

## **JOB PROGRESS REPORT RESEARCH PROJECT SEGMENT**

**STATE:** Territory of Guam

**PROJECT NO.:** E-2-1  
**SUBPROJECT NO.:** D  
**JOB NO.:** 1

**JOB TITLE:** Establishment of Populations of Endangered Species in Snake-Free Areas on Guam

**PERIOD COVERED:** October 1, 1997 to September 30, 1998

### **SUMMARY**

Area 50 was selected as the initial Guam reintroduction site for Guam rails (*Gallirallus owstoni*) following their extinction from the wild in the 1980s. To prepare for the rail release, the brown tree snake (*Boiga irregularis*) population had to be substantially diminished in Area 50. A large-scale test of Engeman's perimeter trapping theory was carried out, the efficacy of which was substantiated by declining snake population estimates from mark-recapture surveys before and after the perimeter trapping treatment. A snake barrier was installed and a method to partially monitor immigration and emigration has been employed. Interior snake removal will continue as snakes mature into a trappable size, breach the barrier, or are otherwise captured. A larger scale operational test of perimeter trapping was initiated in the nearby Munitions Storage Area (MSA) to begin preparation of this area for the release of Mariana crows (*Corvus kubaryi*) translocated from Rota. At the request of the Mariana Crow Recovery Team, an area-wide snake control plan was formulated using the barrier and trapping techniques developed in field research at Area 50 and MSA.

### **BACKGROUND**

A 24-ha area of limestone forest, known as Area 50, located in Northwest Field, an abandoned World War II airfield located on Andersen Air Force Base, was set aside by the Air Force in 1991 as a test area for restoration of natural ecosystems. Area 50 is surrounded by tarmac taxiways and was completely fenced with a six-foot cyclone fence to exclude deer and feral pigs. In early 1997, the area was selected as a potential site for the release of captive-bred Guam rails. Plans were developed to make the area relatively snake-free in preparation for the rail release, using trapping and barrier technology.

Initial surveys were conducted on the vegetative community and lizard and rodent populations of Area 50. A mark-recapture estimate of brown tree snakes was conducted in June 1997 to estimate the pre-treatment population of snakes. A 10x14 trap grid (140 traps), using mouse-baited traps at 40-m spacing, was activated until the recapture percentage (of total captures) exceeded 50%. In 30 nights of trapping, a total of 313 snakes was caught, tagged, and released. The preliminary population estimate was 365 snakes (95% CI=288-463).

Because of the encouraging results in evaluating perimeter trapping in smaller areas elsewhere on Guam (Engeman et al. 1997), it was decided to test this technique on an operational scale in Area 50 prior to installation of the planned snake barrier. In September 1997, 52 traps were installed on the perimeter fence, spaced at 40-m intervals alternating with the traplines of the interior grid.

## **OBJECTIVES**

1. Test the efficacy of perimeter trapping on an operational scale.
2. Reduce and maintain the snake population in Area 50 to levels tolerable for a sustainable Guam rail population.
3. Reduce the snake population in selected areas of the MSA in preparation for release of Mariana crows translocated from Rota.

## **PROCEDURES**

### Area 50

*First Mark-Recapture* - In June 1997, an interior grid of 140 traps was activated inside of Area 50. In all mark-recapture surveys, captured snakes were marked with an electromagnetically labeled passive integrated transponder (PIT) tag for identification. The pre-treatment brown tree snake population was estimated.

*Perimeter Trapping* - From September 1997 until late February 1998, fenceline traps and the 44 outermost traps of the interior grid were operated, with all captured snakes removed. Trap numbers, snout-to-vent lengths (SVL), total lengths, sexes, masses, and PIT tag numbers were recorded for each snake. Databases have been maintained on individual snake capture/recapture histories.

*Second Mark-Recapture* - In late February 1998, fenceline traps were deactivated and the interior grid reactivated for another mark-recapture estimate of density. This mark-recapture exercise was terminated in late March and removal trapping began with the trap grid.

*Immigration and Emigration* - In late January 1998, mark-recapture trapping was initiated with 25 traps installed at 40-m intervals along the forest edge across from the tarmac bordering the north and east sides of Area 50 to detect immigration into or emigration from Area 50.

*Barrier Installation* - A snake barrier based on a design developed by USGS Biological Resources Division was retrofitted to the chainlink fence surrounding Area 50. The barrier was constructed of 1/4 inch galvanized hardware cloth (wire mesh). It was fastened to the tarmac and extends to the top of the six-foot chain-link fence. The barrier has a semi-circular bulge near the top. The interior trapping grid continues to be operated and is combined with nocturnal visual searches on the fence and in the forest interior.

### MSA

In June 1998, 112 snake traps were activated around the perimeter of a 41.5 ha area in the nearby MSA. This area contains several potential release sites of Mariana crows translocated from Rota.

## **RESULTS**

### Area 50

A total of 430 snakes was removed by perimeter trapping, 174 of which were recaptures from the 1997 mark-recapture exercise. The weekly capture rate dropped from 100 in the first week (1.04 snakes per trap-week) to nearly zero by mid-December 1997.

During 30 nights of the post-treatment mark-recapture effort, only 30 individual snakes were captured, with no more than one recapture in any day. Only 25% of the total captures were recaptures, thus a statistically reliable population estimate was not possible.

As of September 30, 135 snakes had been removed from Area 50 by grid trapping. Thirty-seven of those snakes were marked and released during the first or second mark-recapture studies. A total of 565 snakes have been removed from Area 50 since initiation of perimeter trapping in September 1997, inclusive of these grid-trapping results. An additional 125 snakes were marked, but not yet recaptured. Removal trapping continues to date, and the capture rate has dropped to about 4 snakes per week.

An indication that perimeter trapping has significantly reduced the snake population in Area 50 is that although no rats were detected in a small mammal survey made in 1997, rats began to appear in snake traps in January 1998 and 12 rats were caught when the small mammal survey was repeated in 1998. A total of 24 rats were captured in snake traps from February 27 to September 30.

*Immigration and Emigration* - A total of 78 snakes were marked and released from traps across the tarmac from Area 50 as of September 30. To date, seven of those snakes have been recaptured inside Area 50, but no emigration from Area 50 has been detected. During the early part of the perimeter trapping phase, another snake was captured in Area 50 that had been originally marked and released three years earlier at a location 2.1 km north of Area 50.

### MSA

The capture rate in MSA declined in an exponential fashion similar to Area 50, dropping from 160 snakes in the first week (20.4 snakes/100 trap nights) to fewer than 40 snakes (5 snakes/100 trap nights) by mid-July. At the end of the reporting period, the capture rate had stabilized at about 20 snakes per week (2.5 snakes/100 trap nights).

At the request of the Mariana Crow Recovery Team, an area-wide snake control plan has been formulated using the barrier and trapping techniques developed in field research at Area 50 and MSA.

## **RECOMMENDATIONS**

Snake population monitoring and removal will be necessary after the introduction of Guam rails. Snakes continue to recruit into the trappable population as eggs hatch and juvenile snakes mature. Monitoring may include perimeter trapping on the inside of the fence and/or the outermost row of grid traps, periodic activation of the interior trapping grid, and periodic nocturnal visual searches in the forest interior.

The results of perimeter trapping around Area 50 and MSA are encouraging and suggest that a significant area-wide reduction of brown tree snakes may be possible using perimeter trapping alone (DAWR 1998). The key may be discrete areas defined by roads so access is reasonably facilitated. Numerous such areas are found island-wide, particularly in urban areas.

From the endangered species recovery standpoint, these results are very encouraging. Many similar discrete areas of important endangered species habitat are located on Andersen Air Force Base. The MSA, for example, has a network of roads around blocks of forest that are generally half as wide as Area 50. Similar areas occur at Naval Ordnance Annex.

It seems feasible for the perimeters of selected blocks of forest to be routinely trapped as described above. Based on the DAWR's results to date, a 2-person team should be able to service about 125 traps per day. If the traps are visited only once per week, that 2-person team should be able to service as many as 625 traps during a 5-day workweek. If the traps are spaced at 40 m intervals, a total perimeter of up to 25 km could be covered in a 5-day workweek (Anderson et al. 1998).

Examination of a map of the MSA reveals three similar sized blocks, each subdivided into smaller units averaging only 125-150 m in width (in contrast, Area 50 is 400 m wide). Each of these larger blocks contains a total forest perimeter of about 25 km, suggesting that nearly the entire MSA could be continuously trapped by three or four 2-person snake trapping teams.

It is likely that the snake capture rate in the MSA would decline at a more accelerated rate than seen in Area 50 because the blocks of forest are of smaller area. As the snake population is reduced and capture rates decline, the trapping teams may be able to handle increasing numbers of traps, allowing expansion of trapping efforts into additional areas.

Implementation of such an intensive perimeter-trapping program in the MSA or at Ordnance Annex could be accomplished by broadening the scope of the USDA Wildlife Services mandate from the military. In addition to directly benefiting endangered species recovery on Guam, which is a statutory responsibility of federal agencies, a reduction in brown tree snake populations in these areas would also reduce the probability of snakes entering the transportation system via shipments of ordnance and military equipment, or through training exercises.

## **PROGRAM COSTS**

The estimated cost for this project under E-2-1 is \$80,000.

## **LITERATURE CITED**

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Engeman, R.M., S. Sayama, S., and M.A. Linnell. 1997. Operational Utility of Perimeter Trapping for Removing Brown Tree Snakes from a Defined Area. Snake 28: in press.

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