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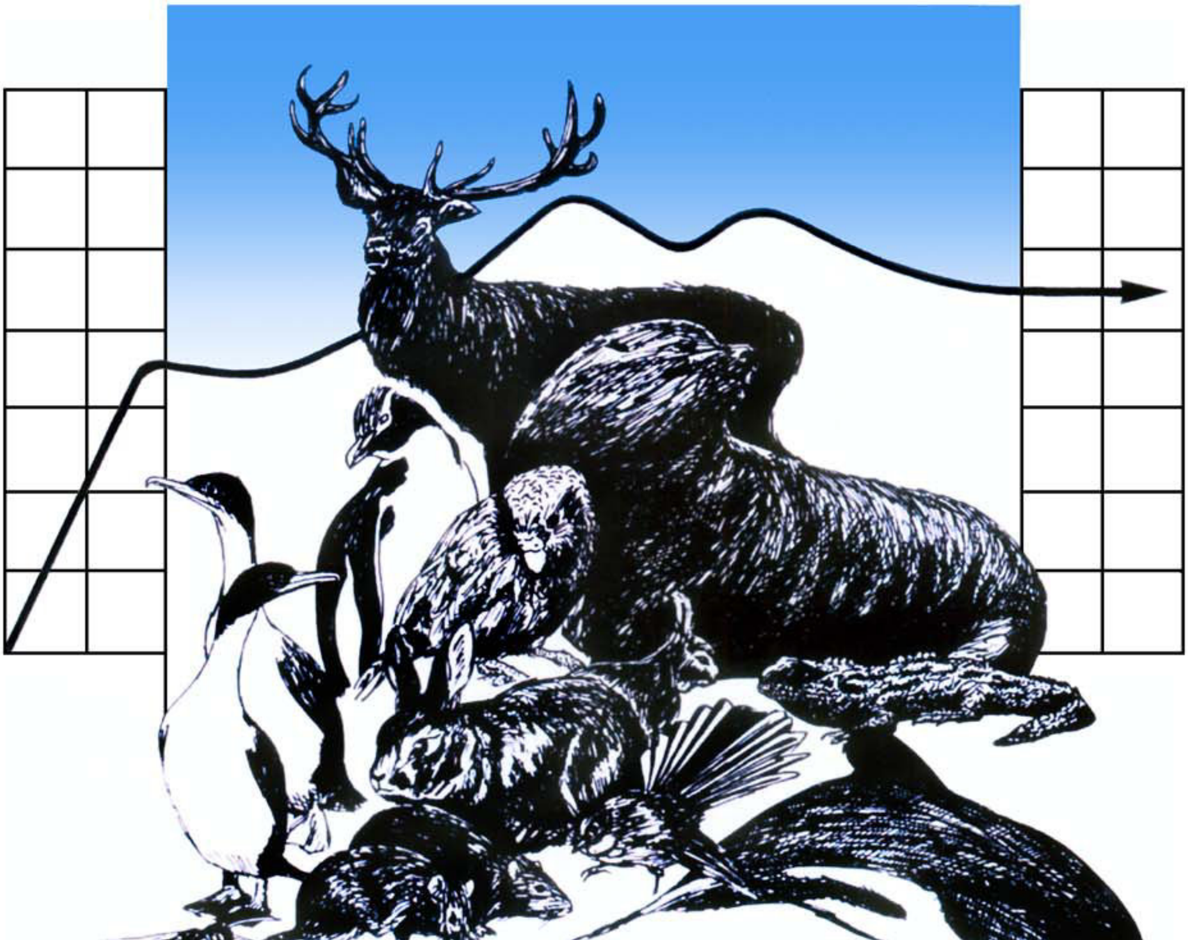

WILDLIFE MANAGEMENT

Using Closed-Cell Foam Artificial Cover Objects to Determine the Abundance of Goldstripe Geckos at Bushy Park, New Zealand

Keely Thomlinson

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University of Otago
Department of Zoology
P.O. Box 56, Dunedin
New Zealand

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By Keely Thomlinson

WILM 403

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Abstract

Reptiles are declining international; in New Zealand 62% are at some level of risk, with 77% (30 species) of geckos being included in this category. The goldstripe gecko is listed as Relict with a population on Mana Island increasing, but limited information is available on the population found at Bushy Park. This project aims to be a baseline study in determining an estimate for this population using closed-cell foam artificial cover objects (ACOs). 96 covers were set up over three sites and each checked five times in December 2011. Using this method along with spotlighting and 30 baited g-minnows traps, no goldstripe geckos were observed. Temperatures during the observation period ranging from 8^{o}C to 24^{o}C were combined with wet weather conditions and may have caused goldstripe geckos to be inactive or undetectable. Factors such as competition or disease may have caused goldstripe geckos to decline. A long term study is required to exclude temperature and rainfall as reasons why goldstripe geckos were not found, and to determine their existence at Bushy Park.

Additional Keywords

Nocturnal, lizards, reptile, weather, temperature, rainfall, retreats.

Introduction

Globally, reptiles are declining due to a number of threats such as habitat loss, introduced invasive species, disease and climate change (Gibbon et al. 2000). In New Zealand there are 109 reptiles and 62% (68 species) are classified as At Risk or worse (Hitchmough et al. 2010). The most threatened are six South Island skinks which are listed as Nationally Critical. Of 39 geckos found in New Zealand, 5 are Threatened while 25 are at some level of risk, leaving only 9 species which are Not Threatened (Hitchmough et al. 2010).

In 1996, the International Union for Conservation of Nature (IUCN) listed goldstripe geckos (Hoplodactylus chrysosireticus) as Lower Risk/ least concern (IUCN 2012). Later in 2005, the New Zealand Classification System stated the goldstripe gecko as Sparse to Gradual Decline (Hitchmough et al. 2007). However, in 2009 updated the species to Relict due to sightings in urban areas and an increasing population on Mana Island, which is assumed to offset declines in the population elsewhere (Hitchmough et al. 2010). Concern has been expressed over the gecko's low ranking, due to reasoning for this status and having only one large population free from all predators and habitat destruction (Lettink & Armstrong 2003). Gill & Whitaker (2007) is the most recent publication which has listed the goldstripe gecko as endangered. The ranking of this species is questionable and is likely due to a lack of factual information.

The goldstripe gecko is a nocturnal species that also basks in the sun. They can be found in most terrain from forest to coastal and is often found in flax (Gill & Whitaker 2007; Middleton et al. 2010). They are omnivores who prey on insects and spiders, supplemented with fruit and nectar. These small lizards have a snout to vent length up to 70mm (Gill & Whitaker 2007). New Zealand's goldstripe geckos are found in coastal Taranaki in an area ranging from Waitara to Patea, and on Mana, a 217ha island found 21km north of Wellington (Timmins et al. 1987; Newman 1994; Gill & Whitaker 2007). Goldstripe populations are assumed to have declined due to their vulnerability to predation (Hitchmough et al. 2007). Mana Island and fenced populations at both Bushy Park and Rotokare in Taranaki are important habitat for goldstripe geckos and many other threatened animals due to their pest free status (Newman 1994; DOC 2012).

Bushy Park is found in Kai Iwi, just west of Wanganui. It is a 245 acre forest sanctuary protected by a 4.8km Xcluder Pest Proof Fence (BPT 2012). Continuous predator trapping takes place inside and outside the fence line to ensure the exclusion of possums, cats, mice, stoats and rats. A number of growing native bird populations reside in the park, such as the native pigeon (kereru), saddleback, bellbird, and tui (BPT 2012).

Monitoring techniques are used to determine population dynamics. Lizard monitoring methods are hindered by a number of obstacles including lizards being nocturnal, arboreal, camouflaged, and having limited visibility in some weather conditions (Mazerolle et al. 2007; Bell 2009). They can be located in areas with difficult access and have the ability to disperse rapidly when disturbed, making accurate counts challenging. These obstacles need to be overcome to develop an accurate and inexpensive method of determining lizard population dynamics (Bell 2009; Lettink et al. 2011).

Bell (2009) has developed an artificial cover object (ACO) using closed-cell foam that is economical, lightweight, easy to install, resistant to decay, and can insulate against the environment. As lizards use tree hollows and tree bark for retreats, closed-cell foam ACOs can be placed over tree trunks, mimicking natural habitats (Bell 2009). ACOs allow for a large sample size with easy repetition, a low observer bias, protection from predators and a low environmental impact (Monti et al. 2000; Clark 2006; Hoare et al. 2009). Their ability to absorb and retain heat enables lizards to increase their body temperature for daily functions (Thierry et al. 2009). These factors make ACOs suitable retreat sites for lizards.

The report aims to determine a population estimate for goldstripe geckos found at Bushy Park, and can act as a baseline study for a long term project. Limited information is available on goldstripe gecko populations and biology, needed to identify how critical the species is and determine what needs to be done to protect its future.

Materials and Methods

Artificial cover objects 0.5m x 0.4m x 3-4mm (Bell 2009) were made from closed-cell foam and randomly nailed to 32 trees within each of the three sites (A, B, and C) in Bushy Park, Wanganui, New Zealand. Site A bordered a swamp area (E2675424 N6154753); Site B in an open ridge area (E2674465 N6154997); and Site C was located at the edge of a forest area (E2674734 N6155255). Covers were positioned in areas with sun exposure, and on a variety of tree species with a circumference of over 40cm to avoid the ACO overlapping. Bell (2009) found that there was no significant difference between lizard occupancy and the tree species the cover was on.

The ACOs were nailed firmly to trees, but had spaces to allow lizards to enter. At each site two sub-sites were used, having 16 ACOs on each. ACOs were labelled with Twink using a site letter, sub-site number and cover number (e.g. A1.1 - A1.16).

Covers were erected on the 19th and 20th of October 2011, and observations commenced November 29th through until December 14th 2011. The artificial retreats were left for a period of five weeks to allow organisms to become habituated to them (Lettink et al. 2011). To check the ACOs the cover was gently pulled back through the nail holes and replaced once checked. Observations of the cover objects were recorded when opened, along with daily temperatures from MetService (2011). One sub-site at each of the three sites was checked on observation days to keep the temperature and weather conditions similar for all sites. The second sub-site at each site was checked on alternative observation days. ACOs were checked every third day to limit the disturbance causing lizards to become trap shy.

Additionally, spotlighting and baited g-minnow traps were used twice over the observation period. Spotlighting occurred on December 8th and 13th at sites A and B respectively for an hour and a half each night between 10.00pm and 12.00am. Two observers went out each night to survey the area using a LED Lenser x21 and binoculars with a torch attached.

Ten g-minnows were baited with banana at each site on December 10th and 13th to be left overnight and re-checked the following morning.

Results

The observation period consisted of 480 checks (96 ACOs checked five times) however no goldstripe geckos were observed. On two occasions lizards were observed under ACOs, however they dispersed quickly so accurate identification could not be made. The lizard found under ACO C6.5 was assumed to be a common skink (Oligosoma polychroma); this ACO was on a fallen tree so the skink may have been able to climb up it. The other lizard was observed under ACO B4.4, it was dark brown so was not likely to be a goldstripe gecko. The ACO was positioned low on a tree trunk surrounded by long grass so there is potential for this to also be a skink.

Slugs and slaters were commonly found under ACOs, along with caterpillars, spiders and other insects. Insect abundances were lower in ACOs situated at Site C, with some having no insects throughout the study. Wetas were found at sites A and C in 6 different ACOs, on one occasion there were three under the same cover. Finally, bell frogs (Litoria aurea) were also seen three times under two different ACOs at Site A, near the swamp habitat.

Temperatures on observation days ranged from 8°C to 24°C (Fig. 1), with wet weather recordings on a third of the days.

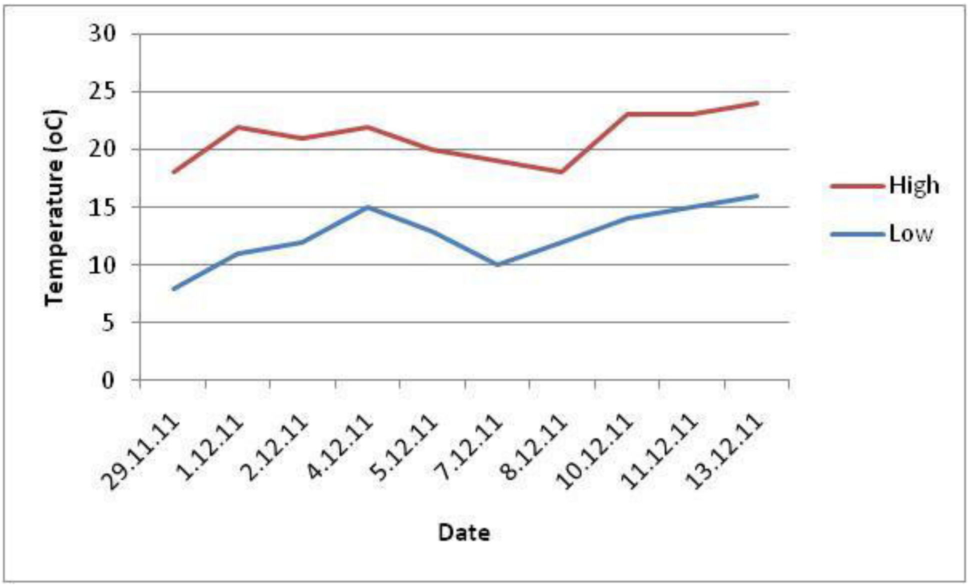

Figure 1: Daily low and high temperatures (°C) recorded from MetService (2011) of all days ACOs were observed.

On December 7th and 8th observations of the ACOs were made recording which were still wet after heavy rain on December 6th. Site C recorded the highest level of wet ACOs with only one from sixteen being dry on December 7th; whereas on December 8th seven were dry at the second sub-site (Table 1).

Table 1: The condition of artificial cover objects (ACOs) from three sites on the 7th and 8th of December after heavy rain on the 6th of December, indicating whether inside the cover were wet, dry or half wet and half dry.

		ACO Condition		
Date	**Site**	**Wet**	**Half**	**Dry**
7.12.11	**A**	7	3	6
	B	1	2	13
	C	10	5	1
8.12.11	**A**	3	3	10
	B	3	1	12
	C	6	3	7

Discussion

Methodology

Closed-cell foam ACOs

Bell (2009) found that when using closed-cell foam cover objects they were more efficient at sampling geckos than alternative methods such as spotlighting and using g-minnows. It was also found that this method can still be successful when gecko populations are low, as goldstripe geckos may be. The ACO technique has only been tested once before, but had good outcomes. The closed-cell foam covers found 31 Duvaucel's geckos (Hoplodactylus duvaucelii) under 80 covers during one check with a 0.387 capture rate (Bell 2009). Both the Pacific gecko (Hoplodactylus pacificus) and forest gecko (Hoplodactylus granulatus) were recorded in the covers with eight caught from 196 covers and seven from 96 covers respectively, but were not caught using spotlighting or g-minnow methods.

The ACO method should work as has been demonstrated, and with two lizard species being observed it is therefore probable that goldstripe gecko were not active, or are no longer in the site areas. This conclusion is supported by no sightings through spotlighting or baited g-minnow methods.

Disturbance

Hoare et al. (2009) checked artificial retreats five times a day for nine consecutive days; they found that common skink presence within the ACOs did not decrease through constant disturbance. However, Marsh & Goicochea (2003) found when using ACOs for red-backed salamanders (Plethodon cinereus), the capture rate for adults was significantly lower when checked daily compared to weekly. A similar effect was also shown for common and McCann's (Oligosoma maccanni) skinks where ACOs were checked daily and weekly, with daily checks causing a decline in capture rate (Wilson et al. 2007). Lizard abundances have been demonstrated to be greatest when ACOs are left for 3-4 months (Lettink & Cree 2007), while salamander counts can be highest after a year (Monti et al. 2000).

Within this study, the ACOs set up at Bushy Park may not have had enough time to habituate to the environment, resulting in avoidance. My presence along with the disruption of ACOs every third day may also have contributed to this outcome.

Weather

Temperature

Temperature has been shown to influence the capture rates of lizards (Towns & Elliott 1996; Hoare et al. 2009). Lizards determine their retreat sites by their thermal properties; the more sun exposure and warmer they are, the more likely lizards are to choose these sites (Langkilde & Shine 2004; Hoare et al. 2009). This is due to lizards being ectotherms, meaning they gain heat from the external environment which allows them to regulate their body temperature (Hare et al. 2010). Reliance on the external environment can result in organisms being unable to reach optimal body temperatures for biological processes such as immune functions, reproduction and digestion (Hare et al. 2010). Most of New Zealand's nocturnal lizards are active when their body temperatures range from 10^{o}C to 14^{o}C, which is lower than diurnal lizards (Autumn et al. 1999). Having adapted to lower night temperatures, nocturnal lizards are able to reach running speeds up to three times greater than diurnal lizards by having a lower cost of locomotion with higher metabolic rates (Tocher and Davison 1996; Hare et al. 2010). Additionally, Tocher and Davison (1996) found that common geckos can go into a dormant stage when temperatures were low.

During the study period, minimum temperatures were as low as 8^{o}C overnight; this would not have allowed goldstripe geckos to reach optimal body temperatures, causing them to be inactive or dormant. This is a possible explanation to the lack of gecko observations through spotlighting, the use of ACOs and baited g-minnows.

Rainfall

Rainfall has been shown to negatively influence skink abundances when it occurred within three hours prior to checking ACOs (Hoare et al. 2009). Bell (2009) also believes that rainfall may have driven lizards out of the closed-cell foam covers, as water runs down the tree trunks and enters the cover.

During observations it was noted that some trunks were wet and certain trees, especially in site C (forest), did not always dry after a day. An extra day post the rain on December 6th would have allowed more ACOs to dry out before observations were made on December 8th. However, many ACOs were still wet and may have remained this way due to rainfall occurring on a third of observation days. Throughout the erection of ACOs, differing tree contours created difficulties to fit the covers tightly and resulted in gaps under some covers. Extra space under the ACOs may have allowed for more rain to enter the covers along with temperature to be lost more rapidly. Therefore, rainfall could be a cause for no goldstripe gecko sightings during the study period. The poor weather conditions during the study also lead to limited spotlighting events.

Seasonality

Newman (1994) concluded that weather from November to March did not influence the capture rates of lizards on Mana Island. However, Towns & Elliott (1996) contradicted this by showing that five lizards involved in their study ((1) common skink, (2) brown skink (Oligosoma zelandicum), (3) copper skink (Cyclodina aenea), (4) Whitaker's skink (Cyclodina whitakeri) and (5) the common gecko (Hoplodactylus maculates)) were more commonly captured during January and February, with rates in December still being high. Their investigation also showed annual catch rates can be variable; in one trapping season no brown skinks were observed and two years prior 54 were recorded. Lettink & Cree (2007) also suggested that late summer or early autumn was the optimum time for common geckos to be found in retreats.

The combination of low temperatures and rainfall that occurred may have resulted in the ACOs being checked to early in the season; a period later in the summer with reverse conditions may have resulted in goldstripe gecko abundances.

Other factors that may be influencing goldstripe geckos

Competition

As species populations such as saddlebacks, bellbirds and kereru are growing in Bushy Park (BPT 2012), the increasing animals could be competing for food resources with goldstripe geckos. However, if there was a food shortage, geckos would have been attracted to the baited traps positioned in the area, which were inaccessible to birds. As most ACOs at sites A and B had insects in, there should have been enough food for geckos to feed on. At site C food may have been limited due to no insects being found in some of the ACOs throughout the study, which could result in no goldstripe geckos in this area.

Disease

When species are translocated stress can lead to diseases such as Salmonella in birds and reptiles (Middleton et al. 2010). Middleton et al. (2010) found that 10 from 18 lizard species found on NZ islands had Salmonella, with Duvaucel's geckos having a high prevalence to this disease. Thirteen goldstripe geckos were tested but the disease was not found, this may indicate that this species is not highly susceptible to Salmonella. Ectoparasites are also common in New Zealand's herpetofauna but are poorly documented so their impact on organisms can be hard to determine (Reardon & Norbury 2004). The risk of disease in goldstripe geckos seems less likely as the disease may have seen in other species.

Poor Population Recovery

On Mana Island mice were removed in 1990, the numbers for common geckos and three skink species (copper skink, McGregor's skink (Cyclodina macgregori) and common skink) increased since the removal of mice (Newman 1994). The increase post-eradication could indicate that mice had suppressed the population from increasing to more sustainable levels. The abundance of lizards was determined using pitfall trapping over 13,222 trap nights, in this time 3,599 common geckos were caught, while despite their occupancy on the island no goldstripe geckos were observed before or after the eradication. This could imply that the goldstripe gecko has a slow population recovery, which could lead to future instability for the species (Lettink & Armstrong 2003). As New Zealand lizards are uniquely viviparous and lack multiple clutches due to the cool climate, this may also be slowing population recovery (Cree 1994). If goldstripe geckos have a slow recovery relative to other species, the population may not be able to increase with a limited population, or if minor threats are also affecting them.

Conclusion

This investigation was only intended to be a baseline study of the goldstripe gecko population at Bushy Park. In the future a long term study is needed to further assess this population, or to determine the presence of the species. The reason no goldstripe geckos were found needs to be explored further over a longer time scale where factors such as temperature and rainfall can be eliminated. Due to time constraint this project lacked robustness as the ACOs could have been left longer and checked less often to ensure disturbance wasn't a contributing factor. Once the population status at Bushy Park has been determined a future plan for the ongoing protection and growth of the species can be established. Goldstripe gecko populations on Mana appear to be thriving (Hitchmough et al. 2010); if this is not occurring on the mainland more geckos should be relocated to similar offshore islands. The ACOs which have been left up at Bushy Park could assist the goldstripe gecko population in the future by enhancing the environment and providing extra habitats for lizards (Thierry et al. 2009).

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