part of the 2-year South-western South Island *Oligosoma* Taxonomic Units project funded by DOC (T. Bell & G. Patterson, unpubl. data). Voucher specimens of the Barrier skink and 'mahogany skink' were collected. Formal taxonomic descriptions of the Barrier skink are expected later in 2008.

6. Recommendations

Based on discussions with DOC (Henderson 2007) and the findings described in this survey, the authors recommend that the following research be undertaken:

- Development of surveying and monitoring methods to aid assessment of the presence of lizards in alpine areas, and determination of their distribution ranges, population trends and conservation status.
- Surveys to identify further populations of all three skink species (Sinbad, Barrier and mahogany) within the wider Llawrenny Peaks and Darran Mountains area to establish the actual range of each species.
- Investigation into the presence, altitudinal reach, population cyclical patterns and impacts of mice, rats, stoats and possums on lizards in the alpine zones of the Darran Mountains and Llawrenny Peaks.

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8. References

Atkinson, I.A.E.; Merton, D. 1975: Habitat and diet of kakapo (*Strigops habroptilus*) in the Esperance Valley, Fiordland, New Zealand. *Notornis 53(1)*: 37–54.

Bell, T.P.; Patterson, G.B. 2006: Sinbad skink survey 09 February – 11 February 2006: a report to Southland Conservancy. Unpublished report to Southland Conservancy, Department of Conservation, February 2006. 12 p.

Brown, K.; Innes, J.; Shorten, R. 1993: Evidence that possums prey on and scavenge birds' eggs, birds and mammals. *Notornis 40(3)*: 169–177.

Chapple, D.G.; Patterson, G.B. 2007: A new skink species (*Oligosoma taumakae* sp. nov.; Reptilia: Scincidae) from the Open Bay Islands, New Zealand. *New Zealand Journal of Zoology 34*: 347–357.

Hardy, G.S. 1977: The New Zealand Scincidae (Reptilia: Lacertilia); a taxonomic and zoogeographic study. *New Zealand Journal of Zoology 4*: 221–325.

Henderson, J. 2007: Fiordland lizard meeting, 25 May 2007. Minutes. Southland Conservancy, Department of Conservation (unpublished). 5 p.

Hitchmough, R.; Bull, L.; Cromarty, P. (Comps) 2007: New Zealand Threat Classification System lists—2005. Department of Conservation, Wellington. 194 p.

Jefferies, C. 2006: The Darran Mountains. An alpine and rock climbing guide. New Zealand Alpine Club. 312 p.

Jewell, T.; Morris, R. 2007: Sinbad Gully, valley of diamonds. *New Zealand Geographic 88*: 44–59.

Lettink, M.; Cree, A. 2006: Predation by the feral house mouse (*Mus musculus*) of McCann's skink (*Oligosoma maccanni*) constrained in pitfall traps. *Herpetofauna 36*: 61–62.

Loh, G. 2003: Te Kakahu skink hunt. Otago Conservancy, Department of Conservation (unpublished). 4 p.

McEwen, W.M. 1987: Ecological regions and districts of New Zealand. New Zealand Biological Resources Centre, Department of Conservation, Wellington.

Montague, T.L. (Ed.) 2000: The brushtail possum—biology, impact and management of an introduced marsupial. Manaaki Whenua Press, Lincoln. 292 p.

Newman, D.G. 1994: Effects of a mouse, *Mus musculus*, eradication programme and habitat change on lizard populations of Mana Island, New Zealand, with special reference to McGregor's skink, *Cyclodina macgregori. New Zealand Journal of Zoology 21*: 443–456.

Pickard, C.R. 1984: The population ecology of the house mouse (*Mus musculus*) on Mana Island. Unpublished MSc thesis, Victoria University of Wellington, Wellington. 234 p. + appendices.

Towns, D.R.; Elliott, G.P. 1996: Effects of habitat structure on distribution and abundance of lizards at Pukerua Bay, Wellington, New Zealand. *New Zealand Journal of Ecology 20(2)*: 191–206.

9. Glossary

Heliothermic Directly basking in the heat of the sun to obtain warmth.

Holotype A single physical example (or illustration) of an organism used to formally describe a species. It is either the single such physical example (or illustration), or one of several such that has been explicitly designated as the holotype. Holotypes act as a reference point for taxonomic work.

Morphometric Measurement data, e.g. snout-vent length, tail length. These data add a quantitative element to descriptions and can be used to make comparisons with other species.

Phenotype Any observable characteristic of an organism. Phenotypes result from the expression of an organism's genes as well as the influence of environmental factors and possible interactions between the two.

Sympatric Where organisms occur in overlapping geographical areas without interbreeding. For example, two species of a closely related taxon may share a geographic range, or parts of, but do not interbreed because they are two different species.

Thigmothermic Absorbing heat by contact with warm surfaces, e.g. rock surfaces.

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