FWC BIOPROFILE FOR THE ARGENTINE BLACK AND WHITE TEGU (*Tupinambis merianae*)

1. CLASSIFICATION

   a. Taxonomy

   Class Reptilia (reptiles)
   Order Squamata (snakes and lizards)
   Suborder Lacertilia (lizards)
   Family Teiidae (teiids or whiptails)
   Subfamily Tupinambinae (tupinambids)
   Genus *Tupinambis* (tegus)

   The Argentine black and white tegu, *Tupinambis merianae* (Duméril and Bibron 1839), is 1 of 7 currently recognized tegu species. There is a northern clade of tegus distinguished by a single loreal scale that occurs in northern South America and Amazonia, and a southern clade distinguished by 2 loreal scales that occurs primarily south of Amazonia (Fitzgerald et al. 1999). *Tupinambis merianae* is a member of the southern clade, along with the red tegu, *T. rufescens* (Günther 1871), and *T. duseni* Lönnberg 1910. The northern clade presently contains *T. teguixin* (Linnaeus 1758), *T. longilineus* Ávila-Pires 1995, *T. quadrilineatus* Manzani and Abe 1997, and *T. palustris* Manzani and Abe 2002. The taxonomy of *Tupinambis* has been the subject of much confusion (see Péres and Colli 2004). Until recently, *T. merianae* was referred to as *T. teguixin,* and the Amazonian form with a single loreal scale (i.e., *T. teguixin*) was referred to as *T. nigropunctatus* Spix 1825 (Boulenger 1885, Peters and Donoso-Barros 1970). Presch (1973) realized that *T. nigropunctatus* was not a good name, but he recognized only 2 species; *T. teguixin* referred to all tegus except *T. rufescens*, regardless of the number of loreal scales. Ávila-Pires (1995) concluded that *T. nigropunctatus* should be renamed *T. teguixin*, and *T. teguixin* should be renamed *T. merianae*. In the scientific literature from approximately 1970 through 1995, *T. merianae* is usually referred to as *T. teguixin*. *Tupinambis teguixin* is also referred to as the common, Colombian black, Colombian black and white, or golden tegu. *Tupinambis merianae* is sometimes referred to as the black tegu (Yanosky and Mercolli 1992*b*, Duarte Varela and Cabrera 2000), and it was usually called the common tegu when it was lumped with the other species as *T. teguixin*.

   b. Physical Description, identifying characteristics

   The southern clade has 2 loreal scales, whereas the northern clade has 1 loreal scale (Colli et al. 1998, Fitzgerald et al. 1999). The southern clade is also characterized by large body size, relatively large clutch size, nesting in burrows and nest attendance, and seasonal activity pattern (Fitzgerald et al. 1991, 1993). In terms of coloration, *T. merianae* most closely resembles the Colombian black tegu (*T. teguixin*), but *T. merianae* has a dorsolateral row ("stripe") of light spots or dashes and beaded scales, whereas *T. teguixin* lacks the stripes and has smooth scales. There is geographic and individual variation in the amount of light and dark pigmentation, prominence of the stripes, and presence of dorsal bands in *T. merianae*. Until ca. 1 month old, hatchling *T. merianae* have shiny green heads and anterior portions of their bodies (Fig. 1), and juveniles are

often browner than adults, which are typically black and white. *Tupinambis merianae* differs from its congeners, *T. rufescens* and *T. duseni*, in having a high number of femoral plus precloacal pores (20–25) (Fitzgerald et al. 1999). Tegus are the largest terrestrial lizards in the New World, and *T. merianae* and *T. rufescens* are the largest tegu species, reaching up to 145 cm (57 in) total length (TL). Male *T. merianae* may attain 50 cm snout-vent length (SVL) (Duarte Varela and Cabrera 2000) and weigh 8 kg (17.6 lb) (Lopes and Abe 1999). Males get larger than females, and large adult males have massive heads and jowls.

Fig. 1. Hatchling *Tupinambis merianae* showing green coloration that later fades (K. Enge).

c. Genetics

Mitochondrial DNA analysis indicates a deep divergence between the northern and southern clades (Fitzgerald et al. 1999). In the southern clade, *T. merianae* is the sister group to *T. rufescens* and *T. duseni*. *Tupinambis rufescens* derived from a *T. merianae*-like ancestor and is restricted to the dry chaco of Bolivia, Paraguay, and Argentina (Fitzgerald et al. 1999). *Tupinambis duseni* is genetically similar to *T. rufescens*; it may have split recently from a *T. rufescens* ancestor and may be experiencing rapid divergence in squamation, coloration, and morphometrics in the isolated cerrado habitats (Fitzgerald et al. 1999).

2. DISTRIBUTION

a. Native range

Tupinambis merianae occurs in southeastern Brazil, Uruguay, eastern Paraguay and northern Argentina (Luxmoore et al. 1988). In Brazil, it occurs south of the Amazonas River in southern Amazonia (Vanzolini et al. 1980), extending at least as far north as the state of Rondônia at 11°S latitude (Gainsbury and Colli 2003). In Argentina, it extends as far south as Rosario at 33°S latitude (Presch 1973) and possibly to 41°S (Langerwerf 2006).

i. Expansion/contraction

Tupinambis merianae is heavily harvested in Paraguay and Argentina for meat and skins, but this has apparently not affected their native range (Norman 1987, Luxmoore et al. 1988, Fitzgerald 1994). In the state of São Paulo in southeastern Brazil, there has been a dramatic reduction in natural habitat for the tegu because of increasing growth of agricultural (e.g., sugarcane fields and citrus plantations) and pasture areas, and tegu populations in the few remaining forests are vulnerable to hunting (Abe 1999).

ii. Relative abundance

There are no density estimates, but tegus are common. Tegus are one of the most abundant lizards in southern Brazil (Milstead 1961). In eastern Paraguay, tegu populations initially increase when forested areas are opened up for agriculture, but human harvest usually reduces these populations (Norman 1987). Active tegu hunters in eastern Paraguay each killed an average of 15.8 *T. merianae*/*rufescens* in 1 year (Norman 1987).

b. Habitat

i. Physical (substrate, temperature, flow, depth)

Tupinambis merianae is typically observed in primary forest clearings, secondary forest, and other disturbed habitats such as roadsides and fence rows (Fitzgerald 1994). It occurs from sea level to an altitude of 1250 m (4100 ft) in northwestern Argentina (Presch 1973).

ii. General: terrestrial, freshwater, estuarine, marine

Tegus are terrestrial, although they may live along freshwater streams, swamps, lakes, and oceans (Martuscelli and Olmos 1996). Tegus have been caught in gill nets set at sea off the rocky shores of São Sebastião Island, Brazil, and will completely submerge for extended periods of time in fresh water (Olmos 1995).

iii. Chemical (pH, dissolved oxygen, salinity)

Tegus are apparently tolerant of at least short-term submersion in salt water (Olmos 1995).

iv. Biological (plant cover species associations)

In forested habitats, tegus often use clearings or edges. *Tupinambis merianae* is a characteristic inhabitant of much of the diagonal corridor of open habitats (Vanzolini 1963) or xeric vegetation (Bucher 1982) extending from northwestern Argentina to northeastern Brazil, which includes the Caatinga, Cerrado, and Chaco biomes (Colli et al. 2002, Oliveira-Filho and Ratter 2002). The Caatinga biome of northeastern Brazil might be beyond the range of *T. merianae*, although some accounts refer to this species from there (e.g., Homewood 1995). The Cerrado receives 900–1800 mm (35–70 in) of rainfall annually and has a 3–4 month dry season, whereas the Caatinga and Chaco biomes typically receive <800 mm (31 in) of rainfall annually and have a strong dry season lasting 5–8 months (Centres of Plant Diversity 2006). The Cerrado biome occurs primarily in central Brazil (this does not include isolated cerrados that occur elsewhere) west of ca. 45°W longitude and south of ca. 15°S latitude (Centres of Plant Diversity 2006), and consists mostly of savannas (grasslands), although mesophytic forests occur on richer soils and gallery forests follow watercourses (Oliveira-Filho and Ratter 2002). The subtropical Chaco biome occurs south of ca. 17°S latitude west of the Paraguay and Parana rivers (Centres of Plant Diversity 2006) on a large sedimentary plain in northern Argentina, western Paraguay, eastern Bolivia, and part of southeastern Brazil (Adámoli et al. 1990). Wet or humid chaco, which is characterized by seasonally flooded savannas and gallery forests, occurs along the eastern edge of the region and receives ca. 1200 mm (47 in) rainfall annually, but most of the region is dry chaco, which receives ca. 500–700 mm (20–28 in) rainfall annually during a pronounced wet season and consists of a mixture of xerophytic forests (often containing thorny shrubs), gallery forests, and savannas (Adámoli et al. 1990). *Tupinambis merianae* occurs in wet chaco in the Chaco province of northeastern Argentina, an area of savannas and forests on poorly drained alluvial soils that is subject to cyclic fires and floods; annual rainfall is 1200–1900 mm (47–75 in), mostly during the November–April rainy season, and the maximum average temperature is 27°C (81°F) and minimum is 17°C (63°F), with recorded extremes of -2–45°C (28–113°F) (Mercollia and Yanosky 1994). *Tupinambis merianae* is also found east and southeast of the Cerrado biome in the Atlantic Forest biome, which stretches along the Atlantic coast south to Rio Grande do Sul in Brazil and barely into Uruguay, and extends inland to eastern Paraguay and the province of Misiones in northeastern Argentina (Conservation International 2006). Lowland, coastal Atlantic Forest (moist tropical forest and savanna) occurs in a strip 50–100 km wide along the coast, whereas interior Atlantic Forest occurs from the foothills of the Serra do Mar into southern Brazil, Paraguay, and Argentina up to 500–600 km inland and 2000 m (6560 ft) altitude, and includes montane forests and high-altitude grasslands (Conservation International 2006). In Argentina, *T. merianae* is common in the pampas (rolling, fertile grasslands) near Buenos Aires (Langerwerf and Paris 1998). In southeastern Brazil, tegus are commonly observed foraging along beaches among debris left at high tide and in the adjacent dune vegetation (Martuscelli and Olmos 1996). In southwestern Amazonia, Brazil, *T. merianae* inhabits latosoil cerrado (both scleromorphic, woody vegetation and grasses on oligotrophic, well-drained soils), sandy cerrado (sparse trees and a mostly sedge ground cover), and transitional forest (tall, thorny semi-deciduous forest on latosoils) (Gainsbury and

Colli 2003). In eastern Paraguay, *T. merianae* inhabits relatively moist vegetational associations, especially gallery forests of river drainages, whereas *T. rufescens* inhabits drier to semi-arid vegetational associations (i.e., the Chaco) (Norman 1987). In Uruguay, *T. merianae* inhabits stony meadows, river valleys and mountains (Gudynas 1981).

c. Introduced range

i. References, studies

There may be an established population southeast of Tampa in eastern Hillsborough and western Polk counties, Florida. Specimens and credible observations exist in the area of Balm north of County Road (CR) 672 and bounded by Balm-Riverview and Balm-Boyette roads. These observations stretch for ca. 3.2 km (2.0 mi) north-south (N-S) and 4.5 km (2.8 mi) east-west (E-W) (Fig. 2). The Balm-Boyette Scrub Nature Preserve, which is managed by the Hillsborough County Parks, Recreation and Conservation Department, is located in this area. The preserve encompasses 1990 ha (4916 ac) and contains the following natural habitats: sand pine scrub, xeric oak scrub, scrubby and mesic flatwoods, hardwood hammock, freshwater marsh, cypress swamp, and hardwood swamp (Resource Management Office 2006). The east end of the preserve contains 486 ha (1200 ac) of restored phosphate-mined land that consists of improved pasture and numerous lakes (Resource Management Office 2006). An adult tegu was first collected in the preserve in June 2006 (Fig. 3), and tegus have been subsequently observed here. For example, 2 juvenile tegus were observed escaping into gopher tortoise (*Gopherus polyphemus*) burrows during a 20-min visit on 18 August 2006 (Kaiser, pers. comm.). Three juvenile tegus have been subsequently trapped from 10 tortoise burrows, although 1 escaped while being removed from the trap. Tegus, including hatchlings, have also been observed on private property in the area in 2006. The next road east of this area is CR 39, and there have been 3 credible tegu observations along this road. There have also been 2 credible tegu observations and a photo (Fig. 4) from farther east on Mosaic Phosphates land in western Polk Co. The total area encompassed by these observations stretches ca. 22.5 km (14 mi) E-W and 3.2 km (2 mi) N-S.

Tupinambis merianae was introduced in the 1970s to the national park Fernando de Noronha, an island 500 km off the northeastern coast of Brazil, to control rats (Homewood 1995). After increasing for a few years, the tegu population stabilized, but it still threatens nesting shorebirds and sea turtles (Homewood 1995, Ziller 2006). A population of *T. teguixin* has become established on the island of San Andrés, Columbia, as a result of the release of juveniles from a pet trade shipment in 1984 (Fitzgerald et al. 2005). A reptile dealer released 200 golden tegus (*T. teguixin*) in the 1980s in northwestern Miami (Powell, pers. comm.), but there is no evidence of an established population there (Enge, pers. obs.). In 1994, a *T. teguixin* was observed in Royal Palm Hammock, Everglades National Park (Butterfield et al. 1997), and Meshaka et al. (2004) reported sightings of this species at a park in North Miami and on Key Biscayne in Miami-Dade County. A former keeper at the Crandon Park

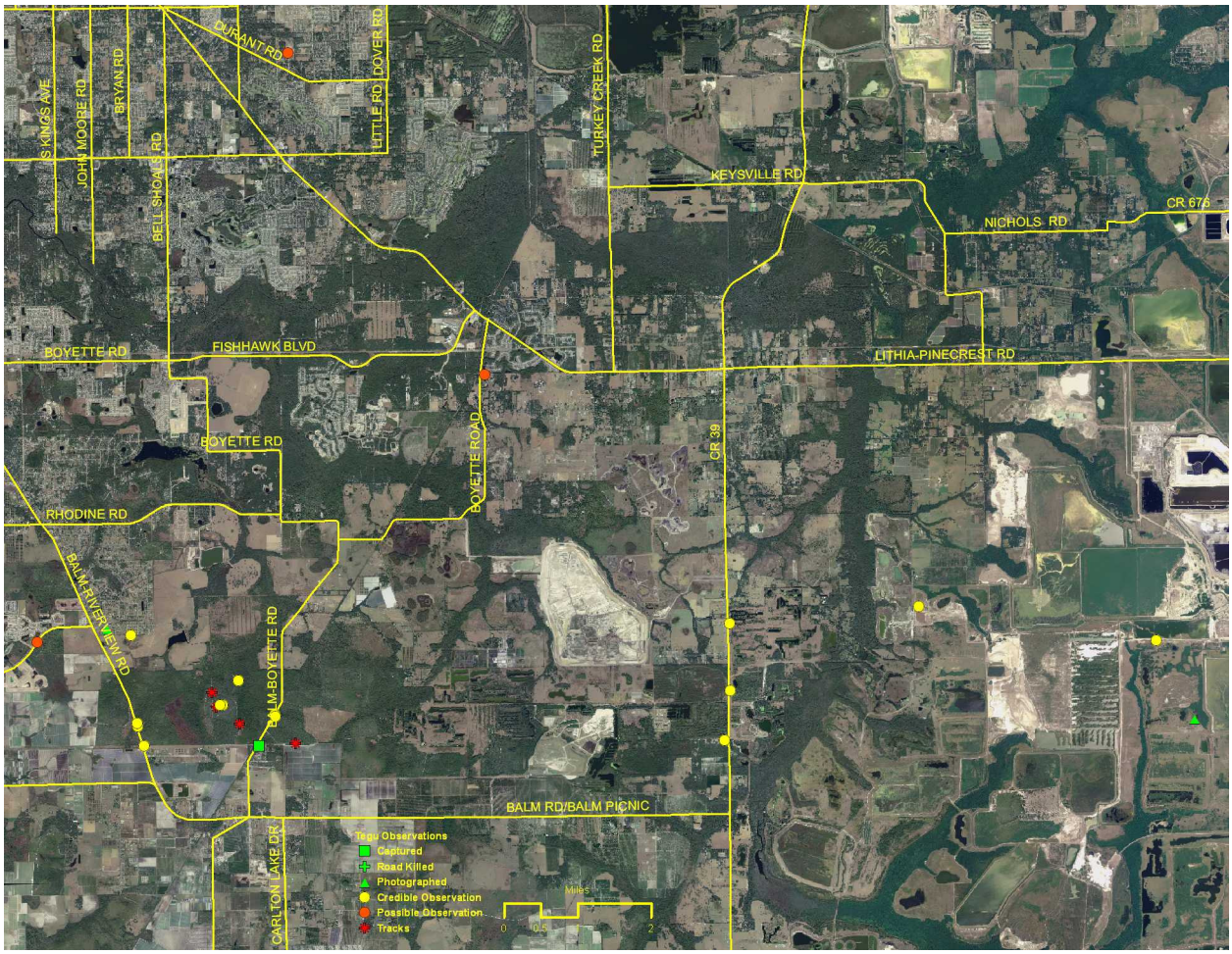

Fig. 2. Map of *Tupinambis merianae* sightings southeast of Tampa in eastern Hillsborough and western Polk counties, Florida, as of 1 September 2006 (L. Connor).

Fig. 3. *Tupinambis merianae* collected in Balm-Boyette Scrub Nature Preserve, Hillsborough Co., Florida, in 2006 (B. Chamberlin).

Zoo on Key Biscayne claims tegus (*Tupinambis* sp.) were sometimes observed eating turtle eggs on the grounds, but these were probably misidentified giant ameivas (*Ameiva ameiva*); no tegus have been observed since the zoo closed in 1979 (Krysko et al., unpubl. ms.). However, V. Cassidy photographed a *T. teguixin* (UF #149983), which was probably a recently released individual, at Crandon Park on 21 July 2006. Also in Miami-Dade County, a resident of Tropical Park sent a photograph to the

Fig. 4. Adult male *Tupinambis merianae* observed at "Bald Mountain" on Mosaic Phosphates land, Polk Co., Florida, in 2004 (J. Guzy, Biological Research Associates).

Florida Museum of Natural History of a *Tupinambis* sp. living in a burrow in his backyard (Krysko, pers. comm.). A road-killed adult *T. merianae* (UF #135044) found in the town of Okeechobee, Okeechobee Co., in 2002 probably represents a single escapee.

ii. Pathway(s)

The most likely source of the Florida population is the release by a dealer of specimens imported from Paraguay in 2000–2002 that had broken tails or other defects that affected their salability. The purpose of this illegal release might have been to establish a population for future exploitation (e.g., Krysko et al. 2003) or to avoid killing unwanted animals. The dorsal banding pattern of the 2 adult vouchers we have from this wild population indicates that they are of Paraguayan origin (St. Pierre, pers. comm.). This tegu species is still not very common in the pet trade, so the likely source of the Tampa population is not from single releases/escapes from several pet owners but instead to releases/escapes of multiple animals by a breeder or dealer. However, tegus sometimes escape from outdoor enclosures because of their propensity for burrowing, and their speed makes recapturing non-tame individuals unlikely. It is possible that the facility of a tegu breeder or reptile dealer could have been damaged by hurricanes, resulting in the release of several animals. However, the extensive E-W distribution of sightings possibly indicates releases at multiple sites in suitable-looking habitat. Prior to importation of cheap *T. merianae* from Paraguay, almost all specimens available in the pet trade were captive bred and worth too much money ($250 for hatchlings) to consider releasing, but afterwards, wholesale prices for hatchlings dropped to $35 each (Pierre, pers. comm.).

3. BIOLOGY

a. Reproduction

i. Time of year

In eastern Paraguay, *T. merianae* mates from late September through early November, and eggs laid around mid-November hatch from late December through early January (Norman 1987). In subtropical Argentina, captive females laid eggs in late October and November, the beginning of the wet spring (Yanosky and Mercolli 1995). In temperate seasonal conditions in Córdoba province, Argentina, eggs hatch from mid-January to late March (Duarte Varela and Cabrera 2000). In outdoor cages in Loxahatchee, Palm Beach Co., Florida, tegus typically bred in March, although cold fronts in March sometimes delayed breeding for up to 1 month (St. Pierre, pers. comm.). Males were apparently prone to sterility at high temperatures, and gravid females exposed to cold temperatures laid eggs with dead embryos (St. Pierre, pers. comm.). In northern Alabama, *T. merianae* started breeding in mid-April (Langerwerf and Paris 1998). Tegu eggs in Palm Beach County started hatching in June (St. Pierre, pers. comm.), so in Hillsborough County, eggs probably hatch in July–August because of the more northerly location and natural incubation temperatures.

ii. Minimum age

In the wild in Paraguay, female *T. merianae* do not breed until their third or fourth year (Fitzgerald 1994). Female *T. merianae* measuring 30 cm (11.8 in) SVL are ready to mate (Yanosky and Mercolli 1992*b*). Tegus could possibly be reared to adult size in 1 year if the normal winter dormancy period were suppressed by increasing the temperature and light (Yanosky and Mercolli 1993). In captivity in northern Alabama, the earliest reproduction was observed at 3 yr of age (Langerwerf 2006). However, well-fed captive females in southern Florida have reproduced at 10 months old and ca. 61 cm (24 in) TL (St. Pierre, pers. comm.).

iii. Frequency

Tegus lay only 1 clutch of eggs annually. Eggs are white and porous-shelled but become stained from the nesting material during incubation (Yanosky and Mercolli 1992*b*).

iv. Fecundity

Seven captive specimens in Argentina laid 24–49 (mean = 30) eggs (Yanosky and Mercolli 1991). The average clutch size has been reported as 36 eggs, ranging from 20 to 54 eggs (Donadío and Gallardo 1984). Captive specimens in southern Florida typically laid ca. 20 eggs during their first year of reproduction and 30–35 eggs during their second year of reproduction, with older laying 40–54 eggs (St. Pierre, pers. comm.). Small females in northern Alabama laid ca. 12 eggs, and large females laid 30 or more eggs (Langerwerf 2006). The largest clutches reported from the wild in Argentina contained 54 eggs (Serié 1932, Yanosky and Mercolli 1992*b*).

b. Early life history

Eggs average 42 mm long and weigh 18.7 g when laid, increasing to 25.6 g after 7 weeks (Yanosky and Mercolli 1995). Eggs incubated at temperatures that varied from an average of 26.4 ± 2.2°C (79.5 ± 4.0°F) in the morning to 30.5 ± 3.8°C (86.9 ± 6.8°F) in the evening hatched in 61–64 days, and hatching was asynchronous (Yanosky and Mercolli 1992*b*). Eggs incubated at a constant temperature of 30°C (86°F) hatch in ca. 60 days, and eggs exposed to fluctuating incubation temperatures suffer high mortality rates (St. Pierre, pers. comm.). Eggs exposed to moisture tend to get moldy and die (St. Pierre, pers. comm.). Eggs laid in soil outside in Alabama hatched in ca. 3 months at an estimated mean incubation temperature of 27.8°C (82°F) (Langerwerf 2006). Hatchling *T. merianae* almost "explode" from their eggs (accompanied by squirting fluids), completely hatching in <10 sec and rapidly dashing for cover (Langerwerf, 1995).

c. Age and growth

Hatchling *T. merianae* are shiny green on their heads and anterior portion of the body and average 8.9 cm (3.5 in) SVL and 23.6 cm (9.3 in) TL (Langerwerf 2006). Nineteen days after hatching, they start shedding their skin and the green color begins to fade, almost disappearing by 1 month of age (Langerwerf, 2006). At 32 days old, 1 tegu measured 13.0 cm (5.1 in) SVL and 37.1 cm (14.6 in) TL (Langerwerf 2006). At 2 months old, 1 tegu measured 14.7 cm (5.8 in) SVL and 41.4 cm (16.3 in) TL, and weighed 142 g (5.0 oz) (Langerwerf 2006). By the time captive-hatched tegus in Argentina were ready to hibernate at 70 days old, their TL had almost doubled from 19.4 ± 2.2 cm (7.6 ± 0.9 in) to 37.3 ± 4.9 cm (14.7 ± 1.9 in), and their mass had increased almost 9 times from 12.8 ± 1.6 g (0.45 ± 0.06 oz) to 114.6 ± 24.3 g (4.0 ± 0.86 oz) (Yanosky and Mercolli 1992*b*). A TL of 19.4 cm equates to an SVL of 7.1 cm (2.8 in) (Yanosky and Mercolli 1992*a*). After juveniles emerged from torpor and began feeding again at 285 days old, they grew rapidly, and by the time they were 394 days old, they had increased nearly 4000% in mass since hatching (Yanosky and Mercolli 1992*a*).

Age can be estimated from cross-sectioned phalanges by counting lines of arrested growth (Duarte Varela and Cabrera 2000). Tegus raised in a semi-controlled environment in Argentina measured 22.5–41.0 cm (8.9–16.1 in) SVL at 1 yr old (≥ 13 months), 33.9–36.0 cm SVL at 3 yr old, 33.0–47.5 cm SVL at 4 yr old, 35.2–49.2 cm SVL at 5 yr old, and 38.4–47.7 cm SVL at 6 yr old (Duarte Varela and Cabrera 2000). The largest male was 11 yr old and measured 50.1 cm (19.7 in) SVL, and the largest female was 8 yr old and measured 43.7 cm (17.2 in) SVL (Duarte Varela and Cabrera 2000). The oldest male was 12 yr old (43.6 cm SVL) and the oldest female was 10 yr old (36.1 cm SVL) (Duarte Varela and Cabrera 2000). An adult male (ca. 33 cm SVL) caught in southeastern Brazil lived for 17 yr in captivity, making its lifespan possibly 20 yr (Brito et al. 2001). For a given length, males are heavier than females until they reach a SVL of 34 cm (13.4 in), when both sexes weigh the same (1.53 kg; 3.36 lb) (Yanosky and Mercolli 1992*b*). Females longer than 34 cm SVL weigh more than comparably sized males, but males get larger (Yanosky and Mercolli 1992*b*).

d. Diet information

Tegus have heterodont dentition as adults, with pointed teeth in the front for seizing prey and molariform teeth in the back of their jaws (Dessem 1985). It has been suggested that these blunt posterior teeth are used for crushing hard prey items (Presch 1974, Rieppel 1980), but development of these teeth when tegus weigh 600–750 g (1.32–1.65 lb) does not seem to be correlated with a change in diet to eating hard food items such as mollusks (Dessem 1985). The posterior teeth of the mostly insectivorous juveniles are tricuspid and pointed (Dessem 1985, Norman 1987). Tegus flick their forked tongues to detect and discriminate between food and nonfood odors (Yanosky et al. 1993). The species is omnivorous, feeding on vertebrates, invertebrates, and plant matter, including fruit, seeds, leaves, stems, flowers, and honey. According to Cei (1986), it eats birds, small mammals, insects, mollusks, fishes, amphibians, and fruit. Achaval (1977) claims its food consists mainly of insects, snails, bird eggs, fruits, and vegetables. The stomach contents of adult *T. merianae* in Argentina contained, by volume, 66.8 % plant material (primarily fruits), 13.4 % invertebrates, and 20.0 % vertebrates (Mercolli and Yanosky 1994; Table 1). In Brazil, stomach contents, by volume, consisted of 29.0% plant material, 27.8% ants, 27.5% vertebrates, 13.1% mollusks, and minor amounts of orthopterans, coleopterans, phasmids, and millipedes (Colli et al. 1998). Another study in Brazil found plant material (*Vitis* and *Philodendron* fruits), arachnids, coleopterans, large land snail fragments, orthopterans, caterpillars, and rodents (Milstead 1961). Stomach contents, by volume, of juvenile (8.7–29.9 cm SVL) *T. merianae* in Brazil consisted of 47.7% invertebrates (mostly spiders, othopterans, cockroaches, and coleopterans), 31.9% plant material (mostly 1 banana), and 15.5% vertebrates (mostly 1 rodent; Table 1); juveniles were also observed feeding on a nine-banded armadillo (*Dasypus novemcinctus*) and house sparrow (*Passer domesticus*) carcass (Kiefer and Sazima 2002). Fruits or seeds were found in only 2 of 30 juvenile stomachs containing food (Kiefer and Sazima 2002), whereas fruits or seeds were found in 62 of 70 adult stomachs (Mercolli and Yanosky 1994). Tegus are predominantly terrestrial; all fruits eaten belonged to trees with fruits that fall to the ground when ripe, and the birds eaten were chicks of the ground-nesting tinamou (Mercolli and Yanosky 1994). Tegu concentrations are found where ripe *Philodendron* fruit or fish discarded by fishermen are present (Milstead 1961). Based on food items, tegus apparently enter shallow water to prey upon fish, crabs, and snails (Mercolli and Yanosky 1994). Other items eaten by *Tupinambis* spp. include mushrooms, frogs, turtle eggs, reptiles, and carrion (Donadío and Gallardo 1984, Dessem 1985, Escalona and Fa 1998, Kiefer and Sazima 2002, Silva and Hillesheim 2004, Toledo et al. 2004). In captivity, tegus fed on 30 species of fruits from southeastern Brazil ranging in diameter from 0.81 to 10.0 cm, including large fruit adapted for dispersal by large mammals (Castro and Galetti 2004). Seed retention in the gut ranged from 22–24 hr to 43–44 hr, and tegus may be important seed dispersers in the Neotropics (Castro and Galetti 2004). Hungry hatchlings will sometimes cannibalize smaller, weaker siblings, and adults will eat their own eggs and young (St. Pierre, pers. comm.). If given a choice, adults are more prone to feed on small prey items like insects than large items like dead adult rats (St. Pierre, pers. comm.). A tegu breeder fed his *T. merianae* rats, turkey meat, eggs, bread, cat food, dog food, pies, tomatoes, cantaloupes, fish, grapes, pears and pitless cherries (Langerwerf and Paris 1998).

Table 1. Most common (by number or percent volume) food items for 70 adult *T. merianae* from northeastern Argentina (Mercolli and Yanosky 1994) and 30 juveniles from southeastern Brazil (Kiefer and Sazima 2002).

	Adults		Juveniles	
Food Taxa	N	% Volume	N	% Volume
Plants				
Queen palm (*Syagrus*) fruit	244	25.4	1	1.1
Caranday wax palm (*Copernicia*) fruit	222	11.4	0	0
Fustic tree (*Chlorophora*) fruit	1263	7.8	0	0
Caranday palm (*Trithrinax*) fruit	84	7.1	0	0
Figs (*Ficus monckii*)	359	1.9	2	0.9
Congorosa (*Maytenus*) fruit	151	1.8	0	0
Myrtle tree (*Eugenia*) fruit	106	0.9	0	0
Spiny hackberry (*Celtis*) fruit	140	0.6	0	0
Soda apple (*Solanum*) fruit	47	0.6	0	0
Surinam cherry (*Eugenia*) fruit	28	0.2	0	0
Longleaf peppertree (*Schinus*) fruit	27	0.2	0	0
Banana (*Musa*)	0	0	1	25.8
Unidentified fruits	116	1.3	4	1.9
Gourd (Cucurbitaceae) seeds	0	0	38	0.9
Myrtle (Myrtaceae) seeds	0	0	123	0.4
Unidentified seeds	75	0.2	45	0.7
Vegetable matter	–	6.9	7	0.2
Total	2870	66.6	221	31.9
Invertebrates				
Gastropods	379	6.9	21	3.5
Lepidopteran larvae/pupae	56	1.9	15	2.3
Coleopteran adults/pupae	69	1.0	54	6.7
Crustaceans	21	1.0	3	0.8
Spider adults and egg sacs	39	0.9	35	10.3
Hymenopteran adults/pupae (mostly ants)	0	0	47	2.4
Orthopterans	29	0.9	35	10.2
Cockroaches	0	0	21	7.0
Millipedes	0	0	13	3.9
Insect eggs	0	0	19	0.2
Total	793	13.4	385	47.7
Vertebrates				
Anurans	49	10.4	2	1.6
Rodents	4	3.2	1	13.7
Fishes	10	1.9	0	0
Snakes	4	1.4	0	0
Bird eggs	1	1.4	0	0
Birds	5	1.2	2	0.2
Total	75	20.0	5	15.5
Unidentified	0	0	8	4.9

e. Parasites and disease
Wild-caught *T. teguixin* seem prone to high nematode infestations (Sprent 1983, Balsai 1998). *Tupinambis teguixin* is the host of a cestode parasite, *Tejidotaenia appendiculata* (Baylis 1947, Rego and Chambrier 2000). At least 5 species of haemogregarine blood parasites have been found in *Tupinambis* spp. (Osimani 1942). Tegus sometimes develop fungal skin problems (Jacobson et al. 2000), which can occur in cold, damp conditions or when not fed fruit (St. Pierre, pers. comm.). In Argentina, 10 juvenile *T. merianae* refused to feed and lost weight after emerging from their first dormancy period; they developed thin and shrunken tails, but 9 recovered in a month after being force fed and losing their tails (Yanosky and Mercolli 1992*a*). *Tupinambis merianae* raised communally were apparently healthy and did not develop bacterial or viral infections (Yanosky and Mercolli 1993).

4. BEHAVIOR AND HABITS

a. Daily activity pattern
This diurnal lizard exhibits marked circadian variation in metabolism, experiencing a significant increase in metabolism during part of the day (Klein et al. 2006). However, the daily increase in metabolic rate does not occur during the first 2 days after feeding, when animals are less active (Klein et al. 2006). In Atlantic Forest in southeastern Brazil, *T. merianae* were observed mostly in sunny patches from 0700 to 1600 hr, with highest activity recorded during the hottest period of the day (1100–1300 hr) and most activity occurring between 1000 and 1500 hr (van Sluys and Duarte Rocha 1999). Tegus in a zoo in Brazil emerged from their burrows in the morning when ambient temperature was ca. 23°C (73°F), and became active about 2 hr later (ca. 1030 hr) when ambient temperature was 27–30°C (81–86°C). The first 2 hr of foraging was accompanied by basking, and activity ceased at 1500–1600 hr when the cage became shaded, but tegus sometimes remain active until sunset in the wild (Milstead 1961). In Venezuela, free-ranging *T. teguixin* emerged from their burrows in the morning between 0700 and 0920 hr with a body temperature of 19.0–32.0°C (66.2–89.6°F) and basked for an average of 110 min (range 60–245 min) during which time body temperatures increased 4.0–14.0°C (7.2–25.2°F) to an average of 34.9°C (94.8°F), ranging from 30.0 to 39.0°C (86.0 to 102.2°F) (King et al. 1994). Tegus were active over a range of body temperatures from 25.7 to 40.5°C (78.3 to 104.9°F) (mean daily activity temperature for 13 tegus was 33.2 $\pm$ 1.5°C [91.8 $\pm$ 2.7°F]) for 285–560 min, and retreated to their burrows before sunset at 1630–1820 when body temperatures were 32.0–36.1°C (89.6–97.0°F) (King et al. 1994). The preferred body temperature of *T. teguixin* in temperature gradients is 35.2 $\pm$ 0.6°C (95.4 $\pm$ 1.1°F) (Bennett and John-Alder 1984). Juvenile *T. teguixin* in a terrarium maintained temperatures of 34–38°C (93.2–110.4°F) when fully fed but allowed them to drop to ca. 32°C (90°F) when feeding in a cool environment (Cabanac 1985).

b. Seasonal activity pattern
In Atlantic Forest in southeastern Brazil, *Tupinambis* sp. were not observed from March through July (winter), and twice as many were observed in November (spring breeding season) as in any other month (van Sluys and Duarte Rocha 1999). During the dry and cold winter in southeastern Brazil, *T. merianae* hibernates for 4–5 months in underground

burrows at temperatures around 17°C (62.6°F) (Abe 1995, Andrade and Abe 1999). In Argentina, tegus hibernate from April to mid-September (Duarte Varela and Cabrera 2000), and in Paraguay, tegus are active roughly from October through April (Fitzgerald 1994). *Tupinambis merianae* can survive temperatures as low as 1.7°C (35°F) (Langerwerf and Paris 1998). During 6 months of dormancy, tegus typically loose 8–9% of their total body mass (Yanosky and Mercolli 1993). Captive animals in outdoor enclosures in northern Alabama hibernated for ca. 6 months from mid-September (even if daytime temperatures were 27–32°C [80–90°F]) through mid-March (Langerwerf 2006). Tegus started refusing food in mid-August and began preparing their burrows for hibernation, digging one large communal sleeping chamber that was closed with dirt during hibernation (Langerwerf 2006). They did not resume feeding until April and had an activity burst through July (Langerwerf 2006). Captive animals in outdoor enclosures in Palm Beach Co., Florida, started feeding less in late August and early September, despite warm temperatures, and spent more and more time in their hide boxes (they could not burrow), typically emerging in early morning to bask (St. Pierre, pers. comm.). By late September or early October tegus stayed in their hide boxes and did not emerge again about the second week in February; emergence occurred even if temperatures were cool (St. Pierre, pers. comm.). After emergence from hibernation, tegus lie around basking a lot before beginning a period of intense feeding prior to breeding (St. Pierre, pers comm.). In captive breeding groups, dominant males mate with the largest females and suppress breeding by subordinate males (Fitzgerald et al. 1991).

While hibernating, oxygen consumption is reduced to ca. 32% of the value reported for resting lizards during the active season at the same temperature (Abe 1995). Hibernating lizards do not become active during occasional rises in environmental temperature, indicating the occurrence of true metabolic depression (Andrade and Abe 1999). Dormant lizards at 17°C (62.6°F) exhibit an episodic ventilatory pattern consisting of 1–22 breaths followed by non-ventilatory periods lasting 1.8–26 min (Andrade and Abe 1999). Dormant lizards at 25°C (77°F) exhibit a uniform ventilatory pattern and higher rates of oxygen consumption and ventilation. Breathing during dormancy at 17°C (62.6°F) is the most costly activity, consuming 52.3% of the total metabolic rate (Andrade and Abe 1999). For first-year tegus, rates of oxygen consumption during winter dormancy are only 20% of the values in the active season and are nearly temperature insensitive over the range of 17–25°C (62.6–77°F) (Souza et al. 2004). Young tegus will decrease their metabolism to the low rates seen during winter dormancy at any time of the year, if exposed to cold (17°C; 62.6°F) and dark conditions sufficiently long (Milsom et al. n.d.). During winter dormancy, larger tegus (3.0–3.75 kg; 6.6–8.3 lb) are more responsive than smaller tegus to changes in the high temperature range (25° and 30 °C; 77° and 86 °F), indicating that reproductively active adults are more prone to prompt arousal during the warmer days towards the end of the dormancy period (Toledo et al. n.d.).

c. Habits, including aquatic, arboreal, and fossorial

Tupinambis merianae is an excellent swimmer, and if threatened, can stay submerged for a long time (Achaval 1977, Cei 1986). On São Sebastião Island, Brazil, a tegu (30 cm SVL) was observed sleeping in springtime at the bottom of a deep pool in a freshwater

stream with a water temperature of 15–18°C (59–64°F) (Olmos 1995). When disturbed at different times, the tegu walked away on the stream bottom or half walked and half swam to deeper water, staying submerged for at least 22 min. (Olmos 1995). Tegus can climb trees (Luxmoore et al. 1988, Yanosky 1991), but may do it rarely (Sprackland 1992). Female *T. merianae* construct elaborate nests of dried vegetation in their nesting burrows (Luxmoore et al. 1988) and attend the nest (Fitzgerald et al 1991, 1993). Yanosky and Mercolli (1992*b*) claim that females do not defend their eggs, which males will eat, but Langerwerf and Paris (1998) claim females will keep other tegus away from their nests. A docile captive female *T. rufescens* fiercely guarded its nest (Hurt 1995). Female tegus dig nesting burrows up to 50 cm (1.6 ft) deep and 1.5 m (4.9 ft) long (Norman 1987). Night-time burrows of *T. teguixin* were either curved or straight and 110–206 cm (3.6–6.8 ft) long and 43–57 cm (17–22 in) deep (King et al. 1994). Tegus also will take shelter in abandoned animal burrows, crevices, hollow tree trunks, gaps under tree roots, culverts, and drainpipes (Balsai 1998; Fitzgerald, pers. comm.). In Florida, various-sized tegus could potentially use burrows made by the gopher tortoise, armadillo, pocket gopher (*Geomys pinetis*), oldfield mouse (*Peromyscus polionotus*), or Florida mouse (*Podomys floridanus*). Gopher tortoise burrows are probably not suitable hibernation sites (Pierre, pers. comm.), because they are typically dug down to the groundwater table and have moist end chambers (Ashton and Ashton 2004). However, the temperature of deep tortoise burrows would be suitable for hibernation, because the temperature is usually > 13°C (55°F) during the winter (Ashton and Ashton 2004). Hide boxes used as hibernation sites in southern Florida typically faced south, and this might also be the case with hibernation burrows in the wild (Pierre, pers. comm.). Nest burrows will probably be short and constructed at the base of a tree or large grass clump, under a log or other surface object, or in a mulch pile (Pierre, pers. comm.). Nests are typically constructed of layers of dead grass and mulch and somewhat resemble a chicken or ostrich nest (Hurt 1995; Pierre, pers. comm.). Nests could be on the surface of the ground under shelter or in a clump of vegetation, particularly in poorly-drained soils.

5. CONTROL

a. Methods; e.g., biological, chemical, integrated

Tegus are susceptible to trapping, and baited Tomahawk or Havahart traps will probably be effective, if suitable baits that can be detected at a distance can be found. Converted Havahart traps baited with rotten squid proved most effective at trapping Nile monitors in Cape Coral, Florida (Campbell 2005). Cracked eggs and ripe or rotten bananas, mangoes, or papayas are potential baits. Small tegus in burrows can be captured using typical funnel traps; a juvenile tegu was trapped this way in August at Balm-Boyette Scrub Nature Preserve (Kaiser, pers. comm.). Larger tegus could be captured using a recently invented "J & J gopher tortoise trap" that is placed above the burrow (Fig. 5). A "D-I-Y snare trap," which is a semicircular mesh trap with a snare at each end and bait in the middle (Johnson 2006) could be effective. Funnel traps or large box traps set along drift fences might prove effective if core activity areas are identified. Around human habitations, funnel traps could be set along building walls, fences, or other barriers to movement. Tegus accustomed to the presence of humans might be approachable and

Fig. 5. Gopher tortoise burrow trap (staked in place) with hinged door held open (K. Enge).

could be noosed, as long as dense vegetation is not present. Juveniles in open areas could be captured using a fishing rod to cast a cricket on a hook nearby (see Krysko 2000, Enge et al. 2004*b*). The use of snares or noose carpets set at burrow entrances might catch nontarget species. During winter, hibernation burrows might be located by looking for entrances plugged with dirt. Gopher tortoise burrows occupied by tegus might be detected by distinctive tracks and tail drags (Fig. 6) on the apron, or by scoping using a burrow camera. Trapping of burrows is preferable to excavation to avoid making them uninhabitable by tortoises and commensal species. In uninhabited areas, such as on phosphate-owned property, shooting tegus with a shotgun might be feasible. During the spring breeding season, males are more likely to be detected than females because of their greater activity, but it is most important to find females before they reproduce. Identification of nest sites or burrows is critical. Nests might be located in disturbed areas, particularly if piles of mulch are present (St. Pierre, pers. comm.). In its native range, *T. merianae* occurs in habitats that burn frequently (Gainsbury and Colli 1998), and prescribed burns in Florida habitats would not be expected to impact tegus, which can retreat to burrows. However, burns during the nesting season (April–July) could destroy tegu nests on or near the surface. Tegu surveys would be most successful during the peak activity period (1100–1400 hr) on preferably sunny days. The best

Fig. 6. *Tupinambis merianae* sign at Balm-Boyette Scrub Nature Preserve, Hillsborough Co., Florida (B. Kaiser).

months to conduct surveys would be March–September, particularly during the March–April breeding season. However, hatchlings would probably be most easily detected in July–August before they disperse far from nests.

b. Case histories; references
Tupinambis teguixin were collected in the llanos of Venezuela by shooting with a 22 caliber rifle or trapping with Tomahawk live traps (15 x 15 x 47 cm) using a mixture of tinned fish and bananas as bait, mostly along elevated dirt roads (King et al. 1994, Herrera and Robinson 2000). Doan (1997) trapped *T. teguixin* using specially made, foldable metal traps baited with cracked chicken eggs (the only successful bait). Rural peasants hunt *T. merianae* on foot using trained dogs that track lizards by sight or sometimes by scent to their burrows, where they are dug out and usually clubbed over the head (Norman 1987, Fitzgerald 1994). Hunting is conducted during the hottest hours of preferably sunny days, when tegus are most active (Norman 1987). In eastern Paraguay, 67 peasants killed 850 *T. merianae* in the summer of 1984–85 (Norman 1987). Peasants hunt tegus for skins, meat, and poultry protection, and the fat is prized by some for medicinal purposes (Norman 1987). Some peasants shoot tegus with slingshots, rifles, or shotguns (Norman 1987), and tegus have been collected by researchers using shotguns (Colli et al. 1998).

6. POTENTIAL FLORIDA DISTRIBUTION

a. Hospitable habitats
Tegus inhabit savannas and disturbed areas in their native range, so old fields, pastures, and a variety of agricultural and suburban areas are potentially suitable habitats in Florida. Tegus probably prefer well-drained soils in somewhat open habitats, so scrub, sandhill, xeric hammock, coastal strand, and possibly scrubby flatwoods are probably the most hospitable natural habitats. Preferred foraging areas in these areas might be wetland or stream edges. In some parts of its native range, *T. merianae* is found in moister habitats, such as gallery forests along streams and seasonally flooded savannas, which might be similar to Florida's dry and wet prairies. In densely forested areas, tegus would be most likely to use clearings and edges, where there is greater insolation. Tegus have been observed using scrub habitat in Florida, which is probably similar to xerophytic forests in its native range. The rolling pampa grassland of Argentina superficially resembles restored phosphate land. During cold weather, *T. merianae* hibernates in burrows and can tolerate temperatures as low as 1.6^{o}C (35^{o}F); thus, this species could survive anywhere in Florida.

b. Ecologically similar species
There is no ecologically similar native species, but the non-native Nile monitor (*Varanus niloticus*) and black spiny-tailed iguana (*Ctenosaura similis*) are somewhat similar. Both these other species are relatively large and live in burrows, but the Nile monitor, which occurs in Cape Coral, is totally carnivorous and exhibits more aquatic and arboreal activity than tegus (Enge et al. 2004*a*, Campbell 2005). The black spiny-tailed iguana has several established populations in Florida (Townsend et al. 2003) and is more arboreal than tegus, particularly juveniles. Like tegus, juvenile spiny-tailed iguanas are primarily insectivorous and adults are omnivorous; adult iguanas are more herbivorous

than tegus but will opportunistically prey upon invertebrates and small vertebrates, including eggs (Fitch and Henderson 1978).

c. Introduction pathways

i. Release from captive populations
Prior to 2000, almost all *T. merianae* were captive bred. People interested in breeding tegus typically maintain them in outdoor enclosures in Florida, and their burrowing habits sometimes result in escapes. Three hurricanes severely impacted Hillsborough and Polk counties in 2004 and could have resulted in the escape of multiple tegus from breeders or dealers.

ii. Direct importation
From 2000 through 2002, Paraguay allowed the annual export of 1500–1732 live *T. merianae* (CITES 2006), and specimens could be purchased for as little as $35 each. Previously, only a few live *T. merianae* were imported into the United States, and only a limited number of captive-bred individuals was available annually. The low supply meant that hatchlings typically sold for > $100 each. At the 2006 National Reptile Breeders' Expo, juvenile *T. merianae* were priced at $70–75 each, and a large female was priced at $400 (Enge, pers. obs.).

iii. Incidental importation
The incidental importation of tegus probably does not occur because of their large size and active behavior.

iv. Range extension
Not applicable.

7. POTENTIAL IMPACT: FWC LISTING CRITERIA

a. Ecological

i. Potential to eliminate or significantly reduce native species through competition for habitat, food, predation, interbreeding
The tegu is a generalist omnivore that could potentially prey upon any invertebrate or small vertebrate encountered. Tegus are egg predators and can locate buried eggs and semifossorial or even fossorial species. A homeowner observed a tegu in the Florida population digging up moles (*Scalopus aquaticus*) in the yard. Tegus can be significant predators on turtle eggs (Escalona and Fa 1998). *Tupinambis merianae* was introduced on an island off the coast of Brazil to control rats, but it became a pest by preying upon eggs of ground-nesting shorebirds, which were forced to start nesting in trees, and hawksbill sea turtles (*Eretmochelys imbricata*) (Homewood 1995). An introduced *T. teguixin* population on San Andrés Island, Colombia, may be adversely impacting an endemic snake species (Fitzgerald et al. 2005). Tegus also feed upon vegetation, particularly fruits, and could compete with native wildlife for gopher apple (*Licania michauxii*) fruit, saw palmetto (*Serenoa repens*) berries, pawpaws (*Asimina* spp.), wild grapes (*Vitis* spp.), blackberries (*Rubus* spp.),

blueberries (*Vaccinium* spp.), etc. Tracks of a tegu in Balm-Boyette Scrub Nature Preserve were frequently observed near a fruiting hog plum (*Ximenia americana*) (Kaiser, pers. comm.). Tegus could disperse the seeds of the exotic Brazilian pepper (*Schinus terebinthifolius*); tegus feed on fruit of the longleaf peppertree (*S. longifolius*) in its native range (Mercolli and Yanosky 1994). Tegus also feed on *Solanum* fruits (Mercolli and Yanosky 1994). The tropical soda apple (*Solanum viarum*), which is native to Argentina, Brazil, and Paraguay, is a common, invasive weed in agricultural and natural areas in Florida, such as fields, groves, roadsides, and edges of pinelands and hammocks (Langeland and Berks 1998). Each fruit contains 200–400 seeds, and animals serve as vectors for seed dispersal (Ferrell and Mullahey 2006). Based on a food habits study in northeastern Argentina (Mercolli and Yanosky 1994), *T. merianae* commonly feeds on fruits of several plants that are used as landscape vegetation in the Tampa area. For example, fruits of the queen palm (*Syagrus romanzoffianum*) comprised 25% of the volume of all food eaten by tegus (Table 1), and this palm species is very common around Tampa and other urbanized areas of central Florida. The Surinam cherry (*Eugenia uniflora*) is one of the most commonly planted hedge species in central Florida, producing both a spring and fall crop of edible fruit. Other tegu food plants that are occasionally planted in Florida are figs (*Ficus* spp.), spiny hackberry (*Celtis* [*spinosa*] *ehrenbergiana*), Caranday palm (*Trithrinax campestris*), and Caranday wax palm (*Copernicia alba*).

Tegus often use the burrows of other animals and could displace or prey upon burrow inhabitants. Adult tegus in Florida probably would have few predators, although in their native range, *Tupinambis* spp. are sometimes eaten by panthers (*Felis concolor*), jaguars (*Panthera onca*) (Palacios et al. 1997, Taber et al. 1997), and harpy eagles (*Harpia harpyja*) (Boinski, pers. comm.). Hatchling and juvenile tegus in Florida could potentially be preyed upon by a variety of mammals, birds, and snakes. Domestic dogs might kill some tegus (Norman 1987, Silva and Hillesheim 2004), particularly those entering yards.

ii. History of range extension, high population growth rate, tendency to monoculture (reduced community diversity)
Tupinambis merianae is a fecund species (30–45 eggs), and subadults and adults would probably have few predators. An introduced population could experience a high growth rate and disperse rapidly into surrounding areas.

iii. Potential to adversely impact listed species
Juvenile tegus have already been observed using gopher tortoise burrows, and adults could prey upon eggs and hatchlings. Other listed ground-dwelling or burrowing species that could be impacted and potentially occur in tegu-occupied habitats are the Florida mouse (*Podomys floridanus*), Florida burrowing owl (*Athene cunicularia floridana*), Florida gopher frog (*Rana capito aesopus*), short-tailed snake (*Stilosoma extenuatum*), Florida pine snake (*Pituophis melanoleucus mugitus*), eastern indigo snake (*Drymarchon couperi*). In their native range, tegus forage along wetland edges, and in Florida, they could potentially prey upon Florida sandhill crane (*Grus canadensis pratensis*) and American alligator (*Alligator mississippiensis*) eggs. Tegus are not adept climbers, so they might not be efficient predators on eggs of shrub or tree-nesting birds, such as the Florida scrub-jay (*Aphelocoma coerulescens*)

and various listed wading bird species. If tegu populations become established in coastal areas, there are several listed species of ground-nesting shorebirds that could be impacted, along with nesting sea turtles and diamondback terrapins (*Malaclemys terrapin*). If the species expands its range to scrub habitats on the Lake Wales Ridge, it could prey upon listed sand-swimming reptiles, such as the sand skink (*Neoseps reynoldsi*) and bluetail mole skink (*Eumeces egregius lividus*).

iv. Potential for habitat alteration
Some minor habitat disturbance may result from tegus digging for food and constructing burrows.

b. Health – directly harmful to humans
Cornered tegus will defend themselves, and captured animals will typically bite, scratch, and whip their tails. Tegus cornered by dogs defend themselves first by biting and then by tail lashing (Milstead 1961). Tegus have very strong jaw muscles, particularly large males, and can deliver a serious bite (Balsai 1998, McBrayer and White 2002).

c. Economic

i. Bio-fouling
Not applicable.

ii. Competition with agricultural/cultured crops
Not applicable.

iii. Impact agricultural/cultured crops
Tegus eat a lot of plant matter, and they require fruit in their diet (Pierre, pers. comm.). Tegus eat ripe, fallen, which is typically unsalable. In Argentina, tegus did not eat local crops (Mercolli and Yanosky 1994), but they could potentially impact strawberries and tomatoes, which are important crops in this area of Florida. The strawberry season is almost over when tegus emerge from hibernation in February, but the tomato season usually extends until the first week in June. Tegus could serve as seed dispersers of the tropical soda apple, which reduces stocking rates of livestock in pastures because of its abundance and unpalatable foliage (Ferrell and Mullahey 2006). Tegus could prey on chicks and eggs in yards or henhouses; *Tupinambis* spp. are sometimes considered a nuisance in this regards in their native and introduced range (Milstead 1961, Valdivieso and Tamsitt 1963, Norman 1987, Luxmoore et al. 1988, Sprackland 1992, Fitzgerald et al. 2005). Numerous tropical fish hatcheries are in the Balm area on the western side of the tegu's range in Florida, and tegus could potentially prey upon fish or damage berms by burrowing.

iv. Potential socioeconomic impacts from listing
Several people in Florida breed tegus and would suffer economic loss, along with reptile dealers and pet stores reselling tegus. This is a relatively valuable species, although the price declined dramatically after importation was allowed for a 3-yr period, prompting at least 1 tegu breeder to discontinue breeding the species (St. Pierre, pers. comm.). *Tupinambis merianae* and *rufescens* are large species that often make good captives (provided adequate caging is provided), unlike the smaller,

warier *T. teguixin*, which usually does not tame well and can be aggressive (Balsai 1998, Langerwerf and Paris 1998). Tame *T. merianae* are sometimes allowed to roam around the house and are almost doglike.

d. Social – potential to substantially impact recreational use
Not applicable, although the Balm Boyette Scrub Preserve is a popular with mountain bikers and hikers, and some recreational users could be deterred by the presence of large lizards. However, loss of these visitors would probably be compensated for by persons interested in seeing or catching these lizards. In campgrounds near Buenos Aires, Argentina, *T. merianae* "beg" for food and allow people to approach within 1.2 m (4 ft) (Langerwerf and Paris 1998).

e. Legal – restricted by national or international law
Tegus are one of the most heavily exploited reptile species in the world, and all tegu species are listed as Appendix II animals by CITES and therefore require permits for export. In the 1980s, an average of 1.9 million tanned tegu belly skins (> 3.5 million in 1981) were exported for the leather trade, with most going to Texas for cowboy boots (Luxmoore et al. 1988, Fitzgerald 1994). The export value of this resource was worth at least $20 million annually, with ca. $7.5 million going to the hunters (Fitzgerald 1994). The trade is now monitored internationally, and harvest quotas are set at 1 million for Argentina and 300,000 for Paraguay (CITES 2006); both countries have management programs that depend upon trade control and harvest monitoring (Fitzgerald 1994).

8. RECOMMENDATION

The FEC has proposed new rules that would establish a category of wildlife called "Reptiles of Concern" (ROC), which would include tegus (*Tupinambis* spp.). If these rules are adopted as proposed, after 1 July 2005, any person or entity not currently permitted to possess a ROC must qualify for a no-cost permit by (1) satisfactorily competing a questionnaire demonstrating knowledge of general husbandry, nutritional, and behavioral characteristics of the species; (2) have appropriate facilities for housing the species; and (3) have a written course of action to be taken in preparation for natural disasters or critical incidents (i.e., releases or escapes of captive wildlife). Appropriate facility requirements are identified. For example, outdoor open-topped enclosures (not cages) for tegus would require securely locked entrance doors, concrete or masonry walls, concrete/masonry floors or strong footers extending at least 3 ft below the grade level outside the perimeter (to prevent escape by burrowing), and close-meshed wire tops or equivalent barriers. In addition, persons with permits to possess ROC shall maintain accurate records of all changes in inventory, uniquely identify all individuals by implanting with a passive integrate transponder (PIT tag), and report all transactions involving ROC every 3 months to the FWC's Division of Law Enforcement. Microchipping tegus will allow the FWC to determine the source of future releases or escapes, but the immediate benefit is to ensure that tegu keepers are more diligent in preventing future escapes or releases. A person will have to obtain a permit before purchasing a tegu, which will prevent impulse purchases and reduce the number of persons interested in keeping tegus as pets.

A Tegu Working Group (TWG) consisting of area land managers, biologists, and tegu experts has been formed and will meet on 21 September 2006 to strategize an eradication campaign for the Tampa tegu population. A flier has been created (Fig. 7) and will be posted around the area to solicit additional sightings of tegus, which will be mapped by the database manager in FWC's Exotic Species Section. This map will help the TWG identify the species' range and core areas for survey and trapping efforts. Managers of public lands and tropical fish hatcheries in the area should be notified of the possible presence of tegus, and their assistance should be solicited in eradication efforts. Captured tegus should be euthanized as soon as possible to eliminate the chance of escape and to facilitate collection of food habits data. Appropriate and feasible euthanasia methods need to be agreed upon by the TWG. Reptile enthusiasts would be interested in capturing tegus, but most would be averse to euthanasia of specimens, compromising data collection and potentially providing a source for future introductions. Therefore, participation by members of local herpetological societies should be discouraged, unless they agree to meet stringent criteria. Potential sources of additional manpower for survey and trapping efforts are university students attending biology/wildlife classes, biologists in the public or private sector, and select volunteers. Control efforts on some lands will need to be restricted to employees because of access and liability issues. Intensive trapping for tegus using baited traps and/or burrow traps should be conducted in problem areas, and attempts should be made to locate nesting sites. Sightings of tegu tracks crossing sandy roads or trails will help in identifying areas of occurrence and in monitoring the success of eradication efforts. Sandy fire lanes, trails, or roads could be dragged to create a smooth surface that would facilitate detection of tegu sign.

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HAVE YOU SEEN THIS LIZARD?

ARGENTINE BLACK & WHITE TEGU

Length: over 4 feet
Thick, short neck
Burrows; tolerates cool temperatures

Black bodies with whitish bands and spots
Prefers open, grassy areas
Could survive throughout Florida

Argentine black & white tegus have been observed in Polk and eastern Hillsborough County, but more specific locality information is needed.
REPORT SIGHTINGS TO LARRY CONNOR (352) 551-9574
OR EMAIL: larry.connor@MyFWC.com
Reporting details on the back

SIMILAR SPECIES

SPINYTAIL IGUANA

Length: to 4 feet
Gray or brown with broad, dark bands
Tails with whorls of spiny scales
Perches on rocks or other objects
Retreats to burrow when disturbed

NILE MONITOR

Length: to 7 feet
Dark body with 6-9 yellowish bands
Long, slender neck
Found near water
Retreats to burrow or swims when disturbed

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

Fig. 7. Flier developed to solicit additional sightings of tegus by the public.

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