A striped gecko (*Hoplodactylus stephensi*) at Coromandel

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Abstract

The striped gecko (*Hoplodactylus stephensi* Robb 1980) is one of the rarest and most restricted of the New Zealand lizards. Until now it has been found only on Stephens Island in western Cook Strait and Maud Island in Pelorus Sound. The species is strongly nocturnal and primarily arboreal, inhabiting shrublands and forest remnants.

In March 1997 an unusual and distinctive gecko was found in a house on the outskirts of Coromandel township on the western side of the Coromandel Peninsula. Morphometric and genetic data (DNA) from this gecko showed that it is conspecific with *Hoplodactylus stephensi* from the Cook Strait region. Minor differences between the mitochondrial DNA sequences of the Coromandel animal and those from Cook Strait indicate that the Coromandel animal is almost certainly from a distinctive-and hitherto undiscovered-population of striped geckos that is natural to the area. Follow-up surveys using a variety of techniques (pit-trapping, spot-lighting and artificial cover) have thus far failed to locate further specimens.

Interpretation of the minor genetic and morphological differences that were observed between the Coromandel gecko and striped geckos from the Cook Strait region is limited by the very small sample sizes, and at this stage further taxonomic differentiation of the Coromandel population is not warranted.

Coromandel is 460 km north of the Cook Strait populations of striped geckos and at the opposite end of the North Island. The habitat they presently occupy (seral manuka-kanuka forest) is novel, but the former lowland forest of the Coromandel region is structurally and floristically similar to that at the Cook Strait sites. This indicates striped geckos were probably distributed through lowland forest in the central and southern North Island, and parts of the northern South Island, and that they may still occur at other sites within this range. Striped geckos appear to be rare and/or elusive, or their primary habitat is yet to be identified.

The new population of striped geckos is exposed to a broad range of introduced mammalian predators and its habitat is not secure from clearance or modification. These factors mean the conservation status of the species is essentially unchanged and the present DOC conservation priority ranking (Category B, Vulnerable) and the IUCN '*Red List*' classification should remain. Because it represents the northern limit of the species' range and is morphological and genetically distinct, the Coromandel population warrants special conservation consideration.

l. Introduction

In March 1997 an unusual gecko was captured inside a house on the outskirts of Coromandel township and handed to the local Department of Conserva-

tion office, from where it was forwarded for specialist identification. The morphology and coloration of this gecko were typical of the striped gecko (*Hoplodactylus stephensi*), but because it had been found in a completely unnatural environment and so far beyond the species' known range-460 km to the north, at the opposite end of the North Island-doubts were expressed about its identity and even the authenticity of the record. Genetic tests were undertaken to verify the identity of the gecko, and field studies were initiated in an effort to confirm a population existed at Coromandel and that it was a genuine range extension.

The striped gecko is one of New Zealand's rarest lizards (Cree 1992). This moderate-sized-up to 80 mm SVL-nocturnal, arboreal species was formerly known only from forest remnants and shrublands on Stephens Island and Maud Island.

Although the striped gecko was first recognised from Stephens Island, in western Cook Strait, in the early 1960s-at which time it was believed to be a highly distinctive colour variety of *Hoplodactylus pacificus* (*sensu* McCann 1955) (Sharell 1966)-it was not until 1980 that it was formally described (Robb 1980). For many years it was thought to be confined to Stephens Island (e.g. Robb 1986, Gill 1986). Bauer (1990) considered it to be a primary endemic, recently evolved from *"pacificus-maculatus* stock", but Towns *et al.* (1985) had correctly predicted its occurrence on the island was relictual. In 1989 a lizard that appeared to be a striped gecko was seen on Maud Island in Pelorus Sound, 40 km south of Stephens Island (Stoker & Garrett 1989). Confirmation that striped geckos occurred there was made two years later, when specimens were collected and genetic tests revealed they were conspecific with animals from Stephens Island (Whitaker 1991, Hitchmough 1997).

Striped geckos are either rare or exceedingly elusive. Stephens Island and Maud Island are free of the introduced mammalian predators (rodents, mustelids and cats) that have decimated lizard populations elsewhere in New Zealand (Towns & Daugherty 1994), and the lizard populations there are thriving. However, in spite of the very high presence of biologists on both islands over the past 3-4 decades-including many with a specialist interest in herpetology-there have been remarkably few sightings of striped geckos. Cree (n.d.) was able to locate just 31 records for Stephens Island in the period 1960-1989 and in a dedicated six-week survey there in 1990 found only 40 more individuals. Only five of 563 geckos found during a six-day survey on Maud Island in 1991 were striped geckos (Whitaker 1991). Striped geckos were not seen on Maud Island again until early in 1996 (Anon 1996), but since then there have been isolated observations at regular intervals (e.g. Anon 1998).

Long regarded as one of New Zealand's most restricted and rarest lizards (Williams & Given 1981), striped geckos are assigned to Category B for conservation priority by the Department of Conservation (Molloy & Davis 1994). Furthermore, the IUCN has ranked striped geckos as *vulnerable (VU)* in the '*Red List*' for threatened species because of the low number of localities at which they occur and the very small area of potential habitat for them (IUCN 1996).

The *vulnerable* category is for species that face a high risk of extinction in the wild in the medium-term future. Striped geckos are listed as VU(D2) which is defined as a population "characterised by an acute restriction in its area of occupancy (typically less than 100 km²) or in the number of locations (typically less than 5)"and thus at considerable risk of becoming *critically endangered* or *extinct* in a very short period (IUCN 1994, Bell 1997). Stephens Island (150 ha) and Maud Island (309 ha) total just 4.5 km² but the area of potential striped gecko habitat (shrubland or forest) is considerably less than this.

This report records the details surrounding the original capture, and the results of the investigation into the genetic status and the follow-up field surveys. The implications of this discovery for the conservation status of striped geckos are discussed.

Grid references, expressed in New Zealand Map Grid (NZMG), and altitude (m) are derived from the 1:50,000 topographical map series NZMS 260, sheet T10 Coromandel.

2. Original capture

2.1 CAPTURE AND SITE DETAILS

The gecko captured at Coromandel on 9 March 1997 was found at 21:20 hr clinging to a wall inside a house. The locality (NZMG 27345 64926) is 2.5 km north of the business centre of Coromandel township, at about 100 m asl on the west-facing toe-slope of the Coromandel Range. The house is set in a large garden and backs on to early seral forest dominated by kanuka (*Kunzea ericoides*), manuka (*Leptospermum scoparium*) and mamaku (*Cyatbea medullaris*) with a canopy at 6-8 m. This forest comes within 2-3 m of the house, and fronds from mamaku growing against the house effectively bridge the gap to the room where the lizard was found. Over the years other geckos have been found in and around the house, including forest geckos (*Hoplodactylus granulatus*) and green geckos (*Naultinus elegans*).

The forest adjacent to the house is part of continuous indigenous forest cover on the Coromandel Range. Between the house and the watershed (1.5 km to the north-east and ~550 m) the forest is almost entirely regenerating from earlier disturbance. The only remnants of the original forest that remain are very small, modified, and in narrow gullies.

2.2 MORPHOMETRICS AND COLOUR

The gecko captured at Coromandel is an adult male. Morphometric measurements and scalation details, made on the live gecko, are presented below. Measurements of body length were made with a ruler to 1 mm; measurements

of head dimensions were made with dial callipers to 0.1 mm; the measurement of weight was made with a Pesola™ spring balance to 0.1 g.

Measurements: SVL = 71 mm, VT = 94 mm, tail unbroken, Wt = 6.9 g, snout-eye = 9.1 mm, eye diameter = 3.7 mm, eye-ear = 6.0 mm, inter-orbital = 9.1 mm, ear opening very small (<1.5 mm).

Coloration (see Figure 1): Body colour and coloration-including opaque under-surface marked with numerous, fine, longitudinal flecks-is typical of *Hoplodactylus stephensi* from Cook Strait region (see Robb 1980, Whitaker 1991). Mouth lining orange around the lips and in corners of the mouth, interior pink, throat greyish, tongue pink with dark tip.

Description: Rostral rectangular, 2 x wide as deep, broadly contacts nostril. Nostril surrounded by rostral, 1st supralabial and four nasals; the anterior nasal largest. Rostral notched posteriorly. First internasal contacts rostral, anterior nasals and 2nd internasal. Second internasal flanked by two others (four internasals in total). Prominent, conical superciliary spines. Mental subquadrangular, with broad posterior margin, notched posteriorly. Post-mental small, contacts 1st infralabials. Supralabials 12/12, infralabials 11/10. Body and tail scales small and granular, ventral scales on body and tail imbricate. Three enlarged, pointed cloacal scales. Preanal pores in 5 rows, femoral pores in 2-3 rows; pores 46 wide. Lamellae 4th toe 14/14, straight. Apical scansors on digit 1 only. Seven scale rows on penultimate phalanx, penultimate phalanx arises from extremity of digital expansion. Webbing slight between toes 2/3/4.

The gecko is currently being held in captivity under permit LIZ97/8, issued by Nelson/Marlborough Conservancy, Department of Conservation, pending a decision on its future. It has been toe-clipped to collect tissue samples for genetic testing and is now marked 34/0/3/0.

2.3 POSSIBLE ORIGIN

Because the Coromandel specimen showed every characteristic of being a striped gecko, yet was so far beyond the known range of the species, the possibility that it was an animal from the Cook Strait region that had been deliberately released or accidentally escaped from captivity required investigation. All the people known to have held striped geckos in captivity and all the people known to have kept captive geckos in the vicinity of Coromandel township were contacted. All those who had kept striped geckos could account for their whereabouts as all these geckos are now dead. None of the people who had held captive geckos in Coromandel had ever had striped geckos in their possession or geckos that looked like them.

In order to solicit further possible information on the gecko a press release was published in the local newspaper, the *Hauraki Herald*. This requested information from anyone having seen or kept geckos distinctively marked with longitudinal markings. Although there were two responses, neither proved to be of striped geckos.

After the DNA results revealed the Coromandel gecko was almost certainly native to the area (see Section 3, below) a photograph and description were circulated in the district to heighten public awareness about the gecko in the hopes that further sightings of the species would be reported.

3. Genetic study

3.1 METHODS

Tissue samples were collected from the gecko captured at Coromandel for genetic analysis to determine whether it was likely to be a striped gecko that had come from Stephens Island or Maud Island, or whether it represented a newly discovered population native to the area where it was found. If it proved to be from a new population, an additional aim was to assess the relationship of the new population to the previously known ones and to related species.

The tests were conducted on toes removed from the animal. Tissue samples were frozen in a domestic freezer (-12°C) immediately after collection and were forwarded to Wellington within a few days in a thermally buffered container. In Wellington they were stored in an ultra-freezer at -80°C until they were processed.

DNA was extracted from the toe tissue and subjected to polymerase chain reaction (PCR) techniques to amplify-make multiple copies of-sections of the mitochondrial 16s ribosomal RNA and cytochrome b genes. DNA base sequences of both genes were then determined using an automated DNA sequencing machine: 865 bases of the 16s gene and 314 bases of cytochrome b were sequenced.

The genetic data from the Coromandel gecko were compared with DNA data from tissue obtained from two striped geckos captured on Stephens Island in 1987 and two captured on Maud Island in 1991. Additional tissue samples, from Stephens Island striped geckos marked during a study in 1990 (Cree n.d.), are being held and are available for genetic testing if a larger sample is desirable. They were also compared with DNA sequences from all named species of New Zealand geckos and with some related Australian and New Caledonian species.

3.2 RESULTS

Allozyme studies have shown that the Stephens Island and Maud Island populations of striped geckos have minimal genetic differences and are clearly conspecific (Whitaker 1991, Hitchmough 1997). Both allozyme and DNA data from tissue obtained from Stephens Island and Maud Island specimens show that striped geckos diverged from other New Zealand species early in the adaptive radiation of New Zealand geckos, and that they have no close relatives. The DNA data from the Coromandel specimen confirm its identifica-

tion as *Hoplodactylus stephensi*, and show the same distant relationship with other New Zealand gecko species.

However, the Coromandel specimen is clearly genetically divergent from the Cook Strait populations. A table of similarity in 16s and cytochrome b sequences of the Coromandel, Stephens Island, and Maud Island populations shows that the two Cook Strait populations are extremely similar, and the Coromandel specimen is different from both (see Table 1). This means that it is very unlikely to be an accidental or deliberate release of an animal brought from Cook Strait, and almost certainly represents a previously undiscovered population of striped geckos natural to the Coromandel area.

4. Field surveys

A variety of field studies have been undertaken in an effort to obtain further specimens of the gecko species found at Coromandel in order to confirm the occurrence of a population there and to assess the conservation status of the species within the district. These include pit-trapping, night-searching and the use of artificial cover.

4.1 PIT TRAPPING

Sixteen pit traps (4 litre paint tins) were installed in the kanuka-manuka forest, all within 25 m of the house where the striped gecko was captured. These traps were baited with either canned pear or sardines. Initially they were checked daily, and later twice-weekly.

The traps were operated from 18 November 1997 to 26 March 1998 for a total of 2,048 trap-days. Apart from invertebrates, the total catch comprised rainbow skinks (*Lampropholis delicata*) and one Hochstetter's frog (*Leiopelma hochstetteri*) (caught in a trap set alongside a small watercourse).

4.2 NIGHT SEARCHING

Methods

Striped geckos are strongly nocturnal and, like all other nocturnal geckos, can most easily be located by 'eye-shine' when torchlight is reflected from the tapetum lucidum in their eyes (Whitaker 1967 & 1994). Because gecko's eyes are small, and their pupils contract rapidly when light is shone on them, the best results are obtained when the light source is close to the observer's line of sight and when light levels are relatively low. The use of a binocular-mounted spotlight to give a coincident line of light and line of sight, and a voltage regulator to control light levels according to the range being searched, has proved particularly effective for locating geckos at low population densi-

ties, occupying inaccessible or difficult-to-search habitats, or where the species are cryptic. This method has been used to locate geckos over ranges up to 100 m and has been used successfully with striped geckos between 30-50 m (Whitaker 1991). Once a gecko has been located by this method it is kept under constant surveillance while an assistant is directed to the site to capture or identify it.

Familiarisation with the site and habitats was undertaken during the day, and routes planned for the night searches. During this daytime reconnaissance brief searches were made for inactive geckos, involving examining potential cover such as logs, cracks and crevices in trees, loose bark, and dense dead foliage on tree ferns (*Dicksonia spp.*), cabbage trees (*Cordyline australis*) and epiphytic astelias (*Astelia* spp.). Daytime searches also included looking for the sign of lizard occurrence such as droppings or fragments of sloughed skin.

Night searches began at dusk (approx 21:30 hr) and continued for 3-5 hours. During night searches the ambient air temperatures were recorded with an electronic thermometer (Ama-Digit AD 15TH™) at approximately hourly intervals (see Appendix 9.1). Wind speed and direction, and cloud cover were also noted.

Searches were made primarily along roads, tracks, and forest margins, as these sites offered sufficient distance for the spotlighting equipment to be used with greatest effect. Some searching was also undertaken within closed forest. The total search area covered approximately 25 ha between NZMG 27345 64926 (100 m asl) and NZMG 27353 64929 (320 m asl).

The night searching was predominantly undertaken by two people (Tony Whitaker and Rollo Muron), both of whom have had extensive previous experience with the search techniques and carried appropriate search equipment. Short periods of assistance were provided by others, including Rob Chappell.

Results

Approximately 45 person-hours of night searching were achieved. The prevailing temperature and other weather parameters were above the minimum thresholds for gecko activity, and on three nights (15, 16 and 25 January) were within what could be regarded as the optimum range. Four geckos were found at night-three forest geckos and one green gecko; no lizards or sign of their occurrence was found by day. In the absence of comparative data from elsewhere on the Coromandel Peninsula the encounter rate of <0.1 lizards/hour may not be atypically low as it is comparable with some other mainland forest sites (pers. obs.).

The three forest geckos were found: 2 m above the ground on the vertical trunk of a large manuka at 22:45 hr; 1 m above the ground on the frond of a kiokio (*Blechnum sp.*) at 22:55 hr; and at approx 8 m above the ground in the crown of a kanuka at 00:45 hr. All these geckos were clearly alert and actively foraging when found, and they vigorously attempted to evade capture. The green gecko was approx 8 m above the ground on the outermost tips of the

crown of a manuka. At the time it was found (22:45 hr) it was torpid and clearly inactive, and made no attempt to escape.

4.3 ARTIFICIAL COVER

The early seral nature of the forest in the vicinity of the gecko's capture site means natural cover for arboreal lizards is scarce and may be a limiting factor. In such environments the use of artificial cover objects (ACOs), in the form of 'shelter boxes' attached to trees, has proved effective for capturing geckos that are otherwise difficult to locate. This method has the major advantages that the boxes do not require frequent or regular inspection, as the animals can come and go at will, and that it benefits the gecko population by 'enhancing' the habitat. In an attempt to obtain information on the striped gecko population, 17 ACOs have been installed in the forest within 25 m of the house where the striped gecko was found. These are in the form of flat boxes made from 9 mm marine-grade plywood with interior dimensions of 21 x 15 cm by 12 mm high, with an opening 40 mm wide. The box is in the form of a fixed 'sandwich' with plywood on one side and clear Perspex™ on the other, and a hinged plywood cover over the Perspex to exclude light. This design allows easy inspection-by raising the hinged outer lid-but causes minimal disturbance to any animals that might be sheltering within. An additional flat-iron roof protects the box from rain.

The boxes are attached to tree trunks by a galvanised flat-head nail slotted through a 'key-hole' in the back. They are positioned about 1.5-1.8 m above the ground, and so that the entrance is close to the trunk.

The boxes were installed on 26 March 1998 and have been checked monthly (27 April, 25 May, 29 June and 27 July 1998). Thus far no lizards have been found in them nor is there sign (skin or droppings) that lizards have visited them. This is not necessarily unexpected, as often it takes a little time before the boxes weather sufficiently to become attractive and habitable.

5. Discussion

5.1 TAXONOMIC STATUS

Morphometrics

Most measurements, body proportions and scalation details of the striped gecko found in Coromandel lie within the range recorded from Cook Strait populations (Robb 1980, Whitaker 1991). Where morphometric differences occur they are minor and their significance cannot be determined due to the very small sample sizes.

The striped gecko from Coromandel has a gracile build and an exceptionally long tail. The unbroken tail length expressed as a percentage of the snout-

vent length (1.32) is proportionally longer than any recorded in Cook Strait (mean 1.15, range 0.97-1.27, s.d.0.063, *n* = 23) (Robb 1980, Cree n.d.,Whitaker 1991).

There were also slight differences in the head shape (when expressed as a percentage of SVL), reflected in the snout being proportionally longer (snout-eye distance 12.8 for Coromandel *cf* mean 11.4, range 10.6-12.5, s.d. 0.72, *n* = 7 for Cook Strait) and the head being proportionally wider (inter-orbital distance 12.8 *cf* mean 11.7, range 11.3-12.3, s.d. 0.32, *n* = 5) (Robb 1980, Whitaker 1991).

On the Coromandel striped gecko the number of rows of preanal pores (5) and femoral pores (2-3) is lower than on male striped geckos from the Cook Strait region (Maud Island-7 preanal, 4 femoral, Whitaker 1991; Stephens Island-6-9 preanal, 4-5 femoral, Robb 1980).

Genetics

The divergence in the DNA sequences between the Coromandel and Cook Strait populations of striped geckos is less than that found to date between most described species of geckos, but is similar to that between black-eyed geckos (*Hoplodactylus kahutarae*) and some populations of forest geckos (*Hoplodactylus granulatus sensu lato*), and between the species of green geckos (*Naultinus spp.*) (Whitaker *et al* in press, pers. obs.). However, the large geographic separation of the striped gecko populations means they may represent the ends of a cline rather than discrete taxonomic entities, and patterns of geographic variation in DNA sequences within other comparably widespread species have not yet been assessed.

Taxonomic status

The minor morphometric and genetic differences exhibited by the Coromandel striped gecko indicate that is genetically isolated and distinct from those in the Cook Strait region. At this stage the differences are not clear enough to justify taxonomic distinction. Further consideration of the taxonomic status will have to await additional material from Coromandel or, preferably, from other localities between or beyond the known sites.

5.2 HABITAT

On both Maud Island and Stephens Island the original coastal forest has been severely reduced in area and modified by past farming activities. On Maud Island, striped geckos occur in lowland forest dominated by kohekohe (*Dysoxylum spectabile*), titoki (*Alectryon excelsus*), pukatea (*Laurelia novae-zelandiae*), hinau (*Elaeocarpus dentatus*), taws (*Beilscbmiedia tawa*), karaka (*Corynocarpus laevigatus*), pigeonwood (*Hedycarya arborea*), nikau (*Rhopalostylis sapida*) and miro (*Prumnopitys ferruginea*). They have been found on the ground, in sub-canopy shrubs, on trunks, and in the canopy (Whitaker 1991). On Stephens Island, striped geckos have been found in coastal forest and shrubland remnants but are most abundant in pohuehue

(Mueblenbeckia) vinelands (Cree n.d.). The predominance of records from vinelands is not regarded as a habitat preference but a direct consequence of the extreme modification of the Stephens Island vegetation (Whitaker 1991).

The occurrence of the Coromandel striped gecko in early seral forest dominated by kanuka and manuka is a novel habitat for the species. However, the natural lowland forest at Coromandel would have been structurally similar to that in the Marlborough Sounds and been largely dominated by the same plant species. Tiny remnants of this original forest could have acted as reservoirs for the striped gecko population, thus allowing the colonisation of adjacent regenerating shrublands and forest.

Within the area searched at Coromandel there are a few large tangles of pohuehue (*Muehlenbeckia australis*) growing over trees. In the light of the spurious association of striped geckos with pohuehue vinelands on Stephens Island these sites were searched particularly carefully.

All localities from which striped geckos have been collected are below 280 m asl, the maximum height of Stephens Island. This is unlikely to represent anything like the upper altitudinal limit for the species.

Sympatric species

On Stephens island, striped geckos are syntopic with common geckos (*Hoplodactylus maculates*) and Marlborough green geckos (*Naultinus manukanus*), and on Maud Island with common geckos and forest geckos. At the Coromandel locality they are syntopic with forest geckos and green geckos, and probably with Pacific geckos (*Hoplodactylus pacificus*) and common geckos. These other gecko species are the only geckos widely distributed in lowland forest of the North Island, so there is not likely to be any inter-specific competition limiting the occurrence or range of striped geckos.

5.3 DISTRIBUTION

Local distribution

in pre-human times the entire Coromandel Peninsula was covered with closed rainforest and this forest cover remained more-or-less intact until the arrival of Europeans. Although forest clearance for timber harvest (kauri *Agathis australis*), gold mining and agriculture following European settlement saw much of this original forest removed or severely modified, large areas that had been cleared are now regenerating. Semi-continuous indigenous forest and shrublands, in various stages of regeneration, now extend along the axial range of the full length of the peninsula.

The habitat immediately surrounding the site at which the Coromandel striped gecko was captured is regenerating shrubland and early seral forest. The original forest cover over most of the area was cleared during the exploration for gold between 1865 and 1890. The current reafforestation began in the mid-1940s, and the present vegetation at the site is continuous with and indistin-

guishable from that on the main range. On the reasonable assumption that this vegetation is suitable habitat for striped geckos, the local distribution on the Coromandel Peninsula is not constrained by habitat limits.

National distribution

The discovery at Coromandel raises the number of known localities for striped geckos to three and dramatically extends the range of the species 460 km to the north. More significantly, the new locality is the first site north of Cook Strait and is effectively at the opposite end of the North Island to the previously known sites.

Lowland forest structurally and floristically similar to that occupied by striped geckos was widespread in the North Island and northern South Island below 300 m (the altitudinal range over which striped geckos have been recorded). Furthermore, the gecko species (or their analogues) syntopic with striped geckos at the known sites are extant throughout this range. This indicates that striped geckos were probably formerly widespread in lowland forest habitats in the North Island, at least between Coromandel and Cook Strait, and that they are likely to be still present at undiscovered localities.

5.4 CONSERVATION STATUS

Threats

The populations of striped geckos on Stephens Island and Maud Island are relatively secure because the islands are free of introduced mammalian predators. On Stephens Island the striped geckos are vulnerable to predation by tuatara (*Sphenodon punctatus*) and on Maud Island they are at risk to moreporks (*Ninox novaeseelandiae*), both of which are known to prey on nocturnal geckos (e.g. Walls 1981, Anon 1996). Wekas (*Gallirallus australis*) and stoats (*Mustela erminea*)-both voracious lizard predators (e.g. Thomas 1982, King 1990)-occasionally swim to Maud Island but a rigorous animal control programme prevents them from establishing. Takahe (*Porphyrio mantelli*), introduced to Maud Island as part of their conservation management, are also lizard predators (Whitaker 1991) but because they are diurnal, forage primarily in pasture areas, and only take terrestrial prey they pose little threat to striped geckos.

At Coromandel, as indeed elsewhere in the North Island, the striped gecko population is at risk to the entire suite of introduced mammalian predators known to prey on lizards. This would have included up to 2,000 years exposure to predation by kiore (*Rattus exulans*) plus variously up to 200 years exposure to other rodents, mustelids and feral cats, and maybe even feral pigs and dogs (Towns & Daugherty 1994, Holdaway 1996). The species and status of mammalian predators currently occurring in the immediate vicinity of the capture site is unknown and requires investigation. At the very least mice (*Mus musculus*), ship rats (*Rattus rattus*), Norway rats (*Rattus norvegicus*), stoats (*Mustela erminea*), and feral and domestic cats (*Felis catus*) are likely to be present. Because of the proximity to an urban area, domestic cats are

likely to be a particular problem, and during the night surveys for striped geckos domestic cats were frequently seen in the forest in the search area. However, there is no evidence that the predator guild or density has changed in the recent past, or is changing now, so it seems that striped geckos can survive in their presence, albeit probably at a considerably lowered population density (*cf.* the response of gecko populations to release from predation pressure (Newman 1994, Towns 1994)).

Stephens Island and Maud Island are Crown-managed reserves for the preservation of flora and fauna, making the habitat of striped geckos about as secure as it can be. The area immediately surrounding the site where the striped gecko was found at Coromandel is all in private ownership and currently used for low density ('rural residential') housing. Most of the landowners appear to be interested in retaining-even encouraging-the regenerating forest. However, there is no requirement that they do so and the area is potentially at risk to increased subdivision, with consequent clearance, or to conversion to exotic forestry.

Implications for the conservation status of striped geckos

The discovery of a new locality for striped geckos and the extension of their range 460 km to the north at Coromandel should theoretically improve their conservation status-primarily because it opens the possibility they could occur in lowland forests anywhere in the central or southern part of the North Island. However, with just a single individual known from the new site, no indication of the extent or density of the new population, exposure to a broad range of predators, and no security for the habitat, any 'improvement' in status is currently minimal.

Moreover, for several reasons the new population requires separate conservation consideration to those in the Cook Strait region. The genetic and morphometric studies revealed differences, albeit minor, between the Coromandel gecko and those from the Cook Strait populations. If further work reveals they should be considered separate species, the conservation status and significance of each will need upgrading to reflect this distinctiveness and corresponding rarity. Additionally, the Coromandel site is important as representing the only North Island location for striped geckos and the northern limit of their known distribution.

Presently no comment can be made on the population density of striped geckos at Coromandel. On Stephens Island and Maud Island, striped geckos are either rare (in comparison to the other geckos present) or elusive-or both, or maybe their primary habitat has simply not been identified and the species is being overlooked. The fact that the Coromandel gecko is the first record from the North Island tends to support the latter explanation.

With this discussion based on just a single animal from Coromandel a precautionary approach dictates that the DOC conservation priority Category B and the IUCN threat classification of *vulnerable* for striped geckos should remain unaltered. Future surveys and genetic studies could easily change either or both of these rankings.

6. Conclusions

As a result of this study the following conclusions can be made:

- The distinctive gecko found at Coromandel is a striped gecko (*Hoplodactylus stephensi* Robb 1980). Morphological and genetic data show this specimen is conspecific with striped geckos from the type locality, Stephens Island, and from Maud Island.

- The striped gecko from Coromandel is not an accidental or deliberate release of an animal from the Cook Strait region but represents a previously undiscovered population and a genuine, if remarkable, extension of the species' range. The genetic data show sufficient divergence from the Cook Strait populations to be certain the specimen did not come from either Stephens Island or Maud Island. The most parsimonious explanation is that it represents a population native to the site where it was found.

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9. Appendices

9.1 Prevailing weather during night searches for striped geckos *(Hoplodactylus stephensi)* at Coromandel, January 1998.

Time (hr)	Temperature (°C)	Wind (speed/direction)	Cloud (oktas)	Notes
14-15 January 1998				
21:40	16.0	SW, light	0/8	no moon
23:10	12.7	SW, light	0/8	no moon
00:15	11.7	SW, light	0/8	full moon
01:25	11.8	calm	0/8	full moon
02:25	10.6	calm	0/8	full moon
03:20	10.5	calm	0/8	full moon
15-16 January 1998				
21:15	17.9	calm	8/8	no moon
22:15	16.8	calm	6/8	no moon
23:15	17.0	calm	8/8	no moon
00:15	16.6	calm	8/8	no moon
01:15	17.4	calm	8/8	no moon
02:15	16.1	calm	7/8	no moon
03:15	15.5	calm	2/8	full moon
16-17 January 1998				
21:30	16.0	calm	8/8, drizzle	no moon
22:30	15.3	calm	8/8, drizzle	no moon
23:30	15.1	S, very light	8/8	forest wet, no moon
00:30	14.9	S, very light	8/8	forest wet, no moon
01:05	14.8	S, very light	8/8	forest wet, no moon
25-26 January 1998				
21:30	18.0	NW, moderate	0/8	no moon
22:30	17.5	NW, moderate	0/8	no moon
23:30	15.8	calm	0/8	no moon
00:14	16.3	calm	0/8	no moon

FIGURE 1: Adult male striped gecko (*Hoplodactylus stephensi*) captured at Coromandel township on 9 March 1997 (SVL = 71 mm). Photo: A H Whitaker.

TABLE 1: Number of differences in DNA bases between populations of striped gecko (*n* = 1 for Coromandel; *n* = 2 for Stephens Island; *n* = 2 for Maud Island. The two Maud Island specimens had identical sequences, as did the two Stephens Island specimens). Values above the diagonal are for the 16s gene (865 bases), those below the diagonal for the cytochrome b gene (314 bases).

	Stephens	Maud	Coromandel
Stephens		3	21
Maud	1		20
Coromandel	14	15	