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# Use of Monofilament Snare Traps for Capture of Varanid Lizards

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**Abstract—**Varanid lizards (goannas, monitors) are wary and difficult to capture. We designed a baited trap consisting of multiple monofilament snares tied in a grid pattern on wire mesh (chicken wire), and used this design to capture mangrove monitors (*Varanus indicus*) on Rota, in the Northern Mariana Islands. We trapped 21 individuals during sporadic trapping in 1998-99, including 7 recaptures; most trapped individuals suffered no apparent ill effects. This trap design is inexpensive and easy to transport, but requires approximately one hour of construction time per trap. This trap has the potential to provide standardized non-lethal methods for estimation of density of varanid lizards in areas where visual counts are difficult. The trap should not be used in areas where threatened non-target species (especially mid-sized carnivores or scavengers) may be captured, as nooses may injure or kill less hardy species.

## Introduction

The mangrove monitor (*Varanus indicus* Boulenger) is semi-aquatic in its ancestral habitats in New Guinea, northern Australia, and Indonesia (Cogger 1992, De Lisle 1996), and some authors state that it is “always found close to water” (Bennett 1995). The Japanese probably introduced this species to many Micronesian archipelagos (e.g., the Marshalls, Marianas, and Carolines) prior to World War II (Fosberg 1956, cited in Dryden 1965). The Mariana archipelago comprises the northernmost extent of the range of this species, where it occurs

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on all but the three most northern islands (Pregill 1998). There is no archaeological evidence to suggest its occurrence in the Marianas during prehistoric times (Pregill 1998). In the absence of congeneric competitors or other mid-sized carnivores, *V. indicus* has broadened its ancestral semi-aquatic niche on many Micronesian islands to encompass all habitats, from low coast strand and atoll forests to higher-elevation mature limestone forest (pers. obs., J. D. Groves, pers. comm.).

We recently undertook a radiotelemetric study of the mangrove monitor on Rota, an 85-$km^2$ island in the Commonwealth of the Northern Mariana Islands; this study was designed to evaluate the potential for predation by *V. indicus* on the endangered Mariana crow (*Corvus kubaryi*). Wiles et al. (1990) considered *V. indicus* common on Rota, where individuals were most frequently observed in secondary growth vegetation. However, varanid lizards are wary and fleet of foot, and capturing them by hand in dense forest and steep terrain is difficult at best.

Recent radiotelemetric studies of varanid lizards have been carried out in a variety of habitats (e.g., Wikramanayake & Dryden 1993, Christian and Weavers 1994, Traeholt 1995), but only Phillips (1995) expressly states that study animals were captured by hand. We assume that the former researchers also captured varanids by hand. Green *et al.* (1991) captured *V. rosenbergi* by digging them from their burrows, while Auffenberg (1981) captured *V. komodoensis* using large stockade-like traps and funnel traps. Auffenberg (1988) captured *V. olivaceous* in the Philippines by tracking and treeing them using trained dogs, after which the lizards were noosed. James (1996) captured the small Australian varanid *V. brevicauda* using pit traps.

We met with limited success in our initial attempts to capture *V. indicus* by hand or with nooses, funnel traps, and more conventional live traps (e.g., Tomahawk™). Mangrove monitors on Rota primarily used inaccessible retreat sites such as hollow limbs in tall trees, rock crevices, or collapsed WWII-era underground bunkers; thus digging them from retreats was not possible. In this paper, we describe a trap design which was successful in capturing live *V. indicus*.

## Materials and Methods

We developed a baited snare trap that was loosely based on the *bal-chatri* commonly used to capture raptors (Berger & Mueller 1959). Traps were made of chicken wire, approximately 50 cm x 50cm. We tied 15 - 30 lb. test monofilament (fishing line) nooses to the outer surface of the chicken wire in a staggered grid pattern, with 4-cm spacing between individual nooses. The proximal end of the monofilament line was attached to the wire using any secure knot, while the distal end had a slipknot which formed the noose (Fig. 1).

To prevent injury to trapped animals, sharp ends along the edges of the chicken wire were bent inward, away from the loops. Traps were baited with small bundles of dead animal matter (rats, crabs, fish, etc.) or canned meat (Spam™). Bait was bundled in nylon mesh cloth, which allowed the release of

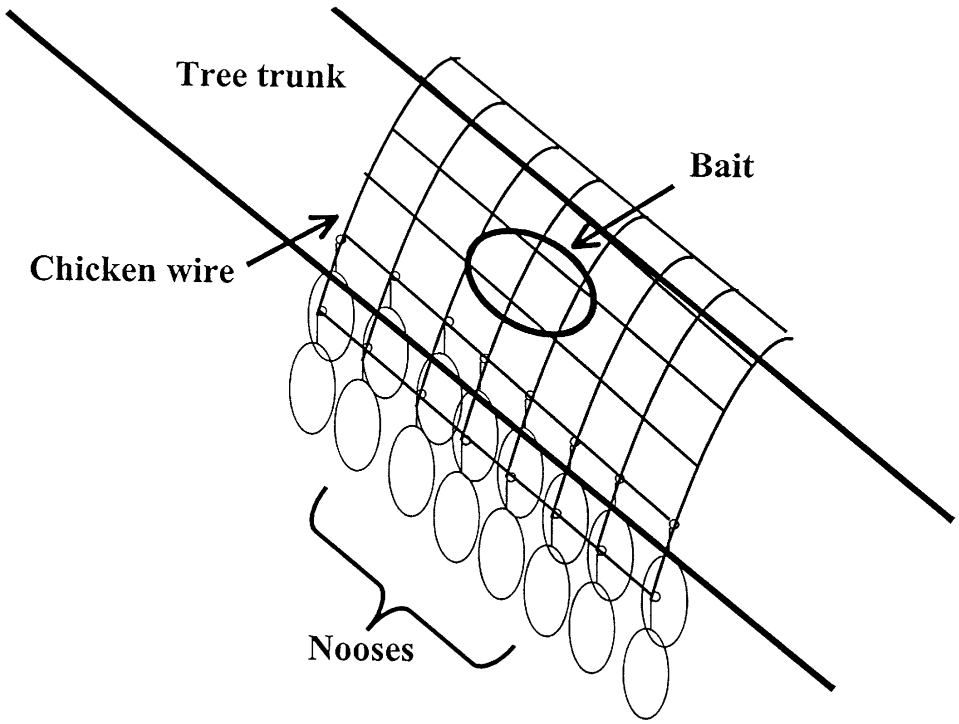


Figure 1. Simplified drawing of a typical snare trap attached to a tree trunk. Chicken wire is fastened around the tree, with bait between the tree and the wire. Monofilament nooses are then tied to the outward-facing side of the wire in a grid pattern (only the bottom two rows of nooses are shown for clarity).

odors while holding the bait together and inhibiting scavenging. The bundle was wired to the center of the underside of the chicken wire, i.e., the side opposite the loops. We also rolled a few traps into tubes, with snares on the inside and bait at the center.

Our study blocks were located at various sites on Rota, and were chosen to provide equal representation of mature limestone forest, coastal atoll forest, and second-growth forest. Traps were placed on and near substrates on which mangrove monitors were actually observed. We usually wired traps to tree branches, trunks, and roots, which meant that the trap could be oriented anywhere from 0 - 90 degrees from the horizon. Other trap sites included large pipes, buildings, and abandoned vehicles. We attached traps to the substrate such that mangrove monitors were forced to walk or climb across a good portion of the noose carpet in order to approach the bait. We positioned traps such that the maximum number of loops hung or remained open.

We checked traps at least twice daily and re-opened any closed loops. Bait was changed as it became desiccated and lost its odor (approximately every third day). Traps had an effective useful life averaging 2 weeks before needing replacement of worn or tangled snare loops. Because trapping lizards was secondary to our main goal of assessing habitat use and movement behavior of *V. indicus*, we did not keep exact records of trap success (capture rate per trap night) in various habitats.

## Results

We obtained 21 captures of 15 *V. indicus* using this trap method on Rota. Trapping effort per day was not quantified, and was confined to brief trapping periods as allowed by research schedules. During this same time, we captured only 14 *V. indicus* by hand, despite numerous intensive searches of suitable habitat patches by up to six field workers at a time (our rate of hand-capture of *V. indicus* was < 0.1 individual per person-hour of searching). Most hand-captures occurred opportunistically as mangrove monitors were seen beside roads on the island, and thus only 6 of these captures were on the telemetry study blocks of interest. Body mass of individuals captured by snare trap ranged from 223 g to 875 g (m = 440.6, SE = 40.45), while mass of individuals captured by hand ranged from 280 to 3450 g (m = 766.7, SE = 336.6). Two telemetered mangrove monitors were trapped twice, one was trapped three times, and one was trapped four times. On one occasion, two mangrove monitors were trapped simultaneously on a single trap.

One gravid female *V. indicus* died in a trap, probably due to trap placement in direct sun during the middle of the dry season. Five individuals captured in the traps exhibited slight abrasions from the nooses, but these injuries were superficial in all cases. After experimenting with various loop sizes, we found that 7-cm diameter loops worked best for capture of an animal the size of *V. indicus*. Smaller loops reduced the chance of successfully snaring an appendage but larger loops were not likely to cinch down. Fragmented monofilament lines were commonly found on traps, but it was not apparent whether these had been severed or broken by mangrove monitors or by nontarget species. Nontarget species included mostly hermit crabs (most of which were used as bait in subsequent trapping efforts), a few coconut crabs (*Birgus latro*), one rat (dead) and one live feral chicken.

We did not observe any differences in trap success between open traps (Fig. 1) and traps that had been rolled into a tube (see Methods, above). Traps oriented vertically (i.e., on standing tree trunks) tended to be more successful than were horizontal traps. We obtained most captures using dead rats and Spam™ as bait, presumably because they dried more slowly, and thus lost odors more slowly, than did fish or crabs.

## Discussion

The snare trap as designed here was extremely inexpensive (< 1 US$/trap), required less than one hour to construct, and proved to be the only reliable method for capturing *V. indicus* on Rota. We did not capture any mangrove monitors with hand-held nooses, funnel traps, or more conventional live traps (e.g., Tomahawk™). A number of mangrove monitors were captured by hand, but this method was very dependent on the agility of the observer and most of these captures occurred away from our telemetry study blocks. We suspect that human persecution has resulted in the high level of wariness which makes hand-captures of *V. indicus* very difficult. On Rota, *V. indicus* is considered a predator of chickens (Wiles et al. 1990) and is killed opportunistically when encountered by humans. In contrast, we have been followed at very close range (< 2 m) by *V. indicus* while conducting field studies on Sarigan, an uninhabited island in the Mariana archipelago.

Trap placement may be critical for ensuring a relatively high capture rate. Our traps were most successful when clustered in areas where lizards had been recently observed rather than haphazardly distributed. We also recommend that trap sites which experience extended periods of direct sunlight be avoided, so as to prevent heat stress in trapped animals.

Our limited data suggest a potential bias toward trapping medium-sized lizards. We observed several juvenile lizards (< 75 g) in the vicinity of traps, but we failed to capture any lizard less than 223 g (nor were we able to catch any juveniles by hand; these small lizards may require completely different capture techniques). It is likely that very small monitors escape by slipping their limbs from the nooses. In contrast, the very largest lizards may break even multiple nooses if given enough time to pull and fray the monofilament line. We observed a very large monitor (> 1 m) walk through several 25-lb test loops in an effort to escape. The fact that we captured two male *V. indicus* by hand that weighed 2200 g and 3450 g, both dwarfing the largest animal trapped (875 g), also suggests that trap samples may represent a biased distribution. This bias could possibly be corrected using stronger monofilament line or by adjusting snare loop size up or down depending on size of target animals.

This trapping methodology could be used to develop a standardized, nonlethal index of varanid abundance. Much like standard trapping methods for assessing small rodent populations, varanid abundance could be assessed with more systematically-distributed snare traps; e.g., a transect or grid. A researcher in Saipan, another Marianas island, has experienced relatively high capture rates by placing traps of this design in a systematic grid pattern (S. Vogt, pers. comm.). Similarly, the possibility exists for employing this technique in a mark-recapture study; multiple recaptures of four individuals in our study suggest that monitor lizards may not learn to avoid these traps.

Because snares and traps that employ snares may capture animals other than the target species, we suggest this method should not be used in areas with high populations of small-bodied vertebrate scavengers, especially if these species are rare and/or threatened. The method was ideal on an oceanic island such as Rota, which has low terrestrial species richness and a depauperate predator community, and thus should be most useful in similar settings.

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