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APHIS

# 2010 Florida CAPS Giant African Snail Survey Report

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# Florida CAPS/DPI Giant African Snail, *Achatina* spp. (Pulmonata: Achatinidae) Survey Report

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## Introduction

The mollusk family Achatinidae contains several different species, all with the potential to become established in the United States. Most notorious among this group is the "giant African snails" (GAS). *Achatina fulica* (Bowdich) and *Archachatina marginata* (Swainson) are referred to as the truly giant African land snails and are also referred to as the travelling species in that both have moved or been moved all over the world (Mead and Palcy 1992). *Archachatina marginata and A. fulica* are species native to eastern Africa; however, they are now distributed globally throughout the tropics and subtropics. Commerce and intentional spread by man appear to be the most likely pathways for introduction of this pest to the U.S. (Lambert and Tillier 1993).

In the 1980s, GAS spread west and eventually made it to the West African coastline in Ghana, where *A. fulica* displaced the native snail *Achatina achatina*. Shortly after its introduction, *A. fulica* achieved dominance in the achatinid community in the Ivory Coast and in Ghana, becoming a significant crop pest (Raut and Barker 2002). In 1984, GAS reached the Caribbean and spread to several Caribbean Islands. They were found in Brazil in 1997, and have since spread throughout most of that nation. In the Pacific Ocean, GAS have continued to spread among the islands. They were found in Gordonville, Australia in 1977 and in Currumbin, Queensland in 2004 (Paiva 2004). Both infestations were eradicated. *Archachatina marginata* was introduced into Martinique in the 1980s, but did not become established.

*Achatina fulica* became temporarily established in Florida in the late 1960s. A boy returning from Hawaii in 1966 brought three snails into Florida, and his grandmother released them in her North Miami garden. In 1969, The Florida Division of Plant Industry was alerted to the infestations and began a survey and eradication program. By 1973, over 18,000 snails were destroyed, a testimony to the reproductive powers of GAS. After an absence of two years, the Florida Department of Agriculture and Consumer Services declared the pest eradicated (Poucher 1975).

*Achatina fulica* is one of the largest land snails in the world, growing up to 8 inches in length and 4.5 inches in diameter (Fig. 1A). When fully grown, the shell consists of seven to nine whorls (complete spirals), with a long and greatly swollen body whorl. The brownish shell covers at least half the length of the snail. Each snail can live as long as nine years and contains both female and male reproductive organs. This snail is an obligate-outcrossing hermaphrodite, which means that one externally fertilized snail has the potential to establish a population. After a single mating, each snail can produce 100-400 eggs. In a typical year, every mated adult lays about 1200 eggs and in a few years the population can grow to tens of thousands. The giant African land snail remains active at a temperature range of 48 º - 84 º F (9º – 29º C), and survives temperatures of 36 º F (2º C) by hibernation and 86 º (30º C) by aestivation. Large adults can successfully aestivate for 10 months (Mead 1961 1979; Srivastava 1992). *Archachatina marginata* matures and stops growing within one year (Fig. 1B). The average life span is 3 to 5 years; however, some individuals may live as long as 10 years. *Archachatina marginata* can reach a maximum length of 8¼ inches and a maximum diameter of 5 inches. It has a very large bulbous protoconch which helps to differentiate from *Achatina* species. Typically, the shell is large and broad with a truncated columella and has a white or bluish-white parietal wall and outer lip,

although some subspecies may have an apricot-yellow or vinaceus red columella and parietal wall. Like *A. fulica* this snail is hermaphroditic and produces eggs and hatchlings that are much larger than those of *Achatina* spp., also making the two genera easy to distinguish from one another (Mead and Palcy 1992; USDA-APHIS 2005). They form oval egg chambers that are smooth walled about 4 to 6 inches below the soil surface laying up to 40 eggs per clutch averaging 6 to 8 eggs (Lange 1950). The eggs will hatch over a 24 to 36 hour period after an incubation of 33 to 41 days in very damp soil (Palcy and Mead 1993).

Giant African snails are a potential threat to a wide variety of crops, including vegetable, field, oil, ornamental and fruit crops. More than 500 host plants have been identified in several genera. Not only are these snails agricultural pests, but they can also cause structural damage to buildings by consumption of plaster and stucco, and in large numbers can cause extensive damage.

These snails are also a threat to public health because of their ability to spread diseases to animals and humans. They are known to be effective transmitters of the rat lungworm, *Angiostrongylus cantonensis* (Chen), which in humans produces eosinophilic meningitis (Kliks and Palumbo 1992). These diseases can be transferred to humans by eating raw, undercooked, infected snail meat and fluids, or contaminated vegetables. Humans can also be infected by handling live GAS if the secretions contact mucus membrane of eyes, nose or mouth.

A recent news program by Maria Laria (originally broadcast by Telemundo Networks) alleged that snails similar to this aggressive species may have been used by unorthodox practitioners during Santeria rituals conducted in Hialeah, Miami.

**Objectives**

The objective of this survey was to find any populations of GAS in South Florida. These pests are sometimes smuggled or shipped into the U.S. for the pet trade or for religious rituals. This survey was clearly of national significance, as Florida could serve as the entry point for these pests and their subsequent spread across large regions.

**Survey Methodology**

Survey for GAS was visual and focused on high-risk areas. In most cases, baits and traps are not very effective or practical. These visual surveys will took place in a 1.5 mile buffer zone around suspected points of entry (Fig. 2).

**Target Areas**

- RAILROAD/STREET INTERSECTIONS: These intersections are very important to many who practice Santeria. Not only do many animal sacrifices take place at railroad crossings (Fig. 3) due to an association with at least one “orisha” (spirit) associated with snails-- Ogún, who is also a master of iron, steel and railroads. In many cases, even if the animal sacrifice takes place elsewhere, the remains will be dumped on railroad tracks (Barnes 1997; Clark 2007). The vegetation along railways may provide GAS released in an urban setting a corridor through which they might find harborage, feed and expand to other locations.

- CANALS: Moisture is a very important component of GAS habitat selection. In the South Florida area, canals commonly run through urban areas and often provide dense vegetation along the banks. The snails could find both food and water in these areas. These types of canals are quite common throughout South Florida. Moreover, these sites are also used as dumping sites for ritual materials by some practitioners of Santeria.

- WOODED/NATURAL AREAS, ALLEYS AND PARKS: Any natural areas, cemeteries, old fields or even overgrown abandoned residential properties could harbor a population of snails. Large wooded areas such as abandoned citrus groves, as well as state, county and municipal parks are good sites for GAS establishment. Green alleyways maintained by the city for water and power lines run continuously behind some properties (Fig. 4), and these were also examined. These areas could also provide possible locations for the deliberate release of snails that may have been kept in captivity.

**Survey and Monitoring**

These snails are known to harbor parasites that can infect humans. While short term handling of a snail by its shell is probably safe, it was strongly recommended surveyors wear gloves when handling any mollusk and to wash their hands afterwards.

Damp and/or overcast conditions are the best time to observe these snails during their active period. During this time they might be found nearly anywhere, on the ground, up in trees or on buildings. When conditions are dry or hot, they prefer to shelter on or near the ground. During cool periods snails will bury themselves in loose soil and aestivate. These sheltered areas are the best places to look for snails and include: in or under debris on the ground, water meter boxes, and under dense vegetation (Fig. 5). Surveyors also searched for large slime trails or slimy feeding damage on plants as an indicator of inhabitation.

When examining specimens, surveyors were made familiar with a few basic characters by which GAS might be distinguished from protected native species. The most outstanding character that could be observed on museum specimens was the inwardly curled, truncate columella (Fig. 6). Dead specimens, if found, would be collected in plastic bags. Live specimens would be sealed in airtight plastic containers and then sealed in Ziploc bags in the field. These would be transferred to a sealed cooler until such time as specimens could be immersed in a 70% solution of isopropyl alcohol. GPS coordinates and a general description of the collection area were recorded. All specimens collected were returned to DPI identifiers in Gainesville for species confirmation.

Surveyors were provided with maps of the area with canals, railroad crossings, and natural areas depicted (Fig. 7). Each team was assigned certain areas to survey and inspect within the aforementioned 1.5 mile buffer zone. Information sheets in the form of pest alerts and door-hangers were provided to any concerned citizens within the survey area.

**Results**

While many locations that were ideal for native and established invasive snails were identified (Fig. 8), no GAS specimens were collected during the survey, and no sign or symptom of snail feeding were observed at any location. Several hundred sacrificial offerings in varying states of decay were dissected at railway and park sites to determine if GAS or other shelled mollusks were used as a regular part of ritual disposal. The shells of marine mollusks (*Cypraea* spp.) were only recovered in one sacrificial offering (Fig. 9).

Other organisms of interest collected during the survey included those seen in Table 1.

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**Photography Credits:**
Cover page:
Background of GAS Survey in Miami (courtesy of Andrew Derksen, FDACS-DPI-CAPS).

Photographs (left to right) courtesy of:
GAS in tree (by David Robinson, University of Georgia, UGA1265031);
GAS, lateral (by Yuri Yashin, Russian Federation, UGA1265027);
GAS in hand (montage, by FDACS-DPI);
GAS head closeup (by Yuri Yashin, Russian Federation, UGA1265024).

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**Table 1.** Checklist of mollusks collected during GAS surveys in Hialeah, FL.

| **Family** | **Genus** | **Species** |
|---|---|---|
| Ampulliriidae | *Marisa* | *cornuaietis* |
| Bulimulidae | *Bulimulus* | *guadeloupensis* |
| Bulimulidae | *Drymaeus* | *multilineatus* |
| Veronicellidae | *Leidyula* | *floridana* |

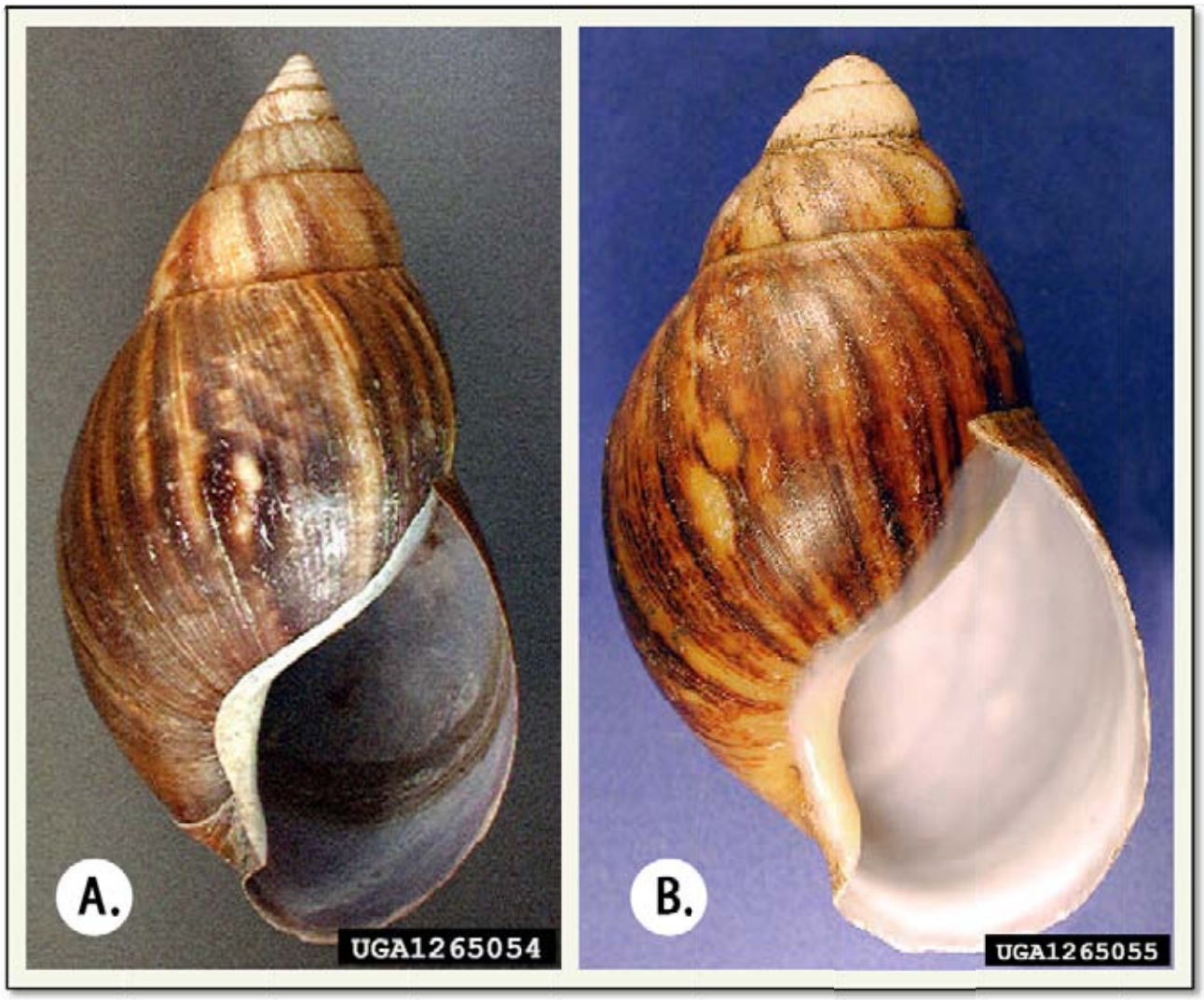

Figure 1. A comparison of *Achatina fulica* (A) and *Archachatina marginata* (B).

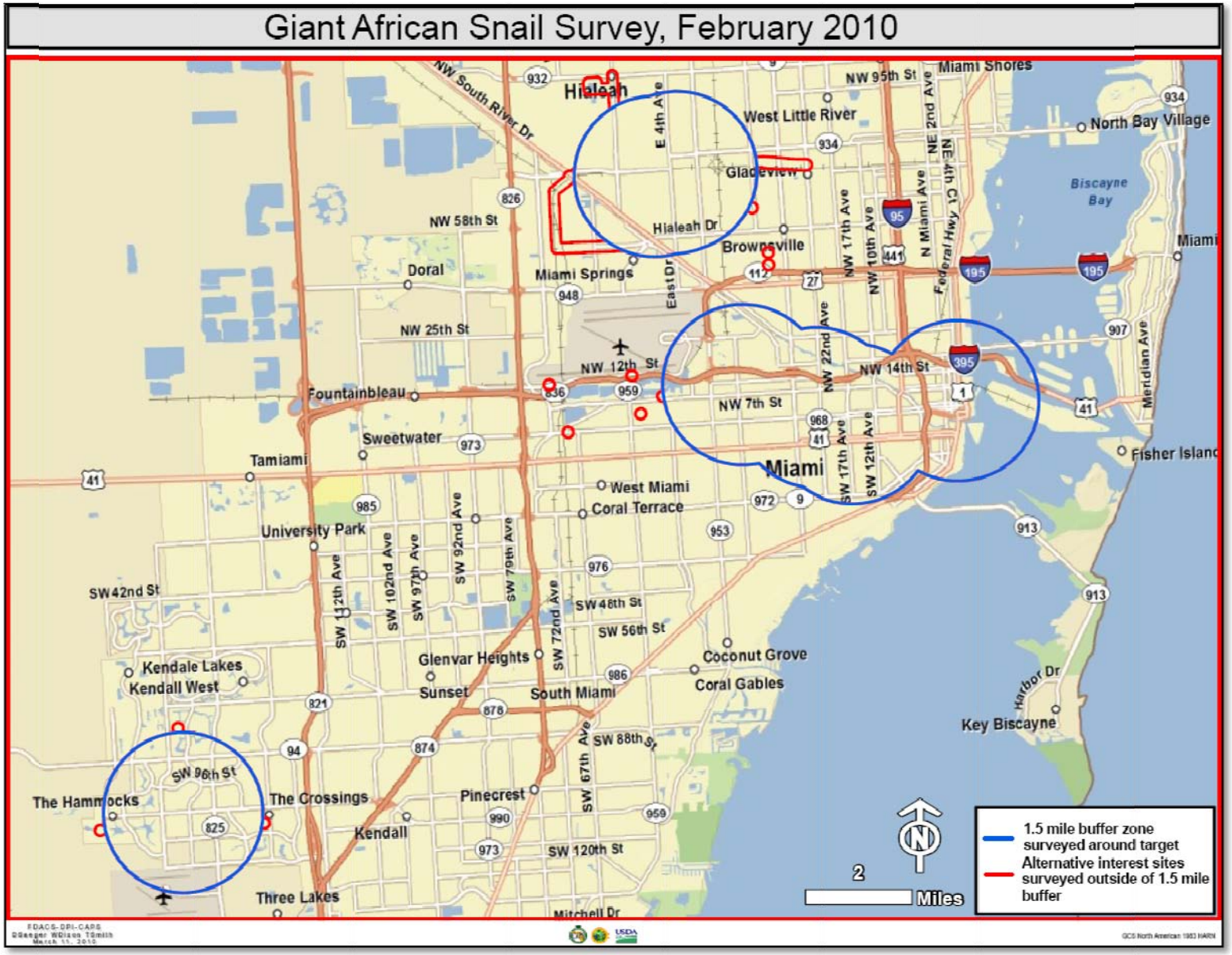


**Figure 2.** Overview map of February 2010 giant African snail survey in Hialeah, FL.

**Figure 3.** Dr. Trevor Smith (FDACS-CAPS State Survey Coordinator) examines the carcasses of several recent sacrificial offerings at a Hialeah railroad crossing. (Photography credit: Andrew Derksen, FDACS-DPI-CAPS)

**Figure 4.** Karolynne Griffiths (USDA-CAPS Pest Survey Specialist) inspecting a typical cluttered alleyway found in Hialeah, Florida. (Photography credit: Andrew Derksen, FDACS-DPI-CAPS)

**Figure 5.** Dr. Trevor Smith inspecting a water meter box for snails. (Photography credit: Andrew Derksen, FDACS-DPI-CAPS)


**Figure 6.** Photographs of various snails that surveyors might expect to observe in the field. The red arrow indicates the columella, a strong diagnostic character for the identification of giant African snails**.**

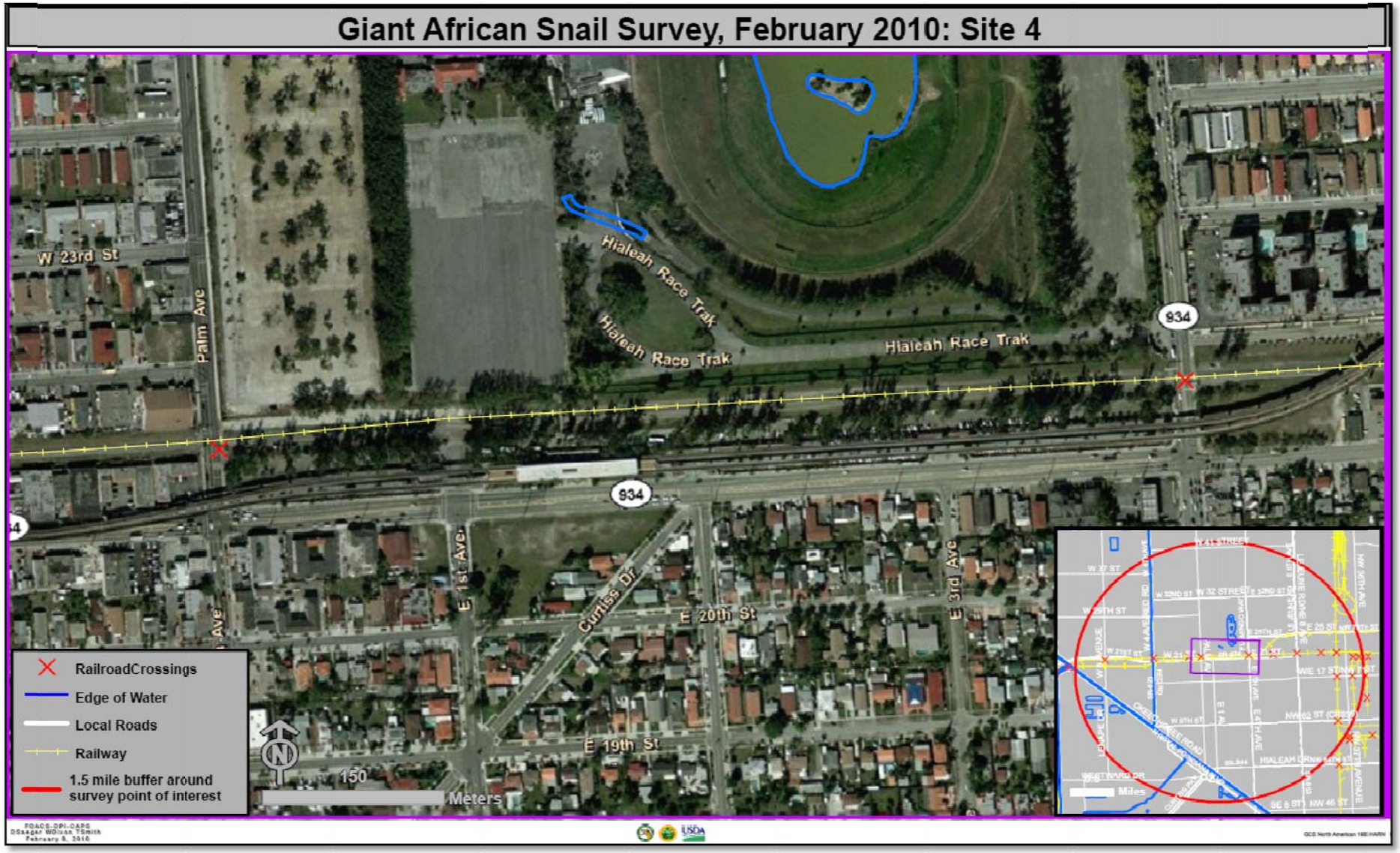


**Figure 7.** Aerial map of specific area surveyed.

**Figure 8.** Image of local and established populations of snails recovered from under harborage in an alleyway. (Photography credit: Andrew Derksen, FDACS-DPI-CAPS)

**Figure 9.** Shells of genus *Cypraea* collected from a sacrificial offering abandoned at a double railroad intersection in Hialeah, Florida. (Photography credit: Andrew Derksen, FDACS-DPI-CAPS)