

Alpine lizard research in Fiordland National Park

February-March 2007

Trent P. Bell, Geoffrey Patterson and Tony Jewell

DOC RESEARCH & DEVELOPMENT SERIES 304

Published by
Publishing Team
Department of Conservation
PO Box 10420, The Terrace
Wellington 6143, New Zealand

DOC Research & Development Series is a published record of scientific research carried out, or advice given, by Department of Conservation staff or external contractors funded by DOC. It comprises reports and short communications that are peer-reviewed.

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Hardcopy is printed, bound, and distributed at regular intervals. Titles are also listed in our catalogue on the website, refer www.doc.govt.nz under *Publications*, then *Science & technical*.

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ISSN 1176-8886 (hardcopy)

ISSN 1177-9306 (web PDF)

ISBN 978-0-478-14510-6 (hardcopy)

ISBN 978-0-478-14511-3 (web PDF)

This report was prepared for publication by the Publishing Team; editing by Helen O'Leary, layout by Amanda Todd and locality map by Arawana Ltd. Publication was approved by the General Manager, Research and Development Group, Department of Conservation, Wellington, New Zealand.

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February–March 2007

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ABSTRACT

In 2004, a new species of skink ('Sinbad skink'; *Oligosoma* sp. 'Sinbad Valley') was discovered in Fiordland National Park, South Island, New Zealand. Although the individual was collected as a potential holotype specimen, it was a juvenile; therefore, a taxonomic description of this species remained incomplete. Field expeditions were undertaken to the Darran Mountains and Llawrenny Peaks, Fiordland National Park, to collect data on and photographs of an adult Sinbad skink for the preparation of a formal taxonomic description of the species. The Barrier Knob and Sinbad Gully areas were surveyed and 11 lizards, including one Sinbad skink, were captured over 5 days. One possible new species of skink, which has been assigned the tag name 'Barrier skink', was discovered. Another skink (tentatively called the 'mahogany skink') may represent a second new species, but requires further investigation. The presence of introduced mammals and weka (*Gallirallus australis*) within the Sinbad area are of concern for both the Sinbad and mahogany (*Oligosoma* sp. 'mahogany skink') skinks, since these skinks are likely to have high priority for research and conservation. Further surveys are required to identify and secure populations of each taxon, and to establish their range, habitat and microhabitat, and conservation status. Our findings suggest that Fiordland is a potential 'hotspot' for lizard diversity. Additional surveys for both geckos and skinks in the Fiordland National Park are required, as further new species are likely to exist throughout the area.

Keywords: *Oligosoma* spp., *Hoplodactylus* spp., Sinbad skink, Barrier skink, mahogany skink, Cascades gecko, taxonomy, Fiordland National Park

© November 2008, New Zealand Department of Conservation. This paper may be cited as:
Bell, T.P.; Patterson, G.; Jewell, T. 2008: Alpine lizard research in Fiordland National Park:
February–March 2007. *DOC Research & Development Series 304*. Department of
Conservation, Wellington. 18 p.

1. Introduction

In 2006, we undertook a contract to capture, collect data and photograph a live adult Sinbad skink (*Oligosoma* sp. 'Sinbad Valley') in the field. This would allow the completion of a formal taxonomic description of this new skink species, since the only known animal, the potential holotype¹, was a juvenile and did not provide a complete representation of the species. Field work to acquire the necessary information and photographs was undertaken in February and March 2007.

2. Background

For many years, Fiordland National Park in the South Island of New Zealand was generally considered an area depauperate in lizard representatives, due to the cold and wet environment prevalent in this area and the difficult terrain. Lizards were not known in the area until c. 1966. Since then, it has been found that several species of skinks and geckos inhabit the area. Common, green and cryptic skinks (*Oligosoma nigriplantare polychroma*, *O. chloronoton* and *O. inconspicuum*, respectively), jewelled geckos (*Naultinus gemmeus*) and the 'Otago large' gecko (*Hoplodactylus* aff. *maculatus*) are now known from lower altitudes, particularly in the Eglinton Valley and Te Anau Downs area (Department of Conservation (DOC) BioWeb HERPETOFAUNA database², accessed January 2007). Fiordland skinks (*O. acrinasum*) are known from coastal southwestern Fiordland, on islands and rocky inlets, with only one known mainland population (Hardy 1977). The 'Te Kakahu' skink, first discovered c. 1999, is an as-yet undescribed species of skink known only from Chalky Island in southwestern Fiordland (Loh 2003). The known range of the Takitimu gecko (*H. cryptozoicus*) was recently extended to include the Waitutu area (R. Cole, DOC Southland Conservancy, pers. comm. 2006), and the 'southern mini' gecko (*H. aff. maculatus*) has now been recorded in the Livingstone Mountains (DOC BioWeb HERPETOFAUNA database 2007).

Before 2004, there had been several sightings of lizards in alpine habitats in Fiordland National Park, but without positive identifications. In 2004 and 2005, DOC undertook alpine gecko surveys in many parts of Fiordland. The Cascades gecko (a member of the forest gecko, *Hoplodactylus granulatus*, species complex) was discovered during these surveys and is now known from several sites, including the Esperance Valley (R. Morris, wildlife photographer, pers. obs. 1974), Mount Underwood (B. Judge, rock climber, pers. comm. 2005), Homer Tunnel area (A. Goodman, DOC Southland Conservancy, pers. comm. 2006) and Barrier Knob (Bell & Patterson 2006).

¹ See Glossary for definition of this and other technical terms included in this report.

² Administrated by B. Kappers, Hawke's Bay Area Office, DOC.

In March 2004, during the DOC surveys, a juvenile skink was discovered at 1100 m above sea level (a.s.l.) at the head of Sinbad Gully, Llawrenny Peaks, by one of the authors (T. Jewell). This skink was assessed by the authors as a new species with strong phenotypic and morphometric affiliations with the Fiordland skink. This skink was given the tag name of the 'Sinbad Valley' skink, hereafter denoted as 'Sinbad skink', and is now in the lizard collection at the Museum of New Zealand Te Papa Tongarewa (Te Papa; specimen number R 5315).

In late 2004, Te Papa sent a selection of Fiordland skinks (*Oligosoma acrinasum*) to T. Bell and T. Jewell to compare with the Sinbad skink. This included one skink (S.484) from the Milford area that had no initial locality or date recorded, collected by T. Choate. In a separate letter from T. Choate to M. Scofield, Chief Ranger, Fiordland National Park, dated 7 November 1966, Choate indicated that the animal was collected from '4000 feet on Students Peak' in the Darran Mountains (DOC Southland Conservancy file FNP28 folio 269). This skink strongly resembles a Sinbad skink.

In 2005, two skinks were captured and photographed at 1600 m.a.s.l. on the North Face rock-climbing area of Barrier Knob in the Darran Mountains (M. Judge and B. Judge, pers. comm. 2005). Although the photographs were out of focus, the specimens they depicted also resembled the skinks from Sinbad Gully. At the time, it was thought they were identical (e.g. see Bell & Patterson 2006). However, our expedition was later to find that these animals were clearly distinct (see section 4.4.1).

3. Methods

3.1 STUDY SITES

Two study sites were selected for this survey work, based on previous sightings (see section 2) and the limited budget available: the Barrier Knob area (Darran Mountains) and Sinbad Gully (Llawrenny Peaks), both of which are in Fiordland National Park (Fig. 1).

3.1.1 Barrier Knob

Barrier Knob is a mountain peak reaching up to 1800 m.a.s.l. in the Darran Mountains (Darran Ecological District 72.01; McEwan 1987), which forms a ridge between the Adelaide and Gertrude Valleys. The study site is alpine in nature, mainly consisting of bare rock cliffs rising above snow slopes, with some alpine vegetation established in rock crevices, especially in areas protected from snow-shear. The flora of this zone consists mainly of the mountain daisy (*Celmisia hectorii*, tikumu), mountain lily (*Astelia* spp.), mountain buttercup (*Ranunculus lyallii*) and snow marguerite (*Dolichoglottis* spp.). The survey area was the North Face climbing area (Figs 1 & 2), which is between 1400 and 1700 m.a.s.l. (Jefferies 2006). Lizards were captured at the base of the North Face cliffs by M. Judge and B. Judge in 2005. This same area was unsuccessfully surveyed for skinks in February 2006 (Bell & Patterson 2006).

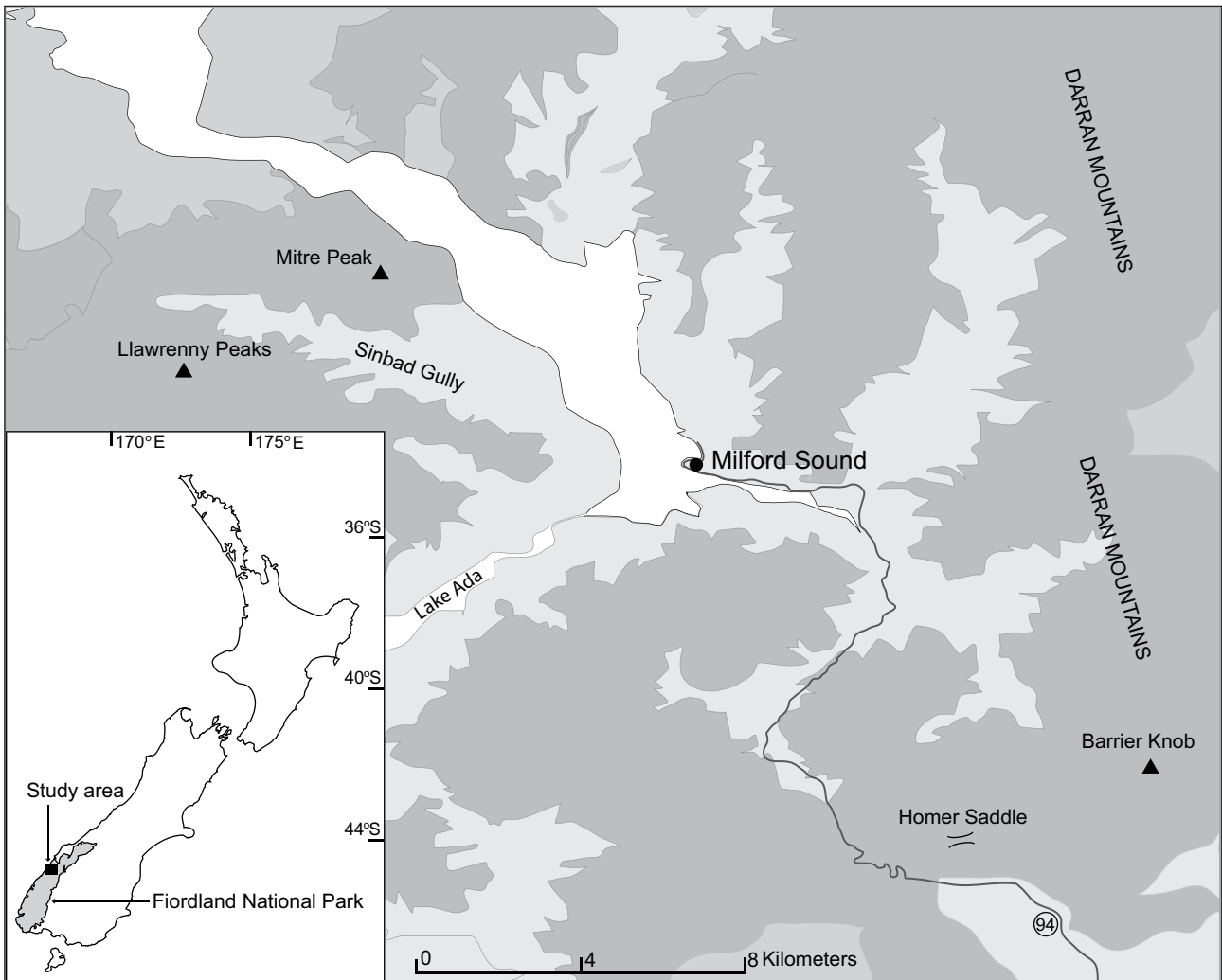


Figure 1. Map showing the locality of Fiordland National Park, South Island, New Zealand, and the main study areas at Barrier Knob, Darran Mountains, and Sinbad Gully, Llawrenny Peaks.

Figure 2. Barrier Knob, Darran Mountains. The Barrier skinks were found at the base of the bluff at 1600 m.a.s.l., above the snow-packed slopes.
Photo: Trent Bell.



3.1.2 Sinbad Gully

Sinbad Gully is a north/northwest-facing alpine cirque basin at the head of Sinbad Valley at 1100 m a.s.l. It is enclosed on three sides by vertical rock cliffs 150–250 m high. These are part of the Llawrenny Peaks (Darran Ecological District 72.01; McEwen 1987), which reach up to 1925 m a.s.l. The study site is alpine to sub-alpine, with the sheer cliffs that form the cirque basin largely supporting subalpine grasses and ferns in crevices and damp areas, and being entirely devoid of vegetation in other areas (such as the ‘Shadowland’ rock-climbing area; Jefferies 2006). The flora of Sinbad Gully consists of plants adapted for alpine and subalpine areas. These include the mountain daisy, mountain lily, mountain buttercup, snow marguerite, snow totara (*Podocarpus nivalis*), *Dracophyllum* spp., and whipcord hebes (*Hebe* spp.). There are also various species of fruit-bearing sub-shrubs, particularly *Coprosma* spp., *Gaultheria* spp. and pohuehue (*Muehlenbeckia axillaris*). The basin floor consists of more diverse subalpine tussock grassland and shrubland. The survey area was along accessible cliff areas at the head of the Sinbad Gully at 1100–1200 m a.s.l. (Figs 1 & 3). This is the site where the first Sinbad skink was discovered by T. Jewell in March 2004.

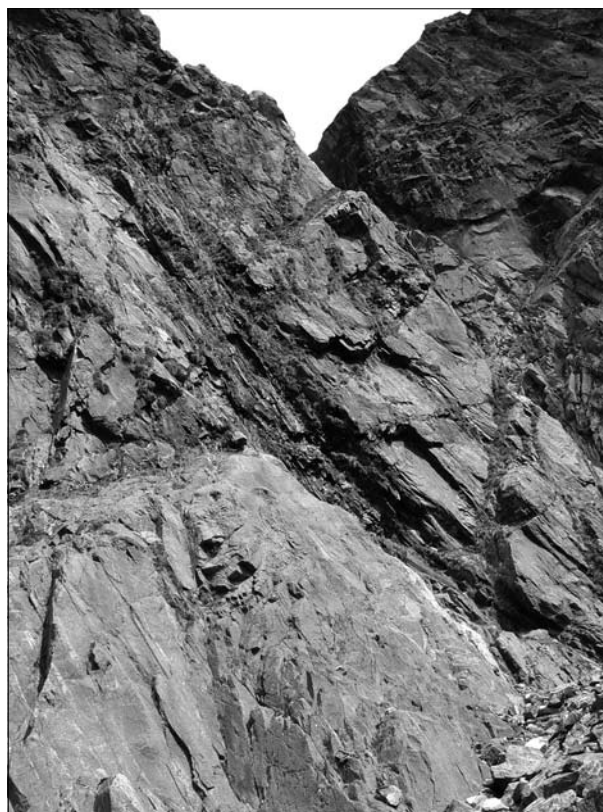


Figure 3. Sinbad Gully, Llawrenny Peaks. The Sinbad and mahogany skinks (*Oligosoma* spp.) were found 10 m apart on tussock ledges of this cliff at 1100 m a.s.l. Photo: Trent Bell.

3.2 FIELD TRIPS

A Low Impact, Collecting and Research Permit (SO-20349 FAU) and One-off Aircraft Landing Permit were secured through the Te Anau Area Office, DOC (A. Smart, K. Osborn).

3.2.1 Barrier Knob

The North Face climbing area of Barrier Knob was surveyed on 26–28 February 2007. The field team for this trip included T. Bell (field leader), M. and B. Judge (experienced rock climbers), T. Jewell (herpetologist), R. Morris (wildlife photographer), J. MacTavish and J. Kelbling (Otago University Natural History Film students), and R. Müller (herpetologist).

After flying in by helicopter from Milford Sound, access to the North Face was gained by traversing the lower slopes of Barrier Knob from the campsite on Adelaide Saddle, and pitching across ice sheets using ice axes, climbing ropes and belay devices. M. Judge and B. Judge led the traverse to the site where the first skinks were captured by them in 2005. This area is a small (50 m × 50 m) but safely accessible section of the 200-m-high faces of Barrier Knob.

T. Jewell, T. Bell and R. Müller surveyed the Barrier Knob area for lizards during sunny days and at times when direct sunlight fell on the face (early morning to mid-afternoon). This gave about 5 available hours of surveying per day. This limited window of opportunity was further complicated by the initial arrival of the team by helicopter and set-up of camp on the first day, and the lengthy daily traverses from the camp site.

3.2.2 Sinbad Gully

Sinbad Gully was surveyed on 9–11 March 2007. The team for this trip consisted of the same core team that visited Barrier Knob (see section 3.2.1), with the exception that C. Hudson replaced R. Müller and J. Kelbling was absent.

Sinbad Gully was also accessed by helicopter from Milford Sound. T. Jewell, T. Bell and C. Hudson surveyed the Sinbad Gully area for lizards under similar conditions as for Barrier Knob (i.e. during sunny days and at times when direct sunlight fell on the face in the mid-morning to mid-afternoon). This gave about 7 available hours of surveying per day. M. Judge and B. Judge provided secure climbing ropes using cam and nut devices to safely access difficult sections.

3.3 FIELD METHODOLOGY

The surveys were timed to coincide with a clear, settled period of weather, using the online weather forecast charts available from MetVUW (www.metvuw.com). The surveys were conducted by observing the rock area for active and basking lizards using visual scanning with and without binoculars, climbing on and around accessible sections of the cliffs to search for disturbed animals, and finally looking into crevices for inactive lizards. Alpine vegetation was also searched and rocks turned over.

All lizards were captured where possible, identified and photographed. Macro photography was conducted using a Canon EOS 400D with extension tubes and a macro ring flash. Measurements (to the nearest 1 mm) were made of snout-vent length (SVL), tail length (TL) and length of the regenerating portion of the tail (where applicable) (r). The following detailed morphometric measurements were also taken (to the nearest 1 mm) for the taxonomic descriptions: snout-forelimb; axilla-groin; snout-eye; eye-ear; diameter of eye and ear; ear-forelimb; and hind-limb length. Mid-body and lamellae scales were also counted. Individuals were weighed to the nearest 0.25 g using a 30-g Pesola™ spring balance and sexed. No temporary or permanent identification marks (such as toe-clipping) were applied to lizards, but genetic samples were taken from tail tips of skinks. Global positioning system (GPS) references and photographs were taken at the site of capture.

D. Chapple (Victoria University of Wellington, New Zealand; now at Museum Victoria, Australia) conducted genetic analyses of nucleic and mitochondrial DNA from tail tip samples of skinks, as part of his national skink phylogeny postdoctoral research at Victoria University of Wellington, New Zealand. Chapple's methodology is described in Chapple & Patterson (2007).

4. Results

During the survey period, the weather at Barrier Knob was fine and sunny, with air temperatures ranging from 20.8°C to 28.8°C for 2 days. During the mid-point of the day on Barrier Knob, the rock reached temperatures of up to 45.3°C, resulting in lizards becoming inactive and thus affecting survey results. At Sinbad Gully, the weather was generally fine, with lower temperatures (12°C to 20°C). Low cloud and cold temperatures on the last day at Barrier Knob, and an incoming front that delivered torrential rainfall on the last day of the Sinbad survey rendered any further surveying ineffective.

A total of 11 lizards were captured during both surveys over 5 days. Four skinks and two geckos were captured from Barrier Knob, and two skinks and three geckos from Sinbad Gully.

4.1 BARRIER KNOB

4.1.1 Skinks

The four skinks (one male, two females and one juvenile) from Barrier Knob were morphologically distinct from the Sinbad skinks, and are likely to be a new species. The tag name 'Barrier skink' was given to these skinks. These 'Barrier skinks' were medium to large in size (reaching up to 81 mm SVL, 179 mm TL, and weighing up to 12.1 g). They were mainly black dorsally and laterally, with yellowish, green, cream or brown flecks, and white ventrally, with occasional black speckles (Fig. 4). They bore a striking resemblance to the grand skink (*O. grande*) of Otago.

Initial genetic analyses (D. Chapple, Museum Victoria, Australia, pers. comm. 2007) placed these skinks in the Fiordland skink (*O. acrinasum*) group, of which the Sinbad skink is also a member. Other members of this group are *O. infrapunctatum*, *O. ottagense*, *O. taumakae* and *O. waimatense* (D. Chapple, pers. comm. 2007).

The Barrier skink is a rock-dwelling, diurnal, heliothermic species, with avid sunbasking behaviour. The four skinks were found occupying mainly clean rock bluffs at 1600 m a.s.l. The skinks retreated into large crevices in cliffs or hid in snow tussock (*Chionochloa pallens*) when alarmed.

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.

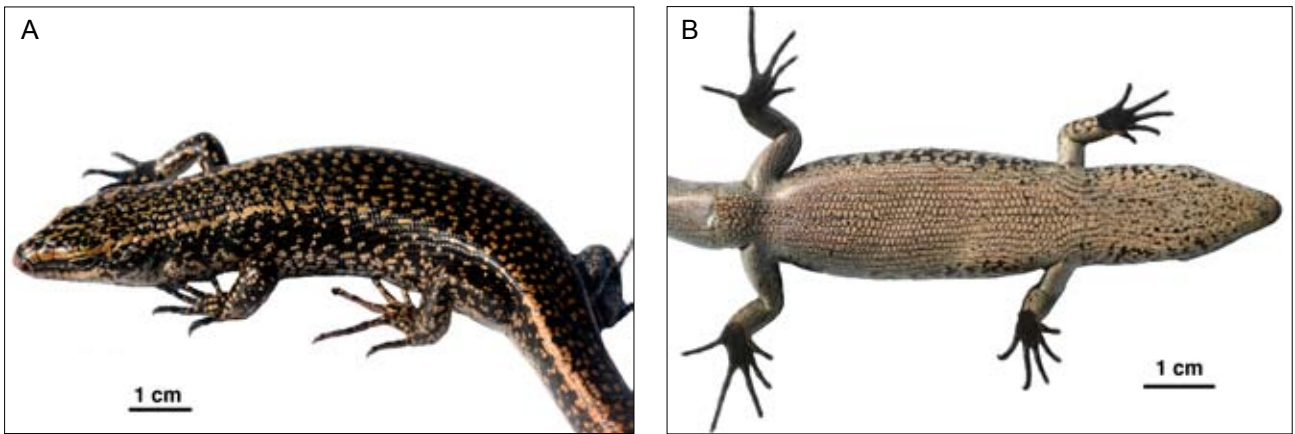


Figure 4. A. Dorsal and B. ventral views of the Barrier skink (*Oligosoma* sp. 'Barrier') from Barrier Knob, Darran Mountains, March 2007. Photos: Trent Bell.

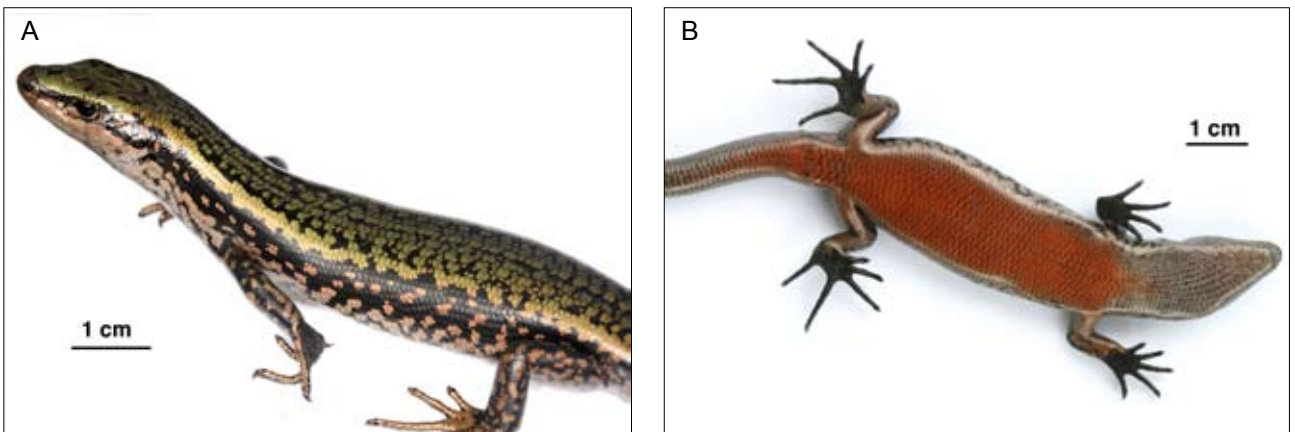


Figure 5. A. Dorsal and B. ventral views of the Sinbad skink (*Oligosoma* sp. 'Sinbad Valley') from the head of Sinbad Gully, March 2007. Photos: Trent Bell.

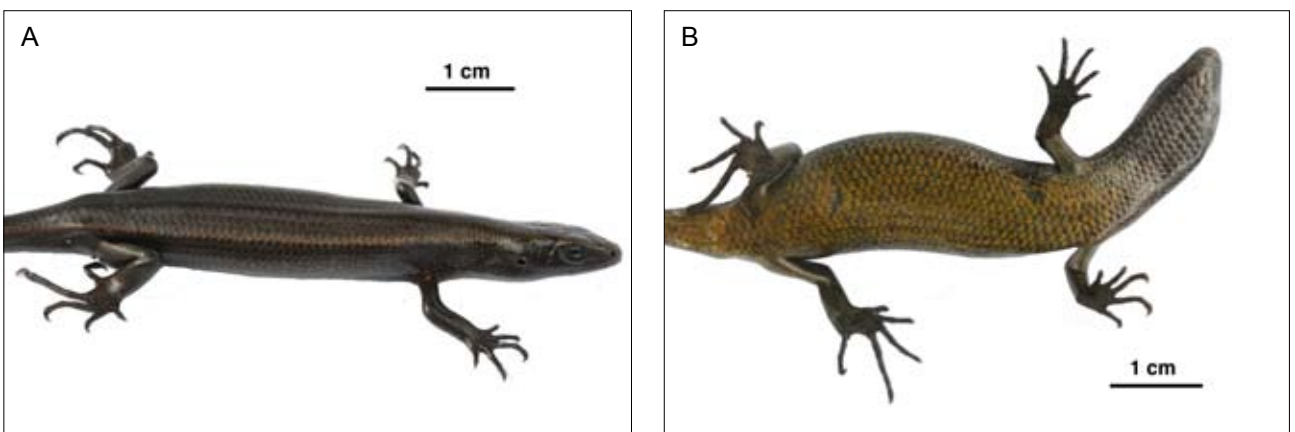


Figure 6. A. Dorsal and B. ventral views of the mahogany skink (*Oligosoma* sp. 'mahogany skink') from the head of Sinbad Gully, March 2007. Photos: Trent Bell.

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 preying on 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 described³. 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 determined³. 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.

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.

7. Acknowledgements

DOC provided the funding required for the field research (Science Investigation No. 3921). Murray and Bronwyn Judge, Julia Kelbling, Jinty MacTavish, and Tony Jewell also provided additional funding to assist with the cost of helicopter travel.

We thank the field research team for their commitment to the expedition. Murray and Bronwyn Judge deserve particular thanks for their extraordinary assistance with technical climbing skills and their full participation in skink research.

We thank Raymond Coory (Museum of New Zealand Te Papa Tongarewa) for providing essential photographs of the soon-to-be assigned Sinbad skink type specimen, the Students Peak animal, and a comparative Fiordland skink. We also thank David Chapple (Victoria University of Wellington) for undertaking genetic analyses of all skinks captured.

We thank Richard Beddick (MicroImaging), Birgit Rhode (Landcare Research) and Gary Julian for advice on field macro photography and equipment. Rod Morris supplied further photographs taken during the expedition. The DOC Te Anau Area Office, particularly Hannah Edmonds and Andrew Smart, gave invaluable support and provided communication and safety equipment for the field research.

We thank Grant Norbury, Andrea Byrom and Christine Bezar (Landcare Research) for comments on earlier drafts of this report. Cissy Pan developed the photographic plates. Two anonymous referees also reviewed this paper.

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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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