

9. Research Priorities

Research is an integral part of the objectives outlined in this Recovery Plan (see Section 8 above). Research topics for striped skinks, in priority order, can be summarised as:

1. Laboratory based research on diel activity, behaviour and thermal requirements.
2. Laboratory based research on ecophysiology.
3. Comparative research on activity periods, thermoregulation (basking) and climbing behaviour using captive animals.
4. Field observations to corroborate the results of laboratory studies and research on captive animals under natural conditions.
(this may require the development of special techniques or equipment to enable tracking or remote location of animals)
5. Determine the impacts of introduced mammalian predators on striped skink populations.
(one important part of risk assessment will be to determine the impact of predation, especially on populations in pasture habitats; it should also include assessment of the cost-effectiveness of intensive predator management to striped skinks at mainland sites).
6. Studies to determine genetic variation throughout the species range and relationships to other *Oligosoma* species.

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Appendix 1: Recommended Time Line for Objectives over the first five Year Period

| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|-------------|-----------------------------|--------|--------|--------|--------|--------|
| Objective 1 | Research plan | █ | | | | |
| | Activity, behaviour (lab.) | █ | █ | | | |
| | Ecophysiology (lab.) | █ | █ | | | |
| | Activity, behaviour (capt.) | | █ | █ | █ | |
| | Field observations | | | █ | █ | █ |
| Objective 2 | Survey methodology | | | █ | █ | |
| | Monitoring methodology | | | █ | █ | |
| Objective 3 | Surveys | | | █ | █ | █ |
| | Locate new populations. | | | █ | █ | █ |
| | Monitor populations | | | █ | █ | █ |
| | Research on predation | | | █ | █ | █ |
| | Genetic studies | | | █ | █ | █ |
| Objective 4 | Print media publicity | █ | █ | █ | █ | █ |
| | DoC literature | | █ | █ | █ | █ |
| | Public meetings | | █ | █ | █ | █ |
| Objective 5 | Selection of key sites | | █ | █ | █ | █ |
| Objective 6 | Identify populations | | █ | █ | █ | |
| | Protect habitat | | | █ | █ | █ |
| | Implement management | | | █ | █ | █ |

Appendix 2: Biological and Ecological Data to Record for Striped Skinks in the Wild

It is important that the maximum amount of biological and ecological data is recorded for any striped skinks found in the wild, as any additional information will contribute significantly to the understanding of their ecology and habitat.

Data to record should include, but not be limited to, any or all of the following;

1. Date and time. Also record duration (start/stop times) if observation covered a period of time.
[EXAMPLE: 12 January 1998, 13:49 14:02]
2. Prevailing weather. Include temperature (estimate if thermometer not available), cloud cover, sunshine (note whether area/site is in sun), wind speed and direction, rainfall, exceptional events (e.g. frost, snow, flood).
[EXAMPLE: Fine, light SW breeze, warm, site in dappled sunlight, heavy rain overnight cleared about 07:30]
3. Habitat (for area where lizard found). Include lithology (rock type), topography, aspect, elevation, vegetation (be specific and list dominant species).
[EXAMPLE: 560m on steep north-east facing slope in deeply dissected, broken siltstone (papa) country; tawa forest with scattered rimu emergents, dense canopy to 25 m, sparse shrub/ground layer vegetation]
4. Microhabitat (for immediate surroundings of lizard). Include vegetation, plant species, vegetation height, vegetation structure and density.
[EXAMPLE: Tangle of logs on edge of small slip, log heap to 4 m above ground, overhanging canopy and tree ferns, dense growth of water fern between logs]
5. Microsite (where lizard was observed). Include description of substrate, height above ground.
[EXAMPLE: a) Nearly horizontal, dead taws log of 60 cm diameter, 3.5 m above ground surface; loose, flaking bark; small epiphytic plants of Collospermum on upper surface. b) Deep accumulation of tawa leaf litter beneath tangled roots of live taws tree]
6. Activity/Behaviour. Record in detail what the skink was doing when found or while it was under observation. Include interaction with the environment and other animals, especially thermoregulatory behaviour (including selection of basking sites), movement through the environment, inter- and intra-specific behaviour, and feeding.
[EXAMPLE: Skink seen emerging from beneath flaking bark, progressively exposed more of its body until it was lying fully exposed to the sun on the side of the log; after 7 minutes it ran ca. 1.8 m to an epiphytic Collospermum and disappeared into the foliage; observed again 3 minutes later when it lay

for about 2 minutes with the head exposed, changed position to expose side of body between leaves making it very difficult to see; suddenly ran from the Collospermum, along the top of the log for ca.4.5 m, and dropped into deep leaf litter at the base of a tree. It was then captured from deep within the litter]

7. Sex/Reproductive condition. Determine sex of adults; assess reproductive condition of adult females from palpation.
[EXAMPLE: Ad female, SVL 63 mm, heavily gravid, at least three embryos detected by palpation]
8. Diet. Record any observed feeding behaviour, carefully noting the identity of the food/prey species. Collect any faecal pellets that are unequivocally from striped skinks for later analysis. If possible, hold newly captured striped skinks in a clean bag or container for at least 24 hours in order to collect droppings. Store droppings dry or in alcohol for expert analysis.
[EXAMPLE: Two droppings collected from retreat site beneath bark contained only invertebrate fragments; one large dropping produced in captivity was also composed of insect fragments, including beetle elytra. Forwarded to DoC S&R, 18/1/98]
9. Specimens. If dead striped skinks are found or any unfortunately die while in captivity they should be retained for autopsy and for voucher specimens regardless of their condition. Specimens should preferably be preserved in 70% ethanol; but temporary storage in a freezer is satisfactory, or in any other preservative (e.g. formalin).
10. Data and specimens. Contact the conservancy SCO (Fauna) or the Striped Skink Recovery Group coordinator for advice on where to send data or specimens.

Appendix 3: Biology and Ecology of Striped Skinks

1. HABITAT

Striped skinks have been found in two markedly different habitats, lowland forest and pastoral farmland.

Forest habitats

Most of the sites where striped skinks have been found in forested habitats are in the northern part of their range, from northern Taranaki to the Waikato, and from Bay of Plenty northwards.

The vegetation at the site on Great Barrier Island where a striped skink was captured is podocarp/hardwood forest in an advanced state of regeneration. Apart from a few scattered remnant podocarp and rata (*Metrosideros robusta*) the canopy, at approximately 6 m, comprises large kanuka (*Kunzea ericoioides*) with taws and rewarewa (*Knightia excelsa*) co-dominant. On Little Barrier Island the striped skink was captured beneath tall, mature taraire (*Beilschmiedia taraire*), rewarewa, puriri (*Vitex lucens*) forest (Anon 1995).

All four sites on the Mamaku Plateau where striped skinks have been found were formerly either podocarp/hardwood forest (mostly as rimu/tawa, kamahi (*Weinmannia racemosa*), tawari (*Ixerbia brexioides*)), or relatively pure tawa forest. At one site on the western edge of the plateau three skinks were found in mature tawa forest from which all the large podocarps had been selectively logged many years earlier. South of Mamaku village one was captured and others were seen during logging of a dense, tall (to 30 m) stand of riparian rimu/taws forest. The rimu trees in this stand had a thick growth of epiphytes (orchids, ferns (*Asplenium polyodon*, *Asplenium flaccidum*), moss) on the trunks.

In the south Waikato four striped skinks have been found in indigenous forest. On the Hauhangaroa Range a striped skink was found in cut-over mature tawa forest where the forest was formerly podocarp/tawa. Further west, one was found in selectively logged podocarp/taws forest at Pureora and another captured in scrub on a forest margin (Anon 1996b), and a third was captured on logs cut from podocarp/hardwood forest near Benneydale.

In north Taranaki two striped skinks have been found in indigenous forest at Waitaanga, one in podocarp/taws forest and a recent specimen from selectively-logged, mature taws forest (Anon 1996a). Near Uruti, a skink was captured in (or adjacent to) tawa forest. In eastern Taranaki striped skinks were found in an area of tall manuka and kanuka scrub containing scattered remnants of the original podocarp/hardwood forest, mostly matai and a few rimu.

Forest microsites

The microsites of the striped skinks that have been found in forests range from the forest floor to the canopy.

The animal from Kaipara Flats was apparently in a rotten log on the forest floor, the one from Great Barrier Island was observed half hidden in the leaf litter in a patch of sunlight, and the one from Little Barrier Island was captured in a pitfall trap in deep leaf litter in an area of dense, dark forest. Two striped skinks collected from the Pureora district were found as they ran across narrow logging roads through indigenous forest during bright and sunny weather and it was suggested at least one of them may have been basking on the roadside. Another striped skink at Pureora was found basking on a grassed walking track through scrub.

Some striped skinks have been collected from low on the trunks of forest trees. One striped skink was first seen in dappled sunlight about 1.8 m above the ground on the vertical trunk of a large taws tree in dense forest; another, killed during logging operations, was hiding beneath flaking bark of a rimu approximately 4 m above the ground.

Several striped skinks have been captured or found dead immediately after trees were felled and from their position appear to have been high on the tree or even in the canopy, sometimes 10s of metres above the ground. The most accurate of these records is a striped skink captured from beneath epiphytes encrusting a branch in the crown of a tawa tree, 22 m above the ground. These records include two skinks from taws trees on the western Mamaku Plateau and several from matai trees and other remnant podocarps in eastern Taranaki. At one Taranaki site trees that were partially rotted out or hollow sometimes had several striped skinks on them.

The striped skink found at Kakahi was on a wooden truss bridge across a steep-sided, wooded gully where the original forest was rimu/tawa, tawa, or mixed hardwoods. Such a site could be construed to be structurally similar to living on branches in a forest canopy.

Several records indicate that striped skinks are inhabitants of epiphytes. A skink captured on the north of the Mamaku Plateau was found when it ran from an epiphyte and down the trunk of a large taws tree that was being felled. In eastern Taranaki striped skinks were found in epiphyte platforms of *Collospermum* and *Astelia* 2 - 4 m above the ground in low sprawling trees (probably old mahoe). Two of these skinks were inactive and buried deep between the leaves of the plants (one in the water-filled leaf bases of the *Collospermum*) and two were seen basking in the epiphytes during sunny weather.

Pastoral farmland habitats

The localities where striped skinks have been found in pastoral environments are in the southern King Country and inland Taranaki. Most are in rolling to very steep hill country on which many logs and stumps remain long after the original forest has been cleared. On more intensively farmed land they have been found in structurally similar sites associated with exotic plantations and

shelterbelts (e.g. Douglas, Toko, Normanby) and at one site near Douglas are present in pampas (*Cortaderia* sp.).

On the hill country the indigenous logs remaining from the former forest cover are usually from podocarps, most commonly matai (*Prumnopitys taxifolia*) but also including rimu (*Dacrydium cupressinum*) and totara (*Podocarpus totara*, *P. halli*). At most sites the logs in which the skinks live are surrounded by rough pasture, at others there is scrub (manuka *Leptospermum scoparium*) or fern growth, rank grass, and in damper sites there may be rushes. In many places they have been found in or adjacent to swamps or on swampy ground. Most often they are in sites that receive little or no disturbance from livestock or other causes.

Occasionally striped skinks have been found in or around buildings. Some of the records clearly relate to animals brought from further afield by predators (domestic cats) but others suggest they may be able to live in such habitats if dense vegetation is present.

Pastoral farmland microsites

In pastoral environments striped skinks are most commonly associated with decaying logs or stumps, and they show a marked preference for being in, rather than under, them. The most favoured logs are those with a hard outer shell and core that has decayed to the point where the wood has fragmented into damp cubes. In such logs the skinks burrow deep into the moist interior, often selecting sites where the wood is sodden. They certainly show a preference for damper sites and when living beneath logs it is usually those closely pressed on to moist soil. Striped skinks have also been found in narrow cracks and splits in logs where the wood has not rotted; occasionally they occur beneath wood debris (planks, posts) or other litter (iron, concrete).

In a pastoral environment near Douglas, striped skinks are living in a pampas shelterbelt. They have also been found in rank vegetation on roadsides and the banks of drains but it is not clear whether the skinks at these sites use the dense vegetation for retreats or whether there are bits of wood or other debris available to provide cover.

Even in pastoral habitats striped skinks are often found above the ground—one was collected "... half way up a dead tree ...", another was captured approximately 2 m above the ground inside a rotten stump that was about 3 m tall, and others have been found above the ground inside standing dead tree fern trunks.

2 HABITS

Activity periods

Both wild and captive striped skinks have been observed basking and foraging during the day. Some observers have also reported that captive animals occasionally forage after dark, sometimes for several hours following dusk, but

it is not clear whether this is natural nocturnal behaviour or a learned response to a food resource (moths) being introduced to the cage at night.

Basking behaviour

The number of striped skinks observed basking in the wild is lower than expected in relation to other heliothermic skinks and lower than their basking behaviour in captivity would indicate. Most searches for striped skinks in eastern Taranaki have been made in fine, sunny weather yet virtually all the animals found were under cover. Observations of basking by wild striped skinks include two seen basking on the ground near Pureora, and in Taranaki they have been observed basking on branches, in epiphytes, in pampas and on logs. Basking appears to be more frequent with gravid animals and more frequent in the early spring.

Climbing behaviour

Records from the wild show striped skinks do climb trees. They have been found on tree trunks and stumps several metres above the ground, on branches in the crowns of trees many tens of metres above the ground, and in epiphytes. However, most of the striped skinks that have been found have been on the ground and the extent to which they are an arboreal species is still unclear.

The degree to which striped skinks can display their propensity to climb in captivity is limited but nonetheless they do seem to climb more than other skinks. Several observers have noted that in captivity they spend a lot of time off the ground, feeding and sleeping in foliage and twigs

Association with high moisture environments and free water

Striped skinks have also been widely associated with swampy environments. In the wild they are often found in the sodden interior of rotten logs and one was found curled up in water in the leaf-bases of epiphytic *Collospermum*. In captivity striped skinks have been seen to lie in their water containers, often staying submerged for days at a time and only emerging in hot sunny weather. Captive skinks are also recorded hibernating in leaf litter in the very wettest parts of their cage. It is unclear whether the association with swamps shown by wild striped skinks is genuine requirement for a wet environment or because such places are usually the least modified parts of the landscape. The observations from captivity tend to indicate the species really does need a damp microhabitat.

Social groupings

Adult striped skinks seem very tolerant of sub-adults and juveniles. In pastoral environments logs or stumps may have a resident population of up to 10 or more animals generally comprising 2 - 3 adults and up to 6 - 7 younger animals of various ages. Larger groups have been reported from some old and decaying forest trees.

3 **DIET**

No information is available on the natural food of striped skinks from observations in the wild, or analysis of gut contents or faecal pellets. It has been widely assumed that the species is primarily insectivorous and in captivity they certainly thrive on a diet of live invertebrates. In captivity they readily eat soft fruit.

4 **REPRODUCTION, GROWTH, LONGEVITY**

Like most New Zealand lizards, striped skinks are ovoviviparous and usually give birth to their young between late-summer and early-autumn. Litters from females that were gravid when collected from the wild have been born in March; litters conceived in captivity have been born from January-March, or very rarely as late as July.

The litter size ranges from 3 - 8, but more commonly 4 - 6. There are no data on growth rates. Longevity in wild populations of striped skinks has not been measured but wild caught adults have survived in captivity for between 14 and 20 years.

Appendix 4: Captive Maintenance and Breeding of Striped Skinks

Striped skinks have been kept in captivity by about 16 people of whom five have combined around 70 years experience with the species. The husbandry success with striped skinks varies widely, even amongst people with a proven record of herpetoculture.

Adult striped skinks are generally regarded as easy to keep and care for regardless of whether they are animals from the wild or those that have been bred in captivity. Special conditions in captivity do not appear to be necessary although some keepers felt the animals did better when moisture levels in the cage were high.

In captivity striped skinks were mostly fed on live invertebrates, including moths, flies, and woodlice. They have also been fed on soft fruit, banana and tinned cat food and finely chopped liver. Free water should be available as they drink readily and also lie in water containers.

In well maintained situations striped skinks have bred regularly in captivity over many years, although problems with raising animals to adulthood have been reported. Some keepers have found them easy to rear but other equally qualified people have experienced difficulties in raising juveniles through their first year or two.

Striped skinks can be quite aggressive in captivity and care needs to be taken to ensure they do not damage each other or other species in the same cage. The problem of intra-specific fighting is particularly acute if a new animal is introduced to an established group.

Appendix 5: Published Recovery Plans

| RECOVERY PLAN | # | COST | YEAR APPROVED |
|----------------------------------|----|--------------|---------------|
| Striped skink | 24 | (\$15) | Approved 1998 |
| Fairy tern | 23 | (\$15) | Approved 1997 |
| Blue duck | 22 | (\$15) | Approved 1997 |
| Kakapo | 21 | (\$15) | Approved 1996 |
| Stitchbird | 20 | (\$15) | Approved 1996 |
| Brown teal | 19 | (\$15) | Approved 1996 |
| Native frogs | 18 | (\$15) | Approved 1996 |
| New Zealand (Hooker's) Sea Lion) | 17 | (\$15) | Approved 1995 |
| <i>Dactylanthus taylorii</i> | 16 | (\$15) | Approved 1995 |
| Bat (Peka peka) | 15 | (\$15) | Approved 1995 |
| Otago and grand skinks | 14 | (\$15) | Approved 1995 |
| Giant land snail | 13 | (\$15) | Approved 1995 |
| Takahe | 12 | (\$15) | Approved 1994 |
| South island saddleback | 11 | (\$15) | Approved 1994 |
| New Zealand Dotterel | 10 | (\$15) | Approved 1993 |
| Tuatara | 9 | (\$15) | Approved 1993 |
| Kowhai ngutukaka | 8 | (\$15) | Approved 1993 |
| Subantarctic teal | 7 | (\$15) | Approved 1993 |
| Mohua (yellowhead) | 6 | (\$15) | Approved 1993 |
| Chevron skink | 5 | (\$15) | Approved 1993 |
| Black stilt | 4 | (\$15) | Approved 1993 |
| Whitaker's and robust skinks | 3 | (\$15) | Approved 1992 |
| Kiwi | 2 | (\$15) | Approved 1991 |
| North Island kokako | 1 | (\$15) | Approved 1991 |
| Yellow-eyed penguin | - | *- | Approved 1991 |
| Kakapo | - | Out of print | Approved 1989 |

* Available from Otago Conservancy, Department of Conservation, Dunedin

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